75 De Vaudreuil, Boucherville, Quebec CANADA J4B 1K7
Tel.: (450) 449-6400, fax: (450) 449-4679, e-mail: dcbuildingsystem@dc-inter.com, website: www.dc-inter.com

DC BUILDING SYSTEM –INSTALLATION MANUAL

INTRODUCTION

DC INTERNATIONAL housing units and buildings are simple to construct. This guide can be used for familiarization and installation instructions. A separate section has been devoted to each step in order to help you plan your project and construct homes or buildings in accordance with good building practice.

SECURITY AND RESPONSIBILITY

It is essential to understand clearly and to follow precisely the procedures and specifications described in this guide in order to avoid any possible weakness and/or damage of the structure. The safety of all personnel involved in the construction project is dependant upon this understanding and the use of appropriate tools and equipment.

DC International Inc. is not responsible for any problem that may arise during or after the construction for not respecting the procedures and specifications of this guide, the substitution of materials, and/or the lack of safety standards.

It is mandatory to obtain the building permits from the local authorities prior to the construction and to count with the supervision and approval of an architect and/or engineer during the whole construction process.

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3. PREPARING THE SLAB AND INSTALLING THE WALL PLATES

The concrete slab is the main support for the PVC walls. This foundation must be properly designed and properly constructed.

Certain standard details of the principal construction methods are included in this section to insure the quality of the slab.

3.1 Concrete recipe *(must be verified and approved by a local engineer)*

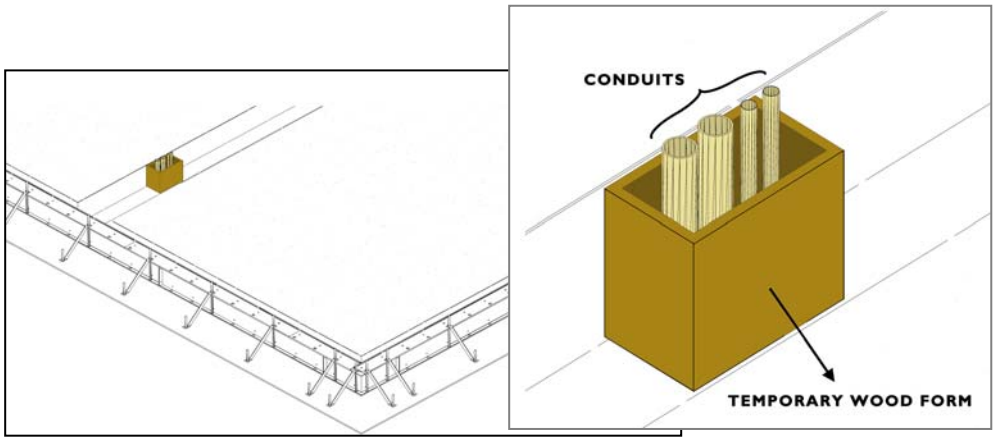
The basic mixing is ¾ parts of sand and gravel by ¼ of water and cement. One cement bag contents 33 litres and one bucket contents 18 litres.

CONCRETE RESISTANCE	SAND	GRAVEL	CEMENT	WATER
100 kg / cm^2	6 ½ buckets	7 buckets	1 bag	2 buckets
150 kg / cm^2	5 buckets	6 buckets	1 bag	2 buckets
200 kg / cm^2	4 buckets	5 buckets	1 bag	1 ½ bucket
250 kg / cm^2	4 ½ buckets	4 ½ buckets	1 bag	1 ½ bucket

3.2 Forming the slab with conventional wood forms

The slab shall be built square, level, straight, smooth and with good quality concrete (20 MPA or 200 kg/cm2 or 3000 psi) with a minimum thickness of 30 cm (12 in.) beneath the walls and 10 cm (4 in.) elsewhere.

Welded wire mesh, 150 x 150 x 6 mm shall be placed in the slab. Also install reinforcing steel bars to anchor the walls to the slab. Since soils vary considerably, the foundation plan should be approved by an engineer who is authorized to practice where the building is being constructed.



3.3 Installing electric and plumbing systems

Install the electrical conduits and plumbing pipes in the slab.

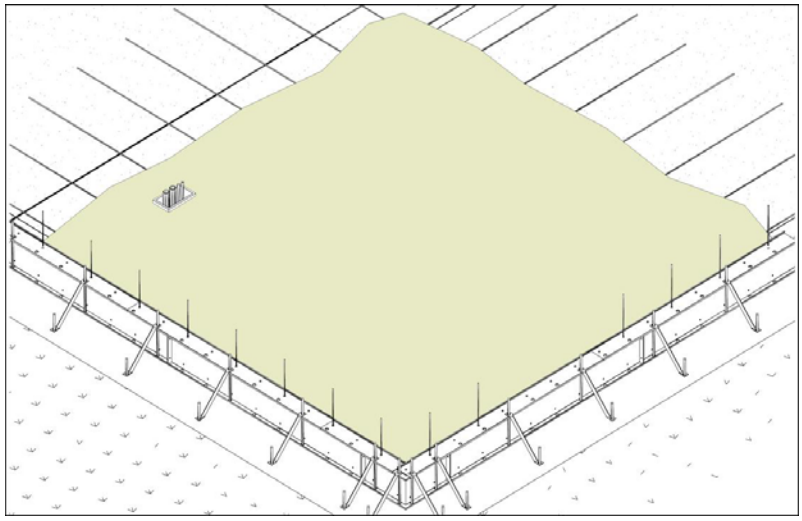
For interior walls, prepare a mechanical shaft for all the pipes.

3.4 Installing the reinforcement steel bars

Install the reinforcement steel bars in accordance with the specifications provided by the local structural engineer. Coat the prefab steel forms with oil to prevent the concrete from adhering. Lay out the anchor bars for the walls inside the holes of the prefab steel forms and fasten them to the slab steel bars.

3.5 Pouring the concrete

Before pouring the concrete, verify the level of the prefab steel forms. Pour the concrete into the ground and flatten any bumps on the slab surface. Remove the prefab steel forms and clean them up.



3.6 Cleaning the slab

Before beginning construction, it is important to organize the site properly. The piles of excavation soil and the trenches resulting from the excavation must be levelled in order to permit easy circulation around the perimeter of the work area. The slab must be clean, dry and free of all debris and dust.

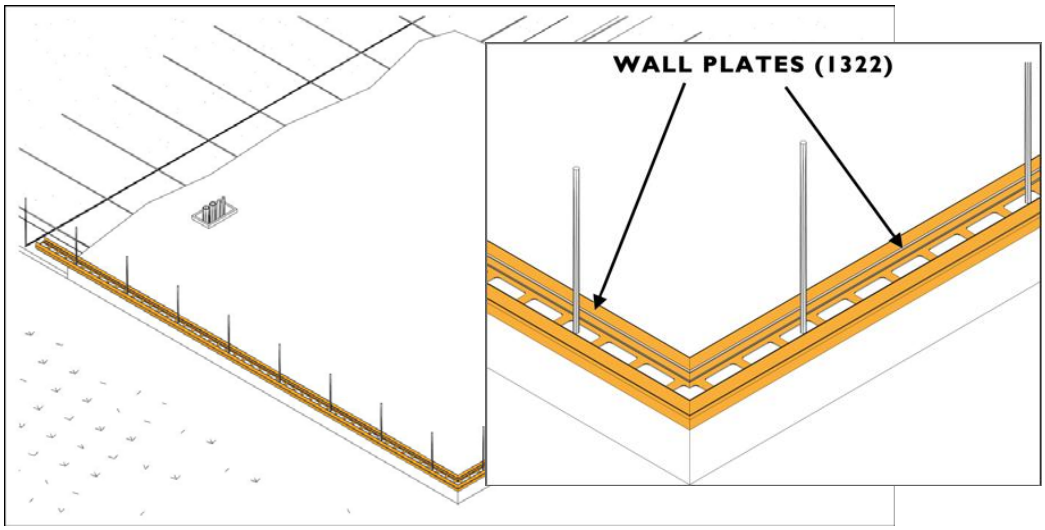
3.7 Laying out the wall plates

a. Trace the outline of the exterior wall plates so that they are square and centred on the slab. In order to ensure that the traced lines are square, the measurements must be checked once using the hypotenuse method.

b. Trace the position of the interior walls using the exterior walls as a measuring guide. The interior plates are installed after laying the exterior walls. The reinforcing steel bars of the interior walls must be laid once the interior plates are laid and anchored in the slab with a non-shrinkage compensating mortar or an epoxy mortar.

c. The dimensions of the exterior and interior walls must be in multiples of 10 cm (4 in.) plus a percentage of 0.3% to compensate the expansion inside the PVC profiles. The door and window openings must also meet this requirement.

3.8 Installing the wall plates



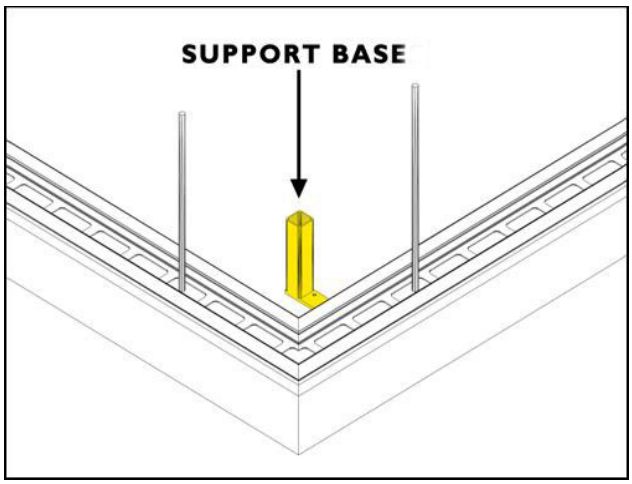
The plates are supplied in lengths of 5 m and must be re-cut on site in accordance with the dimensions shown on the plans. The plates can be cut easily using an electric mitre saw.

Before the wall plates for the exterior ground-floor walls are fastened to the slab, a sealant must be applied below the plates. This sealant may be a polyurethane calking or a polyethylene tape.

The wall plates are fastened to the slab using concrete screws. Firstly install the external wall plates ONLY. The internal plates will be laid once the PVC extrusions of the external wall are in place in order to determine their precise location.

4. INSTALLING THE SCAFFOLDING

The scaffolding system supports the wall components and the workers during the pouring of the concrete. It has five main components: The support base, the scaffolding support, the platform support, the bracing rod and the steel Z-bars.



4.1 Installing the support bases

The support bases must be installed directly against the wall plate. They are fastened using concrete screws or concrete nails.

4.2 Installing the other scaffolding components

The scaffolding supports are simply inserted into the support bases and are fastened in place with a tightening screw which is installed on each scaffolding support.

The stability of the support is insured by one or two bracing rods which are fastened to the scaffolding support with a pin and to the concrete slab with concrete screws or concrete nails.

The bracing rods serve as wind bracing for the scaffolding system. They may be installed in two directions; however, two-directional wind bracing is not needed for every support. The steel Z-bars are held in place by metal clips which are located on the scaffolding supports. They simply slide into the clip and are then held in place by an adjustable screw.

After the walls have been poured, the scaffolding should be dismantled and stored away until it is needed again. Notice that it is required to wait for at least three days before dismantling the scaffolding supports.

It is also possible to remove the Z-bars and to keep the scaffolding in place to be used as a work platform for the installation of the wall caps and the beams for the roof. It will first be necessary, however, to install two bracing rods to each support so that the system will be self-supporting. Install the template horizontal supports after the scaffolding supports and adjust their level at the optimal height.

5. INSTALLING THE WALL COMPONENTS

The walls can be erected simply and quickly. The walls are composed of two main components: The structural component (1376) and the flat wall covering (1377), which are assembled by sliding one into the other vertically, from above.

(Refer to the specific shop drawings to know the precise location of the profiles because they are precut before at the factory).

5.1 Windows and doors with prefab steel templates

The level and the height of the templates must be verified conscientiously. Install the nailing strips (made with plywood of 16 mm or ¾ in.) outside the steel frames and screw them to the 1376 elements through the holes found on the steel frames for this purpose.

5.2 Installing the main components

Starting in one corner of the building, slide 3 or 4 structural components (1376) together inside the wall plate, level them and fasten them to the Z-bar using PVC clips.

Also, screw the PVC though the Z-bars with self-taping screws at every 50 cm (24 in.) and especially in all corners and intersections. *(Refer to section 6 for the installation of reinforcement steel bars and anchors).*

Next, install the wall covering (1377), and then continue placing the structural components (1376) and the wall covering components (1377) in the same sequence. The covering components (1377) must be installed after all pipes and reinforcing bars are in place.

5.3 Wall and corner junctions

For the junctions use a wall junction section (1378) and for the corners use a wall corner section (1379).

These sections slide easily with components 1376 and 1377.

5.4 Electrical conduits

Electrical channel: The electric channels (1323) are installed by sliding them, from above, into components 1376 and 1377.

They may be spaced at 1.5 meters (5 ft.) intervals to permit the eventual installation of electrical or telephone wiring, or in accordance with the requirements of the user as shown on the electrical drawings.

Electrical standard tubing and fitting: All the electric system can also be installed by placing some empty piping in the walls before closing them with covering component 1377.

5.5 Windows and doors without prefab steel templates

To prepare the formwork, fasten a piece of ¾ in. plywood, to serve as a nailing base, on the interior of the side walls and install a piece of wood 50 mm x 150 mm beneath the extrusions which form the head of the window or door opening.

This piece of wood must be supported by wood studs placed no more than 50 cm (20 in.) apart.

5.6 Aligning the walls

Check the alignment of the walls with a string and correct the alignment of the walls by adjusting the bracing rods for the scaffolding system.

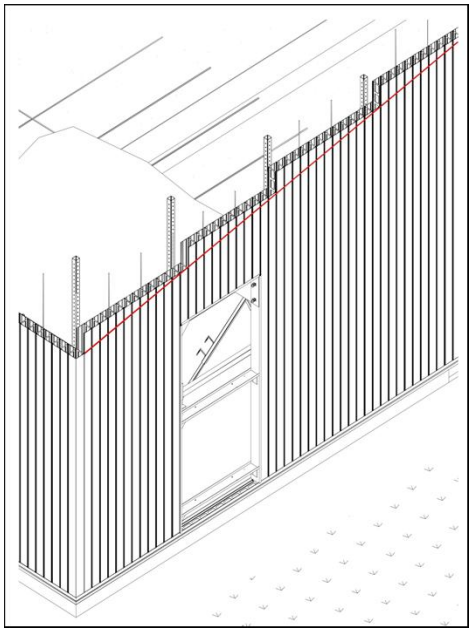
If the level of the components is not straight due to irregularities on the foundation slab, use a chalk line and cut the excess of PVC on the top of the wall.

5.7 Cutting the wall components with a slope

When the system is used with a cathedral roof, it is necessary to cut the profile with a slope before pouring.

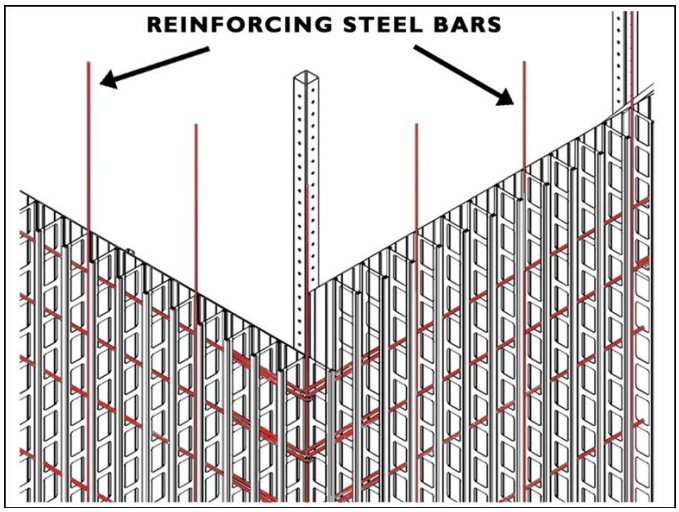
The Z-bars must be installed with the final slope on the scaffolding support and will be used as a guide for cutting the PVC profiles.

Cut the profile with a grinder equipped with a diamond ceramic disk or with a jig saw *(refer to section 1.2)*.



5.8 Roof beam anchors

Cut the PVC components to realize a niche to receive the roof beams. Fill temporary the niche with Styrofoam to keep it clean from concrete.



6. STEEL REINFORCEMENT AND ANCHORING

The reinforcing steel bars must be installed 20 cm (8 in.) below the top of the wall by simply sliding it into the openings in the structural components.

(Refer to the plan prepared by the structural engineer for the location, number and size of the steel reinforcing bars).

7. POURING THE CONCRETE FOR WALLS

7.1 Equipment

The pouring of the concrete walls requires the use of motor-driven concrete mixers and a concrete pump.

The pump may be stationary or it may be supplied with a telescoping arm. The hoses used for the pouring of the concrete must have an interior diameter of less than 75 mm (3 in.).

Use as much possible of fixed steel pipes and a minimum of flexible hose in order to reduce the friction and to increase the pressure. *(Refer to the pump manufacture instructions for the use of the concrete pump and for the cleaning of it)*.

7.2 Type of concrete

The concrete must have a minimum compressive strength of 20 MPA (200 kg/cm2 or 3000 psi) with a maximum slump of 20 cm (8 in.) and 12 mm (1/2 in.) aggregate maximum. *(Refer to section 3.2 to know how to mix the concrete on site).* A superplasticizer must be added to the concrete in order to make it more fluid. This plasticizer may be EUCON 37 by EUCLID, with 500 ml of this product per 100 kg of concrete.

7.3 Pouring the concrete

Before pouring, it is important to fix rubbles to the walls where the beams will be installed to avoid cutting the concrete subsequently. The concrete is poured directly from the pump hose into the formwork.

a. Pour the sections below the windows.
b. Pour all of the walls up to a height of about 1.20 m (4 ft). Exceeding 1.20 m (4 ft) may result in deformation of the PVC wall due to pressure caused by uneven distribution.
c. Pour all of the walls up to the top. Wait at least one hour between pours. Do not drop the concrete. Use a concrete sock at the extremity of the pump hose if the concrete is poured at a height higher than 3 m (10 f).

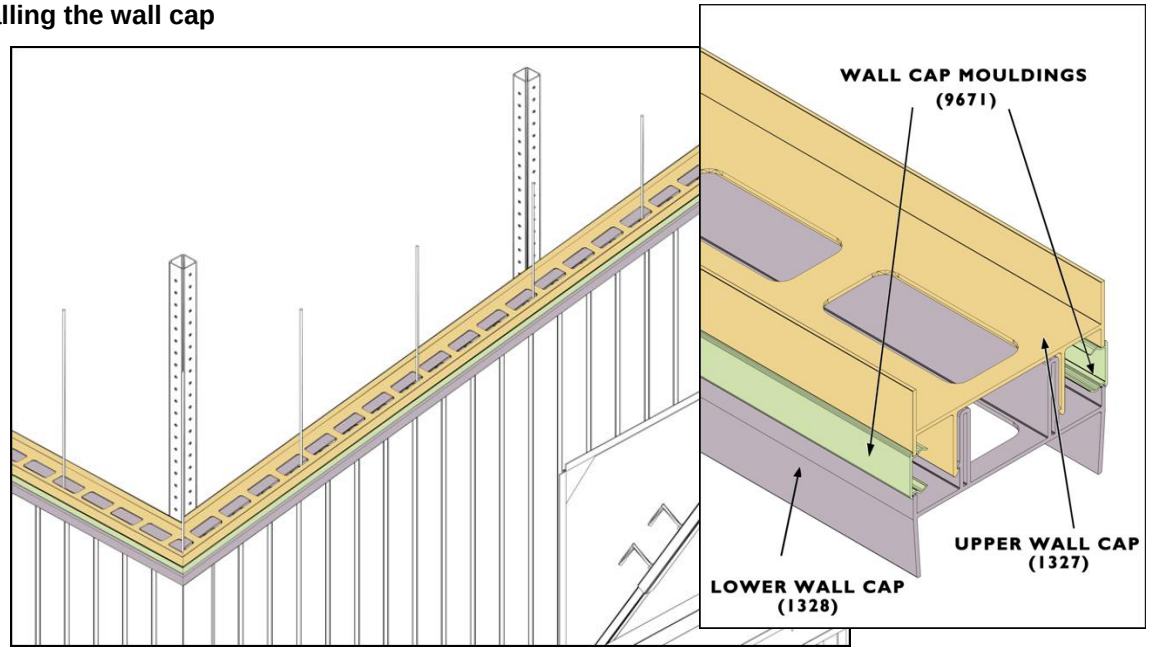
Avoid allowing the concrete to overflow and immediately clean up any concrete that does overflow. It is preferable to leave a few millimetres between the top of the concrete and the top of the PVC components.

7.4 Cleaning the walls

Any concrete which has splashed onto the visible PVC must be removed before it hardens. The concrete on the PVC can be easily cleaned by using water and a cleaning brush. A masonry type cleaning agent can also be used to remove the excess of concrete. Avoid all solvents with petroleum derivatives such as varsol, thinner and terebentine.

8. INSTALLING THE WALL CAP AND THE BLOCKING

8.1 Installing the wall cap

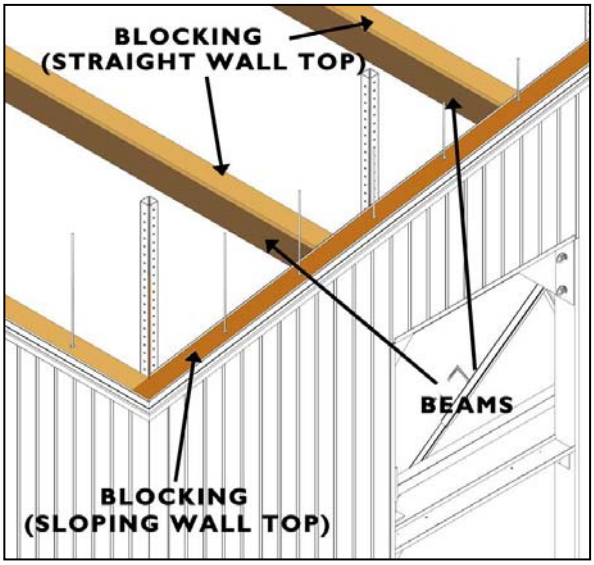


The wall cap consists of two parts: the lower wall cap (1328) and the upper wall cap (1327). Both the upper and lower parts of the wall cap can be cut with an electric mitre saw.

The lower part of the wall cap must be installed first, and it is fastened into place by installing screws from above. The upper part of the wall cap clips into the lower part. Some screws can also be used to hold it in place. The wall cap mouldings (9671) are inserted in between to hide the space that may contain the electrical conduits.

8.2 Placing the grout

Non-shrink grout is used to fill the cavity inside the wall cap. The grout is a mixture of sand and cement, without aggregate, which is mixed by hand and is poured from a bucket directly into the cavity inside the wall cap.



8.3 Installing the blocking

The blocking is made of wood which is treated with preservative to protect it against rot, and it serves mainly as a nailing base for the roof extrusions. The blocking is fastened to the wall cap using concrete screws which are anchored in the grout of the wall cap.

Anchors which are fastened directly into the wall concrete may also be required. Consult the plan prepared by the structural engineer. Drill holes in the blocking to allow the vertical reinforcing bars to pass through.

9. MULTI-STORIES BUILDINGS

The other concrete slab of a multi-stories building should be poured on regular wood forms. To cover the thickness of the slab, the profile wall cover 1377 must be longer than the 1376. After the pouring of the slab, install a wall plate 1322 and follow the previous instructions to install the scaffolding and the wall profiles. A moulding such as profile 1335 may be installed to cover the outside part of profile 1322.

10. INSTALLING THE ROOF STRUCTURE

10.1 Preparing the supports for the beams

The upper part of the wall cap must be cut at those locations where the beams will rest. The walls of the wall cap can easily be cut using a general-purpose knife and sheet-metal shears.

10.2 Installing the beams

To determine the dimensions of the roof beams, consult the specifications on the plan prepared by your structural engineer. The beams may be made of a single piece or they may consist of many pieces.

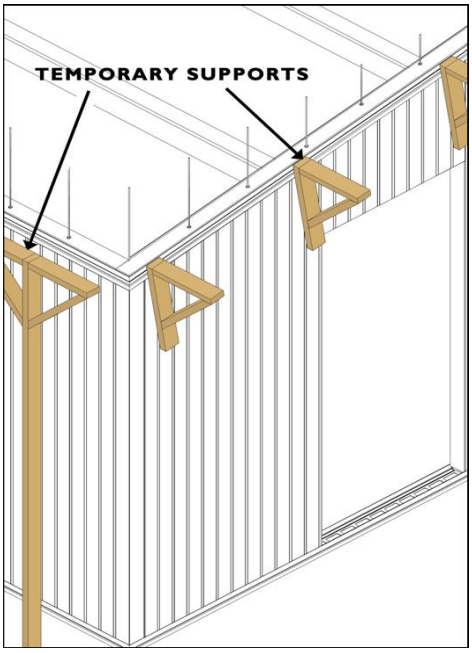
In the latter case, the beams will need to be assembled. The beams can be assembled using bolts, and care must be taken to stagger the joints and to follow the indications shown on the construction plans.

It is preferable to paint or stain the beams before installing them. Once the beams have been assembled and painted, these may be put into place on the walls. Before fastening the beams it is essential to check the level of the beams and the alignment of their slopes and to adjust them if necessary.

10.3 Levelling the beams

The beams are levelled using a string and wood shims. The wood shims are inserted at the ends of the beams in order to compensate for any differences in level. After the beams have been levelled, they must be bolted in place in accordance with the instructions on the structural plans.

11. INSTALLING THE ROOF COMPONENTS



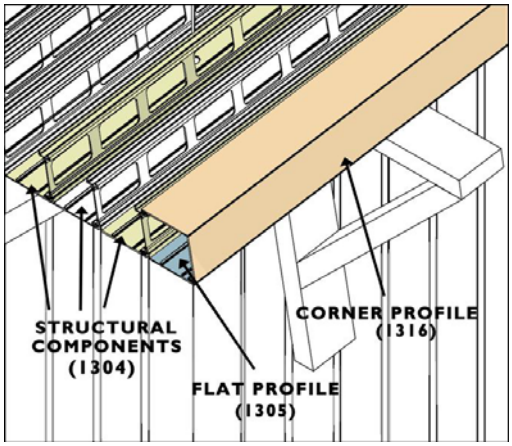
11.1 Installing the temporary supports

Install the temporary wood brackets at the roof perimeter in order to support the overhang. Adjust all temporary supports at the same level than the beams.

11.2 Installing the structural components

Before beginning to install the structural components (1304), it is recommended to install a guide in order to keep the bottoms of the extrusions in line. This guide will be fabricated using steel sections and will serve as the formwork which retains the concrete at the bottom of the extrusions.

Install the first structural component (1304), aligned and parallel with the exterior walls. The structural components (1304) are fastened to the wood beams with screws; the screws must be placed at each end and in the middle.



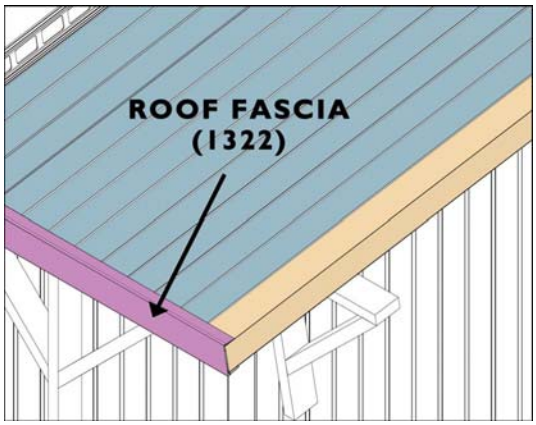
Slide the subsequent components together, in the same way as for the walls, beginning with the components which are already fixed in place, and then screw them to the beams. Every time those three components have been installed, it is important to verify that the axis-to-axis distance between each pair is 10 cm and that the components are parallel.

Install the corner profiles (1316) at the lateral edges of the roof and install a flat profile (1305) underneath the corner profile that does not joint completely the structural component 1304.

The conduits and electrical boxes, which will be located in the roof, must be put in place before the roof concrete is poured. Installation at the end of a corner profile 1316 to be used as formwork.

11.3 Installing the roof covering and fascia

The roof profile covering (1330), or flat profile 1305, slides easily into the structural components which are already in place. Before the concrete is poured, you must first install a guide along the bottom of the slope to hold these components. Install a profile 1322, without opening, as a fascia moulding.



12. POURING THE CONCRETE FOR THE ROOF

12.1 Protecting the roof

Before the pouring of the concrete for the roof is begun, it is recommended that the PVC covering be protected by using inexpensive plywood panels, especially if the PVC profiles are painted. This protection will make the work more efficient by providing a less-slippery surface for the workers.

12.2 Type of equipment

The pouring of the concrete for the roof requires the use of motor-driven concrete mixers and a concrete pump. The pump may be stationary or it may be supplied with a telescoping arm. The hoses used for the pouring of the concrete must have an interior diameter of 50 mm (2 in.).

To inject the concrete into the roof, use an extension made of a 50 mm (2 in.) diameter steel or ABS plastic hose, 3 m (10 ft.) in length, which must be installed at the end of the flexible hose of the concrete pump.

12.3 Type of concrete

The concrete must have a compressive strength of 20 MPA (200 kg/cm2 or 3000 psi) with a maximum slump of 20 cm (8 in.) and aggregates 12 mm (½ in.) or less in size, depending on the pump which is used.

A superplasticizer must be added to the concrete in order to make it more fluid.

12.4 Pouring the concrete

The concrete is poured directly into the formwork from the extension installed on the hose of the pump. When pouring the concrete, the extension must be fully inserted into the interior of the roof. This will enable the bottom portion of the roof to be completely filled with concrete. When the lower portion of the roof is being filled, the extension should be removed gradually, which will permit the concrete to be poured evenly up to the top of the roof.

12.5 Cleaning the roof

Any concrete which has splashed onto the visible PVC must be removed before it hardens. The concrete on the PVC can be easily cleaned by using water and a cleaning brush. A masonry type cleaning agent can also be used to remove the excess of concrete. Avoid all solvents with petroleum derivatives such as varsol, thinner and terebentine.

13. FINISHING THE ROOF

13.1 Finish trim and fascias

After the guides, which served as formwork, have been removed and a fascia must be installed at the lower end of the roof. The fascia is fastened using stainless steel screws. Install the fascia at the bottom of the slope. Extrusion 1322 (without opening) is fastened below and on top of the roof extrusions at every 50 cm (20 in.).

13.2 Installing the ridge cover

The ridge of the roof is covered with a metal ridge cover. The ridge cover is screwed directly into the roof profiles with stainless steel screws. It is necessary to apply sealant before installing the ridge cover.

14. INSTALLING DOORS AND WINDOWS

14.1 Installing windows

Install the window frame by the outside of the wall and fix it by screwing the window anchors to the nailing strip of the windows opening. Be sure that the window frame is at the good level and in right angle. By the inside, insert the window moulding between the window frame and the nailing strip. Fix with some screws the moulding to the wall in the track and close the cover. Fix in the corners the small finishing rosette.

Install the glasses in the window frames and verify the watertightness. Seal the frame to the wall by the outside with a polyurethane calking.

14.2 Installing steel door frames before pouring

The steel door frame can be installed at their permanent location before pouring the concrete. They must be in place at the good level, because not adjustment will be possible after pouring. Wood braces must be installed at mid-height to prevent any deformations during the pouring.

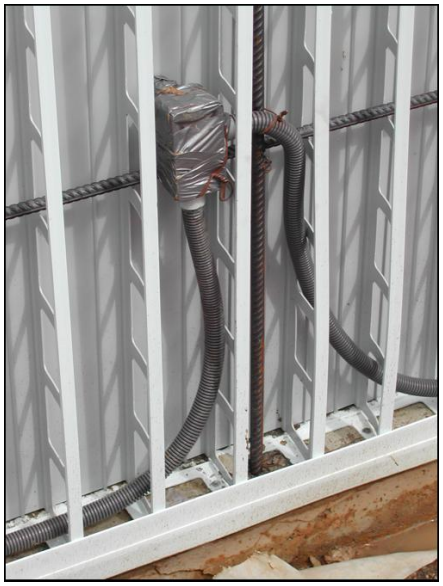
14.3 Installing steel door frames after pouring

The steel frames in three parts must be assembled in the door opening and attached at the bottom by screwing the steel straps to the wall. The header of the frame has to be adjusted with the adjusting screws included in the frame.

14.4 Installing doors

The doors must be installed only when all finishes are completed and should be stored in the meantime in a dry area on a flat surface.

15. ELECTRICAL



15.1 Materials and equipment

The electrical system in DC homes uses standard components which are generally available. The electrical wiring consists of type RW90 copper conductors in various gauges (#14, #12, #10 and #8) in accordance with the applicable codes.

The supply can be provided via the roof, using standard PVC electrical conduits and boxes. The boxes located beneath the ridge cover are pull boxes which are connected to 1¾ in. conduits. The fixtures, the electrical components (outlets and switches), the distribution panels and the circuit breakers shall be locally available products which conform to the applicable local standards and codes.

15.2 Power supply and wiring

The power supply to the panel may be underground or above ground. Most of the wiring is supplied via the roof, or the second floor slab, from a master conduit which links the distribution panel with the distribution system located along the roof ridge.

On the roof the wiring is installed inside PVC conduits. Do not install PVC conduits perpendicularly to the roof slop in order to allow the free flow of the concrete. If absolutely required, the conduits should be installed only in the lower part of the roof.

In the walls the wiring is installed also in PVC conduits (flexible or rigid) or the inside electrical conduits (1323) which are already in place and connected to channels located inside the wall caps.

15.3 Installing the components

During the construction of the walls, it is necessary to plan the installation of the electric channels. The electric channels slide into the interior of the structural components (1376) and into the interior of the wall coverings (1377). The electric channels must be installed before the concrete is poured. The electric channels must be placed inside the walls facing each electrical outlet and switch box *(refer to the electrical plan).*

The electrical system can also be installed in the walls using flexible PVC pipes already used on the market with all regular fittings. Before the concrete is poured, it is necessary to plan the installation of the pull boxes, the junction boxes and the electrical conduits.

15.4 Heating units

The PVC coverings must be protected from live sources of heat, such as electric baseboard heaters or gas-fired systems, by using gypsum board or asbestos panels which are at least 30 cm (12 in.) larger than the heating units.

16. PLOMBING

16.1 Materials and equipment

The plumbing equipment, faucets, washbasins, water closets and piping used in the construction of Digigraph buildings are standard products which are available locally and which conform to the applicable standards and codes. The drainage and sewer system is composed of 40 mm (1½ in.) ABS piping for the sinks and washbasins, and 75 mm (3 in.) for the water closets.

16.2 Installing the components

The piping for the potable water supply and for the drainage system must be installed in the floor slab before the concrete is poured. It is strongly recommended to keep openings in the slabs to be used as a mechanical shaft to run all plumbing pipes.

Certain portions of the interior walls may not be filled with concrete in order to permit the installation of drain and vent pipes in these cavities. *(Refer to the plumbing plan prepared by a local firm of engineers)*. Never install cooper pipes that require welding using a torch because heat can damage PVC.

17. FINISHES

17.1 Installing ceramic tile

Ceramic tiles can be installed directly on the PVC profile of the walls using regular acrylic cement.

17.2 Painting

The PVC sections may be painted at the factory using a special paint which protects the PVC from ultraviolet light. It is also possible to paint the extrusions in place once the construction of the building has been completed. It is recommended that 100% acrylic-base paints be used.

Before the paint is applied, light sanding of the surface to be painted is recommended in order to insure proper adhesion of the paint. On the interior face, only a single coat of paint is required. Other types of paint may then be applied as long as they are compatible with the base coat.

17.3 Acrylic stucco

Cement stucco cannot be applied directly onto the PVC. It is necessary to use acrylic stucco such as DUROCK, ACRIFIX or ADEX. *(Specifications can be obtained upon request).*

17.4 Insulation panels and coverings

In order to increase the thermal resistance of the walls and roof, it is possible to install rigid or semi-rigid insulation panels.

The panels may be held in place by screws which are installed in the slots provided for this purpose. The panels may then be covered with gypsum board panels, if the insulation is installed on the interior side, or by roofing materials, if the insulation is installed on the exterior side.

If insulation is installed on the roof panels, it is possible to cover them with clay or slate tiles. The structural engineer should be notified in advance if this is to be done.

Prepared by
DC INTERNATIONAL INC.
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