About this Manual

This manual was developed for the purpose of assisting constructors/builders in the proper manufacturing of monolithic reinforced concrete walls of any type with the stay-in-place formwork system – Armopanel™**.** This system does not only provide comfortable and safe means of producing monolithic reinforced concrete walls, but also significantly reduces labour costs at the construction site. This Manual assumes that generally accepted building techniques are used during construction of buildings with application of Armopanel™ stay-in-place formwork system. Structures erected with Armopanel**™** stay-in-place formwork system should be designed, engineered and erected in compliance with the current Building Codes and regulations.

DISCLAIMER

Although every effort was made to ensure that all data in the Armopanel's Manual, Design Guide, and Detailed Drawings is factual, accurate and in the accordance with the Current structural design practice, Hi-Tech Building Systems Corporation does not assume any responsibility for errors or oversights that may result form the use of the information contain herein.
Anyone making use of the content of these Manual, Design Guide, and Detailed Drawings assumes all liability arising of such use.
The information contained herein should not be used without careful examination and verification of its applications in specific projects and compliance with the local building code by certified professional structural engineer.

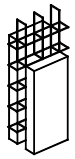
Rights of the manufacturer

Company producing Armopanel ™ follows the policy of continuous research and development in the field of wall erection with stay-in-place formwork. Due to this fact, the company reserves the rights to change or modify the contents of this Manual at any time.
It is the consumer's responsibility to use the most updated manual and design guide available on the market, during the use of Armopanel™ system. If the manufacturing company does not provide supervision services on the construction site during the use of the Armopanel™ system, the manufacturing company carries no liability with regards to wrong implementation of the system or any subsequent results.

Armopanel™ stay-in-place formwork system and all drawings or symbols are the trademarks of Hi-Tech Building Systems Corp.

About Armopanel™ stay-in-place formwork system

1) Armopanel™ stay-in-place formwork system is an easy-to-install product.
2) Its unique design is patented.
3) The three dimensional system of Armopanel^{TM} consists of individual three-dimensional blocks each of which contains the following elements. Perforated panels from foamed polystyrene sheets (Expanded or Extruded) are placed in parallel and positioned at interval by means of two dimension metal spacers. The interval corresponds to the width of the wall to be erected.



The metal spacers simultaneously offer a protective layer of concrete for the reinforcement and facilitate the insertion of horizontal and vertical rebars in compliance with the requirements of the current Building Codes and Standards. The sheets are fastened to the steel spacers by plastic caps providing stability to the entire three-dimensional Armopanel™ system.

3) Information on reinforcement installed inside the panel is classified according to the size of the reinforcement, the space between them and other design requirements. This information is summarized in tables and diagrams to follow (See Design Guide).
4) The thickness of the polystyrene sheet in the system exposed to the weather are as follows:
   The thickness of the exterior panel is determined by climate conditions in the region and varies between 50mm (2") to 150mm(6");
   The thickness of the interior panel is 50mm (2") of width.
6) The thickness of the polystyrene panels, which are used to erect interior walls, is always 50mm (2");
7) The individual blocks, which comprise the Armopanel™ system, are connected to each other and are capable of withstanding concrete pressure and wind forces during construction.

Armopanel™ is a fast and economical method by which the benefits of insulating concrete forms can be obtained.

Energy savings:

Thermal resistance:
R-value 20.3 – 21.5 (when the thickness of both the external and internal polystyrene panels is 50mm(2") and the thickness of the concrete wall is 100-350mm (from 4" to 14"))
When massive concrete walls with high thermal capacity are erected using the Armopanel™ system, they possess twice as much thermal stability as typical wooden frame walls.

Low noise level

STC > 50 practically eliminates outside noise.

Resistance to inflammation

Temperature of inflammation at open fire:	370ºC
Temperature of self-inflammation:	430ºC
Smoke forming:	< 380

Fire resistance

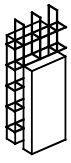
Concrete is a fire-resistant material (possesses fire rating ranging from 1 to 4 hours or more depending on the thickness of the concrete wall).

Non-toxic

Panels are free from toxic materials.

Comfort

The high thermal inertia created by the use of the Armopanel™ system produces stable temperature in the premises due to causing it to be cool in the summer and warm in the winter.



Advantages of Armopanel™ system at the construction phase

Armopanel™ is very attractive system for the Contractor/Builder due to the following reasons:

a) Use of Armopanel™ system yields minimal labour costs at the construction site because the polystyrene panels are supplied ready for installation (size 1200 mm (48") x 2400 mm (96")). Thus, the panels can be easily assembled and braced by two workers. Also, the creative design of the metal spacers allows for simple insertion of the vertical between the panels. Metal spacer is designed in the shape of mesh, which cells allow to position vertical and horizontal rebars. Horizontal reinforcement can be simply pushed into the panel space from the open end of the panel. Thus facilitating the placement of vertical and horizontal reinforcement of the concrete. In addition, the panels contain a pattern of plastic caps to which drywall or exterior siding can be easily attached by means of screws.

b) Panel assembly and wall erection doesn't require any special scaffolding. Scaffolding usually used for interior and exterior finishes may be employed during the erection of the wall.

c) The assembly and use of Armopanel ™ does not require highly skilled labour. Thus, intensive training of labourers can be avoided. Routine instructions are enough for effective assembly, bracing and placement of concrete, as well as for installation of electrical and plumbing services.

d) Panels have high thermal stability providing favourable conditions for concrete hardening.

e) Reinforcement installation can be easily controlled and inspected as any sheet can be entirely or partially removed and re-installed.

f) The Contractor/Builder will get all elements necessary for wall erection, including various types of corners and accessories from one supplier (manufacturer).

g) Based on the above, the Armopanel™ system is low-priced per square foot of panel surface (or the surface of the wall).

Armopanel™, is of the highest quality and is the most affordable system on the market.

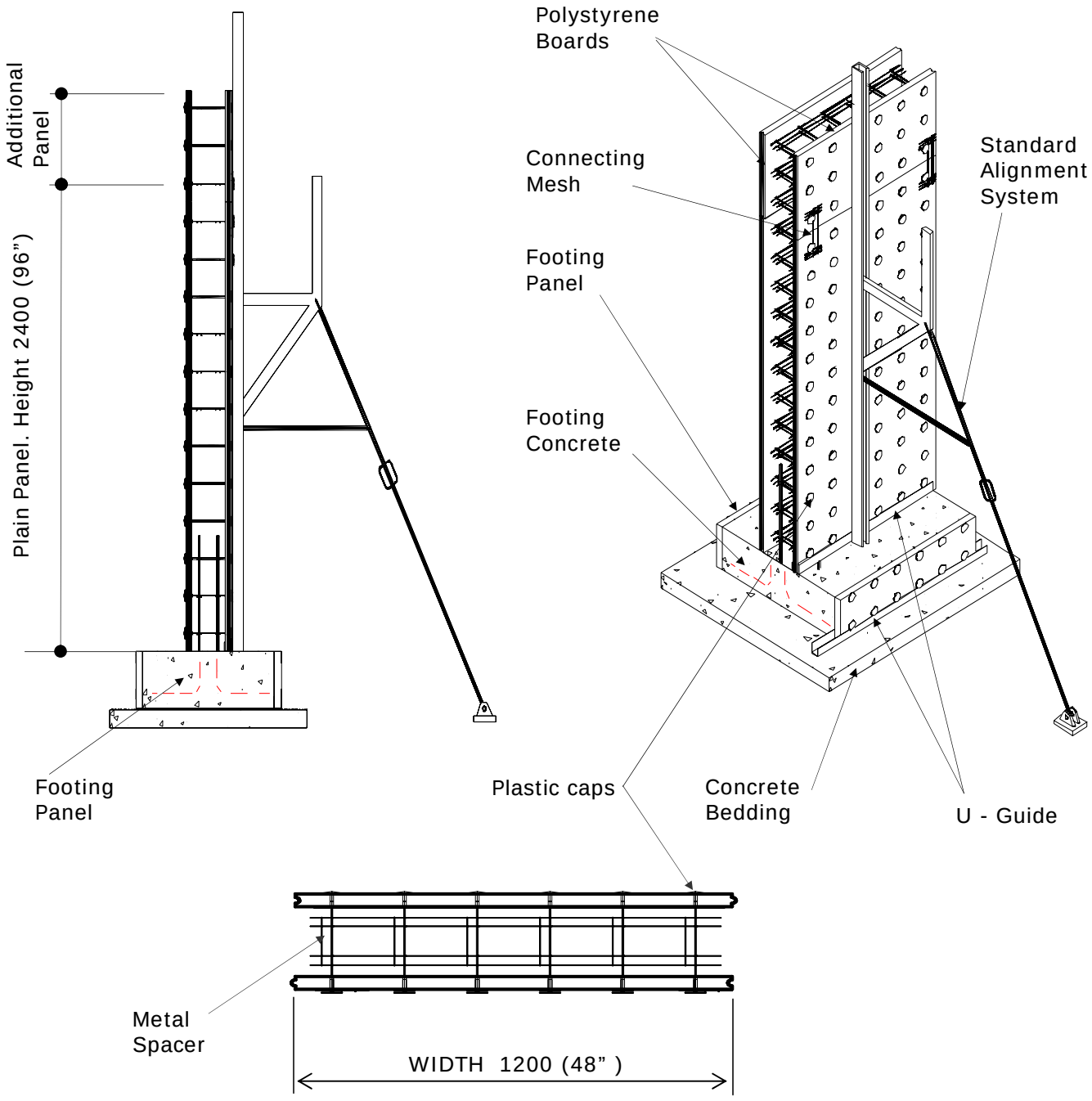


Figure i-1 Armopanel™

Stay-in-place formwork system for Concrete Walls

Armopanel ™ Concrete Wall System may be used for the following types of constructions:

- residential, institutional, commercial and industrial building,
- underground facilities, underground garages and parking lots,
- retaining walls and reservoirs.

The optimal height for elevated buildings erected using Armopanel™ should be up to 20m (65'), including roof; or 5-6 floors of height from 2.4 to 3.8m (96" to 152") each. In both cases, Armopanel™ allows for a 1-3 story basement with depth varying from 2.4 to 3.8m(96"÷152") each. Also, Armopanel™ should only be used in areas with low to medium seismic level.

The individual three-dimensional blocks of the Armopanel™ system are connected vertically by the overlapping of vertical reinforcement, which provides continuity for vertical reinforcement.

Connections between the wall and the top concrete slab are designed in two ways: either with hinge between the wall and slab or with a fixed (moment) connection. These details are specified in "Detailed Drawings" and provide significant help to the designer of the structure.

Armopanel™ Concrete Wall System comprises the following:
- main units: plain panels, corner panels, T-panels, and foundation panels;
- assembly elements and accessories: brick-ledge panel, meshes for the horizontal reinforcement, connecting elements and scaffolding.

The main units

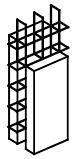
Armopanel™ system has six options for wall thickness: 100mm(4"), 150mm(6"), 200mm(8"), 250mm(10"), 300mm(12") and 350mm(14").

Panels of all types- are used for the basement walls and for the above-grade walls of the building.

H-Plain Panels are un-reinforced panels that have horizontal metal spacers only. During the erection of foundation or basement walls, these panels should be used together with Armopanel ™ foundation HVF panels. Standard length of each panel is 1200mm(48") and height is 2400mm(96").

HR-Plain Panels have the horizontal reinforcement. During the erection of foundation or basement walls, these panels should be used together with Armopanel™ foundation HRF panels. Standard length of each panel is 1200mm(48") and height is 2400mm(96").

V-Plain Panels are un-reinforced panels that have vertical metal spacers only. During the erection of foundation or basement walls, these panels are used with any type of foundation. Also, they can be used for retaining walls as well as for walls adjacent to door and window openings.



VR-Plain Panels have vertical reinforcement. During the erection of foundation or basement walls, these panels should be used together with any type of foundation. Also, they can be used for retaining walls as well as for walls adjacent to door and window openings.

Corner Panels are designed for walls with 90º, 45º, 30º angles in the horizontal plane. Apart from the horizontal metal spacers, these panels have horizontal reinforcement, which is selected according to the minimal reinforcement requirement of the concrete wall by code.
The spacing between rebars should be 200mm(8") or 400(16") in the vertical direction.

T-panels are installed in T-shaped wall crossings and have horizontal reinforcement, which is selected according to the minimal reinforcement requirement of the concrete wall by code. The spacing between rebars should be 200mm(8") or 400(16") in the vertical direction. Also, they can be used in the industrial buildings for pilasters in the load bearing walls supporting the beams, joists or trusses.

Foundation HVF-Panels have width that varies from 460mm(18") to 1000mm(40"). They should be reinforced by rebars spaced @ 200mm(8"). The length of the vertical dowels connecting the foundation panel to the plain panel is to be according to code. These panels can be used with *Plain H-Panels* or separately as the foundation formwork.

Foundation HRF-Panels have width that varies from 460mm(18") to 1000mm(40"). They should be reinforced by rebars spaced @ 200mm(8"). The length of the vertical dowels connecting the foundation panel to the plain panel is to be according to code. These panels can be used with *Plain HR-Panels* or separately as the foundation formwork.

Foundation panels for buildings without basement are panels pre-fabricated for simultaneous construction of foundation wall and footing. The panels are reinforced by vertical rebars with dowels spaced @ 200mm(8") according to the local building code. The footing should be placed below frost depth (see local building code for reference).

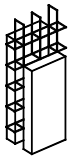
Assembly elements and accessories:

Brick-ledge Panels are used for the construction of concrete ledge for support of various structural members and may be used to construct ledges for an exterior layer of brick.

Brick-ledge element is a metal stirrup used for the construction of alternative ledge of brick support.

Horizontal Reinforcing meshes
Are used for reinforcement of the concrete walls. The spacing between reinforcement should be 200mm (8") or 400mm (16") along the height of the panel. The minimal area of horizontal reinforcement is to be according to the local building code.

Connection element
The panels are connected by means of steel meshes. These connecting elements are placed in the horizontal and vertical directions of the panels.



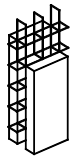
U-guide is a cold formed metal channel of 1500mm(59”) length which ensures accurate alignment and stability of the panels to prevent the possible horizontal displacement.

Turnbuckle brace is included in the system of panels vertical alignment during installation.

Post is included in the system of panels vertical alignment during installation and is also used for scaffolding.

Pad flange Detail is used to connect the panels during installation and is also used for the mounting of the alignment system.

Scaffolding is used during the erection of monolithic concrete walls.

Connecting elements connect plain panels of types V and VR to form corners of 90-degree angles.

Plastic spacers are the standard elements for securing vertical reinforcement.