

## B-1. BASIC DOCUMENTS AND MATERIALS FOR ARMOPANEL™

### **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 from 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.*

#### B-1.1. Codes and Standards considered during the design process.

The system of the cast in place reinforced concrete walls, **Armopanel™**, is designed in accordance with recommendations of National Building Code of Canada and American Codes and Standards - ICBO, SBCCI and BOCA.

This design guide considers provisions of the above codes regarding live and dead loads as well as safety factors.

Recommendations of NEHRP 2000 are considered for calculations and design of concrete structures built in seismic zones.

For each specific project, the Engineer should follow the local structural Codes, Standards and Regulations in order to calculate the factored loads and forces applied on the structure.

#### B-1.2. Calculation of the cast in place reinforced concrete walls is performed in accordance with CSA STANDARD A23.3-94; US CODE ACI-318-99 and Commentary 318R-99. Also, recommendations from "Reinforced Concrete Fundamentals", Phil Ferguson, John E. Breen, James O. Jirsa, 5<sup>th</sup> Edition and "Guide to Formwork for Concrete".

#### B-1.3. The following Standards were used for references:

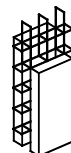
Welding of reinforcement: in accordance with CSA Standard W59-M1989, ANSI/AWD  
D 1.4 – 98 (USA).

Reinforcement:

Deformed bars: CSA Standard G30.14; ASTM A496, ASTM A497, ASTM A615/A615 M  
A616/A616M, A706/A706M

Yield Strength 400MPa; (Grade 60) is no lower than 60 000 psi

Plain wires are required for reinforcement ties, bracers and fasteners for polystyrene boards with strength of at least 280MPa, CSA Standard G30.3; 40 000 psi: ASTM B-82; ASTM A-85.



- B-1.4. Concrete: in accordance with the requirements: CAN/CSB-A23.1/A23.2-00;  
ASTM 150 and C 595; ASTM and C 172; ASTM and C 173 (or C 231)
- B-1.5. Polystyrene: CAN/ULC-S701-97    EPS or XPS    not less than    Type 3  
ASTM C 578-00    EPS or XPS    Type IV, Type IX, Type X
- B-1.6. The material of the polypropylene caps for securing of the polystyrene boards meets the requirements of CAN/CSA-C22.2 N0. 0.17-00;  
ASTM D1505, D638, D790 and D2240.
- B-1.7. The U-guide material is zinc cold formed profile with thickness of approximately 1/16" (1.52 mm) and meets the requirements of CAN S136-M84; ASTM A-792M, AZ50.
- B-1.8. Fire safety requirements for monolithic reinforced concrete walls built with elements of Armopanel™ Concrete Wall System.
- Monolithic reinforced concrete walls designed with **Armopanel™ Concrete Wall System** are classified as noncombustible type of materials with 1-4 hour fire resistance according to NBC of Canada 1995 (Section D-2) ; BOCA (NBC1999), ICBO (UBC1997), SBCCI (SBC1999.)
- B-1.9. Armopanel™ can be used according to codes in the following types of residential, industrial and commercial structures:  
Group A - Assembly (UBC - Section 303; SBC-Section 304, NBC-Section 303), 2.2.1.2;  
Group B - Business (UBC - Section 304; SBC-Section 305, NBC-Section 304), 2.2.1.3.;  
Group E - Educational (UBC - Section 305; SBC-Section 306, NBC-Section 305);  
Group F - Factory-Industrial (UBC - Section 306; SBC-Section 306, NBC Section 306),  
Group M -Mercantile (UBC - Section 309; SBC-Section 310, NBC-Section 309), 2.2.1.6.  
Group R -Residential (UBC - Section 310; SBC-Section 311, NBC-Section 310), 2.2.1.7.  
Group S -Storage (UBC - Section 311; SBC-Section 312, NBC-Section 311).
- B-1.10. Minimal thickness of monolithic reinforced concrete walls accepted for Armopanel™ Concrete Wall System design is equal 100mm (4"). With dry plaster by thickness 5/8", fire resistance of walls with thickness 100mm (4") will correspond to the required 2 hour fire resistance rating. Accepted in **Armopanel™ Concrete Wall System** walls thickness of 150-350mm (from 6 " up to 14 " ), it corresponds to 3 hour fire resistance rating and without plaster, and walls thickness 200 – 350mm (from 8 " up to 14 " ) corresponds to 4 hour fire resistance rating( NBC of Canada 1995, part 3.1.7.5.; ICBO 709; SBCCI-709.2.3A and BOCA-709.2.3.1).
- B-1.11. The spacers in the Armopanel™ system provide concrete cover of 1.5" (40mm) for reinforcement.  
This corresponds to the 3 and 4-hour fire resistance requirements for all wall thickness within the range of 100 to 350mm (from 4" to 14").  
(CAN STANDARD A23.3-94 ; ICBO 704-3; SBCCI-709.2.4.3.2.3 and BOCA-709.2.3.1).



- B-1.12. The concrete that is to be used for the erection of monolithic walls with Armopanel™ system, must be concrete type "S" (NBC of Canada 1995, Appendix "D") according to fire resistance requirements. As coarse aggregate for this concrete, is granite, quartz, gravel, or other dense materials containing minimum 30% of quartzite, or silicium (see CAN/CSA-A23.1/A23.2-00; ASTM C-33-97).
- B-1.13. The Flame Spread index for polystyrene boards is in the range of 5-10, that is less than 24 (25) -limiting index - specified in CAN/ULC-S701-97 (ASTM E84) for groups of the buildings described in the Design Guide. According to ICF classification, Smoke Developed index of the internal polystyrene board with thickness of 50mm (2 ") does not exceed 300, while index allowed by the American Code is no more than 450.
- B-1.14. According to the requirements of NBC of Canada 1995; ICBO-2602, SBCCI-2603 and BOCA-2603.6, this manual also stipulates that the polystyrene sheets should be separated from the interior area of the building by a layer of dry wall with thickness of at least ½" secured by screws to the plastic caps.
- B-1.15. The concrete used in reinforced concrete walls design.  
While placing the concrete in the Armopanel™ Concrete Wall System, the following concrete is recommended to use:  
Normal weight (2300-2400 kg/m<sup>3</sup>) concrete with the strength of 20-30 MPa. Quality of used aggregate see B-1.12 (CAN/CSA-A23.1/A23.2-00; ASCE C-33-97).
- B-1.16. The panels are made from the following materials:  
Reinforcing steel shall be deformed according to CSA Standard G30.18-M1992 with the strength of 400 MPa.(6000 psi), TM A497, ASTM A615/A615M, A616/A616M, A706/A706M  
  
Reinforcing steel for connecting meshes and ties is according to CSA Standard G30.3; with strength of 280 MPa; ASTM B-82; ASTM A85. .( 40 000 psi)  
  
Plastic caps are made from polypropylene. They have thermal resistance and module of elasticity of (1,5 - 1.8) x 10<sup>5</sup> psi.
- B-1.17. **Armopanel™ Concrete Wall System's** exterior sheets are made from expanded or extruded polystyrene. The 3-D block consists of two EPS or XPS sheets, Type 3 or 4 (Type VI or IX), density of no less than 30 kg/m<sup>3</sup> (1,8-2,0 Lbs/ft<sup>3</sup>) and the module of elasticity is not less than E=3.5 MPa (500 psi).
- B-1.18. U-guides are used for horizontal alignment of the formwork and for the fastening of the interior polystyrene sheets. This protects the formwork against lateral movement during the placement of the concrete. The U-guides are made from cold form steel with thickness of 1/16 " (1.52 mm).
- B-1.19. Screws provided to fix the U-guides to the floor should be made from galvanized steel with length of 25 – 38 mm (1.0 ".5 ") and have minimum Grade 10.

