LEGACY REPORT

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Legacy report on the BOCA® *National Building Code*/1999

DIVISION: 06—WOOD AND PLASTICS
Section: 06128—Cementitious Reinforced Panels

EVALUATION SUBJECT:

VIROC TYPE T2 CEMENT BONDED PARTICLEBOARD

MANUFACTURER:

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EVALUATION SCOPE

Compliance with the following code:

BOCA® *National Building Code*/1999

- Section 106.4 Alternative materials and equipment
- Section 704.1.1 Fireresistance ratings
- Section 704.4.1.1 Elementary materials
- Section 716.5 Impact protection
- Section 803.2 Classification
- Section 1214.2 Air-borne noise
- Section 1301.1 Scope
- Section 1404.2 Durability
- Section 1404.3 Weather resistance
- Section 1406.2.1 Backing surfaces for veneers
- Section 1604.1 Basic requirements
- Section 1609.8 Building components and cladding
- Section 1704.3 Labeling
- Section 2308.0 Standards
- Section 2503.4 Water-resistant gypsum backer board

DESCRIPTION

VIROC Type T2 Cement Bonded Particleboard is a noncombustible cement bonded particleboard. Type T2 is a designation of this material based upon the British Standards Institution BS 5669 Particleboard and shall not be confused with any other standard designation. VIROC Type T2 Cement Bonded Particleboard is manufactured in thicknesses from 6 mm (1/4 in.) to 40 mm (1 1/2 in.). VIROC Type T2 Cement Bonded Particleboard is produced in English and metric sizes; the English sizes are in 4 feet widths with lengths of 8 and 10 feet (metric equivalents are 2440 mm by 1220 mm and 3050 mm by 1220 mm) and the metric sizes are 1250 mm by 2500 mm and 1250 mm by 3050 mm. VIROC Type T2 Cement Bonded Particleboard is intended for use as wall, floor, and roof sheathing on the interior and exterior of buildings of all construction types. The intended applications of VIROC Type T2 Cement Bonded Particleboard include use as:

- Interior finish sheathing or substrate in areas:
  - subject to impact damage;
  - requiring fireresistant rated construction;
  - separating residential dwelling units;
- An alternative to fireresistant gypsum board in fire-resistance rated assemblies;
- A component in walls required for sound transmission control;
- A component in walls requiring energy conservation;
- An exterior weather resistant covering;
- A substrate for field applied finishes to exterior wall surfaces;
- Flooring, both as finish material and as sheathing;
- Sheathing for pitched roofs, and decking for flat roofs;
- An alternative to particleboard (resin bonded) sheathing in areas where protection of wood members is required because of exposure to soil or weather, or where material is subject to rot or decay;
- An alternative to water-resistant gypsum board.

The VIROC Type T2 Cement Bonded Particleboard panel is light grey in colour and is constructed of portland cement and wood particles. The wood particles are mineralized by the portland cement into a material that is intended to resist attack from chemicals, weather, fire, and fungi. The VIROC Cement Bonded Particleboard is classified as a Type T2 particleboard

in accordance with the British Standards Institution BS 5669:Part 4: 1989 entitled *Particleboard Part 4. Specification for cement bonded particleboard*, (this is not to be confused with the classification for the bonding system described in ANSI A208.1-1989 for resin-bonded particleboard).

The VIROC Type T2 Cement Bonded Particleboard has a smooth, hard surface on both faces of the board and is available in panel sizes of 1250 mm by 2600 mm (4 feet by 8 feet) and 1250 mm by 3050 mm (4 feet by 10 feet). VIROC Type T2 Cement Bonded Particleboard does not contain asbestos, silica, toxins, hazardous volatiles, or formaldehyde. VIROC Type T2 Cement Bonded Particleboard is fabricated for field installation from full-sized sheets employing conventional wood production tools and practices. The attachment of VIROC Type T2 Cement Bonded Particleboard to the building framing is accomplished with fasteners and details consistent with the application and the desired structural resistance values.

CONDITIONS OF USE

This report is limited to the applications and products as stated in this report. The ICC-ES Subcommittee on National Codes intends that the report be used by the code official to determine that the report subject complies with the code requirements specifically addressed, provided that this product is installed in accordance with the following conditions:

- VIROC Type T2 Cement Bonded Particleboard shall be installed in accordance with this report and the manufacturer's installation instructions entitled *VIROC Technical Characteristics/Processing,* dated May 1992.
- The attachment of VIROC Type T2 Cement Bonded Particleboard to the building framing shall be with fasteners and details consistent with the application and the desired structural resistance values.
- VIROC Type T2 Cement Bonded Particleboard panels shall be installed with a minimum thickness of 12 mm (1/2 in.) unless noted otherwise in this report.
- Fastener location and placement shall be designed and installed so that the pull-out on the fastener does not exceed the following values:
  - 6d nails--325 pounds,
  - #8 × 1″ bugle head screws - 363 pounds
- Fastener location and placement shall be designed and installed so that the lateral edge resistance on the fastener does not exceed the following values:
  - 6d nails--389 pounds,
  - #8 × 1″ bugle head screws - 359 pounds
- Fireresistance ratings of assemblies using VIROC Type T2 Cement Bonded Particleboard shall not exceed the ratings listed in this report. The assemblies shall comply with the provisions of Table 1 at the end of this report.
- Live-load values placed upon VIROC Type T2 Cement Bonded Particleboard shall not exceed the loads listed in Table 3 at the end of this report.
- Wind-load design pressures placed upon VIROC Type T2 Cement Bonded Particleboard shall not exceed the loads listed in Table 3 at the end of this report.
- When VIROC Cement Bonded Particleboard is used to resist racking, it shall be fastened in accordance with Table 2305.2 of the BOCA *National Building Code*/1999 and so that the pull-out stresses on the fasteners does not exceed the values listed in this report.
- This report is subject to periodic re-examination. For information on the current status of this report, contact the ICC-ES.

ITEMS REQUIRING VERIFICATION

The following items are related to the use of the report subject, but are not within the scope of this evaluation. However, these items are related to the determination of code compliance:

✔Construction documents consistent with this report.

INFORMATION SUBMITTED

■ FIRE PERFORMANCE EVALUATION

- United States Testing Company, Test Report Number 097354, dated March 16, 1990, was submitted and contains test results of flame spread and smoke-developed ratings, in accordance with ASTM E84, indicating a Class I interior finish rating for the VIROC Type T2 Cement Bonded Particleboard.
- Test reports were submitted which used the British Standards Institution Fire Test on Building Materials and Structures, B.S. 476 Part 20 (which incorporates Parts 21 and 22). These specific tests are identified in Table 1 at the end of this report.
- PFS Corporation, in a letter from Michael J. Slifka to Ronald H. Reindl, dated July 5, 1994, compared the B.S. 476 Part 20 to ASTM E119. In the letter by PFS Corporation it states "the BS B6476, Part 20 test is comparable to the ASTM E119 fire test used in the United States to within one minute of fire rating for one-hour rated assemblies. For assemblies beyond one hour, the British method will produce results in excess of the ASTM E119 method." This conclusion was reached based upon the fact that the British test is "hotter" than the ASTM E119 after the first 30 minutes of the test.

  The results of four different fireresistance tests indicate fireresistance ratings which range from between 75 minutes to 157 minutes. This range results from changes in the tested wall assemblies.

  The maximum allowable fireresistance rating for a partition with a single layer of VIROC Type T2 Cement Bonded Particleboard on each side of the partition, with a minimum panel thickness of 12 mm (1/2 inch), shall be one (1) hour. The maximum allowable fireresistance rating for a partition with a single fillet (a narrow strip of the same thickness VIROC panel) of a minimum width of 100 mm (4 inches) VIROC Type T2 Cement Bonded Particleboard over each stud and track/plate and then a single layer of VIROC Type T2 Cement Bonded Particleboard on each side of the partition, with a minimum panel thickness of 12 mm (1/2 inch), shall be one and one half (1 1/2) hours. Refer to Table 1 at the end of this report for complete test information including wall assembly composition. Refer to Figure 1 at the end of this report for a sketch of this wall assembly.
- VTEC Laboratories Inc., Test Report Number 100-525, dated April 17, 1995, was submitted and contains test results of elementary materials combustibility in accordance with ASTM E136. Tests results indicated that VIROC Type T2 Cement Bonded Particleboard meets the criteria of Section 704.4.1.1 of the *BOCA National Building Code*/1999, and is noncombustible.
- United States Testing Company, Test Report Number 097354, dated September 7, 1990, was submitted and contains test results of impact resistance testing in accordance with ASTM D256-90, *Impact Strength Test, Method B*. Additionally, Mechanics Laboratory in Paris for the CTBA-The Wood and Furniture Engineering Centre performed three similar European tests for Safety Impact Resistance. The result of all these tests indicated that the VIROC Type T2 Cement Bonded Particleboard is capable of successfully resisting substantial impact forces without

experiencing breakage or fissuring. Refer to Table 2 at the end of this report for complete test information on impact resistance.

■ SOUND TRANSMISSION CONTROL

- CEBTP Building and Public Works Research and Investigation Experimentation Centre in France, Test Report File No. 642.6.985, dated October 23, 1987, with the actual test dated September 24, 1987, was submitted and contains test results of sound transmission testing of conventional metal stud framed wall with 12 mm thick VIROC Type T2 panels on both sides with rock wool sound insulation. This test uses the fact that ASTM E90 references ASTM E413 and ISO 717 as standards for deriving the sound transmission rating. The results of the sound transmission testing indicated that the average STC rating was greater than 45.

- CSTB Building Sciences and Engineering Centre in France, Test Report Number 26012, dated January 22, 1988, was submitted and contains test results of sound transmission testing. Test results indicate that when 12 mm (1/2 in.) VIROC Type T2 Cement Bonded Particleboard is mounted alone between supports, and has an STC rating of 31.

■ ENERGY CONSERVATION

- United States Testing Company, Test Report Number 097354, dated September 7, 1990, was submitted and contains test results of VIROC Type T2 Cement Bonded Particleboard for thermal conductivity and thermal resistance in accordance with ASTM C518-90. The results of this testing indicate that 12 mm (1/2 inch) thick VIROC Type T2 Cement Bonded Particleboard has a thermal conductivity, K, of 1.02 Btu-inch/hour-feet²-F° and a total thermal resistance, R, of 0.45 hour-feet²-F°/Btu.

■ EXTERIOR WALL COVERINGS

- The test data submitted indicate that the VIROC Type T2 Cement Bonded Particleboard meets the code criteria for use as a weather-resistant exterior wall surface by itself or as a substrate for other exterior materials such as masonry veneer. The VIROC Type T2 Cement Bonded Particleboard panels are an alternative to pressure-treated water-resistant plywood because of its resistance to moisture and rot.

- Long-term testing for moisture exposure and water immersion in accordance with a test similar to ASTM C630 was performed on VIROC Type T2 Cement Bonded Particleboard. This testing indicates that VIROC panels were unaffected by exposure to water, and lost none of their integrity. Similarly, the VIROC panel, after immersion in water testing, was not affected by the moisture and had no degradational effect.

- Test results were submitted indicating that the VIROC Type T2 Cement Bonded Particleboard meets code criteria for use as: a weather-resistant exterior wall surface by itself, a substrate for other exterior materials, or as an alternative to pressure-treated water-resistant plywood. The results of the following tests reviewed for this material criteria are indicated in Table 4 at the end of this report:

  - ♦ United States Testing Company, Report Number 097354, dated September 7, 1990. (Report #1)

  - ♦ EN 112 European Standard Frost Resistance Test, dated March 1993. (Report #2)

  - ♦ CSTB Building Sciences and Engineering Centre in France, Report No. CR 24.352, dated February 6, 1987. (Report #3)

  - ♦ CSTB Building Sciences and Engineering Centre in France, Report No. CR 86.2188, dated January 15, 1987, and Reference: 5.1/3536, dated March 15, 1982. (Report #4)

  - ♦ CSTB Building Sciences and Engineering Centre in France, Report No. CE 86.2188, dated September 24, 1986. (Report #5)

  - ♦ CSTM Building Sciences and Engineering Centre in France, Test Report Number 24.351, certified by Control Chief Engineer R. Charlier on November 1994. (Report #6)

■ STRUCTURAL PERFORMANCE

- Load testing of the VIROC Type T2 Cement Bonded Particleboard was performed to determine the maximum allowable load to be safely supported by the panels based upon their thickness. These maximum loads were developed using a safety factor of **5**, and a deflection limit of L/360 (including the weight of the panel). Refer to Table 3 at the end of this report for these load values, which are the maximum **live** load (the weight of the panel has been deleted from the values indicated in the table). The values used for Table 3 were taken from the printed literature titled *Technical Characteristics/ Processing* dated July 3, 1986, and were verified by Professional Engineer David C. Brigham.

- Structural analysis to determine allowable wind-load values were performed by Richard M. Reinhard, P.E., Technical Director of PFS Corporation. The analysis was performed on 12 mm (1/2 inch) thick panels that span 400 mm (15.75 inches). The results of this analysis were indicated in a letter dated April 4, 1994 and are consistent with the load values indicated in Table 3, at the end of this report, for 12 mm (1/2 inch) thick panels that span 400 mm (15.75 inches).

- United States Testing Company, Inc., Test Report Number 097354, dated September 7, 1990, was submitted and contains test results of nail/screw head pull through and lateral resistance on fasteners used with VIROC Type T2 Cement Bonded Particleboard in accordance with ASTM D1037-90. The results of this testing indicated that 6d nails were capable of resisting 325 pounds pull through and 389 pounds of lateral load, and #8 ×1 inch bugle head screws were capable of resisting 363 pounds pull through and 359 pounds of lateral load.

- United States Testing Company, test report number 097354, dated September 7, 1990, was submitted and contains test results of comparison of VIROC Type T2 Cement Bonded Particleboard to the requirements for ANSI A208-1989 in accordance with testing to be performed using ASTM D1037-90. ANSI A208-1989 comprises the standard of quality for wood particleboard that is made from particles of wood bonded together with synthetic resins or other suitable bonding systems. ANSI A208 uses ASTM D1037, entitled *Standard Methods of Evaluating the Properties of Wood Base Fiber and Particle Panel Materials* as the basis for evaluating the quality of the particleboard panels. Tests in accordance with ASTM D1037-90 indicated that VIROC Type T2 Cement Bonded Particleboard met or exceeded all the requirements for resin-bonded particleboard listed in ANSI A208.

- A comparison of the ANSI A208 standard to the British Standards Institution British Standard BS 5669: Part 4: 1989 indicates that the VIROC Type T2 Cement Bonded Particleboard is the equivalent to resin-bonded particleboard covered in the ANSI A208 standard.

- CSTB Building Sciences and Engineering Centre in France, Test Report Number CEBTP PV OD 38 was submitted and contains test results of VIROC Type T2 Cement Bonded Particleboard as wind bracing in a test similar to ASTM E72. Test results indicated that the performance as wind bracing material is equivalent to or better than:

  - ♦ 10 mm (3/8 in.) plywood,
  - ♦ 12 mm (1/2 in.) gypsum board.

- CSTB Building Sciences and Engineering Centre in France, Test Report Number CE 86.2188, dated September 24, 1986, was submitted and contains test results of formaldehyde content determination in accordance with standard NF B 51271 (EN 120): entitled *The So-called "Perforator Extraction Method."* These test results indicated that VIROC Type T2 Cement Bonded Particleboard contained no formaldehyde. ANSI A208 allows up to 0.30 parts per million of formaldehyde in the manufacture of resin-bonded particleboard.

■ **LABELING REQUIREMENTS**

- A copy of *Certifaction # 2/97-597* signed by CSTB, dated December 31, 2002. The certification includes procedures for inspection and labeling of the Viroc Type T2 Cement Bonded Particleboard panels. The panels are marked with a reference to the quality control agency, CSTB.

■ **ALTERNATIVE TO WATER-RESISTANT GYPSUM BACKER BOARD**

- The CSTM Building Sciences and Engineering Centre, Test Report Number 24.351, certified by Control Chief Engineer R. Charlier on November 1994, was submitted and contains test results of moisture exposure and water immersion testing on VIROC Type T2 Cement Bonded Particleboard in accordance with a test similar to ASTM C630. This testing indicated that VIROC panels were unaffected by the exposure to water and lost none of their integrity. Similarly, the VIROC panel, after the immersion in water testing, was not affected by the moisture and had no degradational effect. This test was similar to that of the ASTM C630 test in performance outcomes.

APPLICATION FOR PERMIT

To aid in the determination of compliance with this research report, the following represents the minimum level of information to accompany the application for permit:

■ The language "See ICC-ES Legacy Report No. 94-61" or a copy of this report.

■ All building permit applications specifying VIROC Type T2 Cement Bonded Particleboard, shall be accompanied by construction documents, including calculations, which shall be furnished to the code official verifying compliance with this report. The individual preparing such documents shall be competent and qualified in the application of the structural design principles involved, and shall possess the registration or license in accordance with the professional registration laws of the state in which the project is constructed. The construction documents shall include, at a minimum, the following;

  - ■ The specific usage of the VIROC Type T2 Cement Bonded Particleboard.
  - ■ The building construction type and the fire separation distance between the building and the lot line when intended for use as a component of an exterior wall.
  - ■ The product manufacturer's name, product name, panel size(s), panel thickness, and panel finish.
  - ■ Sufficient joint details and other installation details. These details shall show all necessary fastening methods and any other special joint conditions.
  - ■ The required fireresistance rating of any assembly that uses the VIROC Type T2 Cement Bonded Particleboards.
  - ■ If VIROC Type T2 Cement Bonded Particleboard is used as an exterior wall sheathing, wall covering, or roof sheathing, then the wind design pressure values, positive and negative, used in the design of this building. Structural calculations to indicate panel and fastener conformance to applicable wind-load requirements.
  - ■ If VIROC Type T2 Cement Bonded Particleboard is used as floor sheathing or roof sheathing, then the building live loads shall be indicated along with the appropriate material thickness in accordance with the values contained in Table 3 at the end of this report. Structural calculations to indicate panel and fastener conformance to applicable live-load requirements.

PRODUCT IDENTIFICATION

■ VIROC Type T2 Cement Bonded Particleboard manufactured in accordance with this research report shall be marked at the plant with the identifying language, "See ICC-ES Legacy Report No. 94-61."

■ In addition to the identification referencing the ICC-ES Legacy Report, the VIROC material described in this report shall also be identified as follows:

  - ■ It shall bear the label of the third party inspection agency, CSTB.
  - ■ It shall be color coded by having a red color coded stripe applied to either the two long edges or two short edges of the board. The stripes shall be at least 25 mm (1 in.) wide and shall be applied diagonally between opposite corners.

This report is subject to re-examination in two years.

Table 1
VIROC CEMENT BONDED PARTICLEBOARD
FIRERESISTANCE RATINGS [9]

REPORT NUMBER	INTEGRITY RATING[1]	INSULATION RATING[2]	LOADBEARING RATING[3]	BEARING STATUS	WALL CONSTRUCTION
J 82668/1	93 minutes	93 minutes	not applicable	nonloadbearing	12 mm thick-see note [4]
Firto—3 July 1986	157 minutes	157 minutes	157 minutes	loadbearing	12 mm thick-see note [5]
J 92253/1	126 minutes	113 minutes	not applicable	nonloadbearing	16 mm thick-see note [6]
Warren No. 55962	73 minutes	73 minutes	75 minutes	loadbearing	8 mm thick-see note [7]

[1] Per BS 476: Part 20, this rating is given for the time in which there is no collapse of the specimen, no flaming on the unexposed surface and no loss of impermeability.

[2] Per BS 476: Part 20, the highest mean and maximum individual unexposed face temperature rises allowable are 140°C and 180°C (60°F and 82.2°F) respectively. This rating is given for the time in which the highest mean and maximum individual unexposed face temperature rises prior to the time of integrity failure.

[3] Per BS 476: Part 20, this rating is given for the time in which specimen fails to support the test loading, which is usually determined by a rapid change in the rate of deformation tending towards infinity.

[4] The test assembly consisted of an unloaded partition, formed from steel channel studs, 50 mm wide by 55 mm deep (2 in. wide by 2-1/8 in. deep). The studs were clad on either side with 80 mm (3 in.) wide fillets of 12 mm (1/2 in.) thick VIROC cement bonded particleboard and insulated with mineral wool batts between the studs. The fillets were faced on either side with 12 mm (1/2 in.) thick VIROC cement bonded particleboard. The assembly was fastened with gypsum panel screw type fasteners at 300 mm (12 inch) centres and the joints were filled and skim coated. Assembly was tested per BS 476: Part 22.

[5] The test assembly consisted of a loaded partition, formed from timber studs, 45 mm wide by 70 mm deep (1-3/4 in. wide by 2-3/4 in. deep). The studs were clad on either side with 100 mm (4 in.) wide fillets of 16 mm (5/8 in.) thick VIROC cement bonded particleboard and the voids between the studs were filled with 50 mm (2 in.) thick mineral-fibre slabs. The fillets were faced on either side with 12 mm (1/2 in.) thick VIROC cement bonded particleboard. The assembly was fastened with gypsum panel screw type fasteners at 250 mm (10 inch) centres and the joints were filled and skim coated. Assembly was tested per BS 476: Part 22.

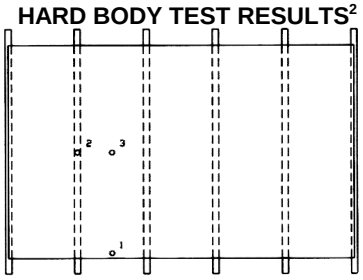
[6] The test assembly consisted of an unloaded partition, formed from steel I-section studs, 70 mm deep (1-3/4 in.). The studs were clad on either side with 75 mm (3 in.) wide fillets of 16 mm (5/8 in.) thick VIROC cement bonded particleboard and voids between the faces of the fillets were pack filled with 100 mm (4 in.) thick rockwool batt insulation. The fillets were faced on either side with 16 mm (5/8 in.) thick VIROC cement bonded particleboard. The assembly was fastened with gypsum panel screw type fasteners at 400 mm (12 inch) centres in the field and 300 mm (10 inch) centres at the periphery and the joints were filled and skim coated. Assembly was tested per BS 476: Part 22.

[7] The test assembly consisted of a loaded composite wall assembly, formed of two skins of VIROC cement bonded particleboard and a polyisocyanurate foam insulation core. The foam core contained I-section steel studs, 70 mm deep (1-3/4 in.). The foam core/studs were faced on either side with 8 mm (5/16 in.) thick VIROC cement bonded particleboard. A layer of 15 mm (5/8 in.) thick plasterboard was fastened to the fire exposure side of the assembly. The assembly was fastened with gypsum panel screw type fasteners at 400 mm (12 inch) centres and the joints were filled and skim coated. Assembly was tested per BS 476: Part 21.

[8] 25.4 mm equals 1 inch.

[9] For the maximum allowable fireresistance ratings for partitions using VIROC Type T2 Cement Bonded Particleboard, refer to the conclusions of the fire test results contained in the "information submitted" section of this report.

Table 2
VIROC CEMENT BONDED PARTICLEBOARD IMPACT TESTING RESULTS

PANEL THICKNESS		SPACING BETWEEN SUPPORTS		"SAFETY IMPACT" TEST RESULTS[1]	HARD BODY TEST RESULTS[2] 					
					Location 1		Location 2		Location 3	
mm	IN	mm	IN		mm	IN	mm	IN	mm	IN
Report on Impact Testing of Vertical Coating (VIROC Panels) performed by CTBA The Wood and Furniture Engineering Centre, Report CR CN 86/005										
12	1/2	600	24	at 200 joules (148 ft. lbf.) rupture of the panel in the centre of the bay	11	7/16	11	7/16	13	1/2
12	1/2	400	16	up to 500 joules (369 ft. lbf.), indentation of the panel of 3 mm (1/8 IN) with fissuring at the centre of the bay	11	7/16	12	1/2	14	9/16
16	5/8	600	24	at 600 joules (443 ft. lbf.), indentation of the panel of 2 mm (3/32 IN) with fissuring at the centre of the bay	11	7/16	11	7/16	14	9/16
16	5/8	400	16	at 700 joules (516 ft. lbf.), indentation of the panel of 1.5 mm (1/16 IN) without apparent fissuring; at 800 joules (590 ft. lbf.), indentation of the panel of 2.5 mm (3/32 IN) with fissuring at the centre of the bay visible from the back	12	1/2	12	1/2	15	5/8
18	13/16	600	24	at 1000 joules (738 ft. lbf.), indentation of the panel of 1.5 mm (1/16 IN) with fissuring at the centre of the bay	11	7/16	12	1/2	15	5/8
18	13/16	400	16	at 1000 joules (738 ft. lbf.), indentation of the panel of 2 mm (3/32 IN) with fissuring at the centre of the bay	12	1/2	12	1/2	15	5/8
Report on Impact Tests on Walling Element for Timber Framed House Carried out on the Exterior Lining (VIROC Panels) performed by CTBA The Wood and Furniture Engineering Centre, Report PV-CS-No. 052-1/86										
10	3/8	400	16	at 400 joules (295 ft. lbf.), indentation of the panel of 13 mm (1/2 IN) with fissuring at the centre of the bay	19	3/4	15	5/8	9.5	3/8
10	3/8	400	16	at 400 joules (295 ft. lbf.), indentation of the panel of 2 mm (3/32 IN) with fissuring of the panel at the centre of the bay; at 500 joules (369 ft. lbf.), panel penetrated and fell	---	---	---	---	---	---
10	3/8	600	24	at 200 joules (148 ft. lbf.), indentation of the panel of 2 mm (3/32 IN) with fissuring of the panel at the centre of the bay	22	7/8	14	9/16	8	5/16
10	3/8	600	24	at 200 joules (148 ft. lbf.), indentation of the panel of 7 mm (1/4 IN) with fissuring of the panel at the centre of the bay	---	---	---	---	---	---
12	1/2	600	24	at 200 joules (148 ft. lbf.), indentation of 1.5 mm (1/16 IN) without apparent fissuring of the panel	17.5	11/16	17	11/16	11	7/16
12	1/2	600	24	at 300 joules (221 ft. lbf.), indentation of the panel of 4 mm (3/16 IN) with fissuring of the panel at the centre of the bay	---	---	---	---	---	---

[1] The "Safety Impact" Test tests the VIROC Cement Bonded Particleboard panels for their resistance to external impacts. The safety impact with a power of 1000 joules (738 ft. lbf.), carried out in stages of 100 joules (74 ft. lbf.), is applied with a cylindrical linen bag 400 mm (16 IN) in diameter filled with dry silica sand with a weight of 50 kg (110 pounds), which is suspended in the plane of the mock-up.

The bag is allowed to drop in a pendulum fashion without initial speed, from a height of 2 m (6.5 FT). The test is carried out at the center of a bay next to the central bay and half way up the panel.

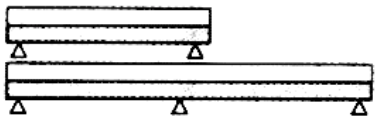
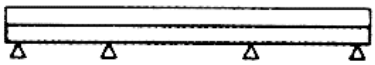
[2] The test for impact from a hard body, with an energy of 10 joules (7 ft. lbf.), is carried out with a steel ball 62.5 mm (2.5 IN) in diameter, with a mass of 1 kg (2.2 pounds) which is suspended in the plane of the mock-up.

The ball is allowed to fall in a pendulum fashion without initial speed, from a height of 1 m (3.25 FT). The test is carried out on 3 points; Location 1 which is at the center of the bay 30 mm (1-3/16 IN) up from the bottom, Location 2 which is centered over a support at the center of the bay, and Location 3 which is at the center of a bay half way up the panel.

[3] 1 joule = 1 newton thru 1 meter = 0.737562± pound feet of force.

[4] The U.S. equivalent measurements given in this table are approximate values as the tests and the components are measured in exact metric values.

Table 3
VIROC CEMENT BONDED PARTICLEBOARD
TOTAL MAXIMUM ALLOWABLE LOADS (LIVE LOAD PLUS PANEL DEAD LOAD)

PANEL THICKNESS AND WEIGHT		DISTANCE BETWEEN BEARINGS = L		2 or 3 BEARINGS (Single Span) with evenly distributed loads 				MULTIPLE BEARINGS with evenly distributed loads 			
				MAXIMUM LOAD[1,2]		L/360[3,4]		MAXIMUM LOAD[1,2]		L/360[3,4]	
mm	IN	mm	IN	kp/m²	lb/ft²	kp/m²	lb/ft²	kp/m²	lb/ft²	kp/m²	lb/ft²
6 kilograms per square meter (XX) (7.5)	1/4 pounds per square foot (X.XX) (1.53)	300	12	123	24	27	5	123	24	58	11
		400	16	66	13	7	1	66	13	20	4
		500	20	39	8	NA	NA	39	8	1	1
		600	24	25	5	NA	NA	25	5	NA	NA
		1000	40	4	1	NA	NA	4	1	NA	NA
8 (10)	5/16 (2.04)	300	12	222	44	72	14	222	44	146	28
		400	16	120	24	25	5	120	24	56	11
		500	20	73	15	8	1	75	15	24	5
		600	24	48	9	NA	NA	48	9	9	2
		1000	40	11	2	NA	NA	11	2	NA	NA
10 (13)	3/8 (2.65)	300	12	350	69	148	29	350	69	292	57
		400	16	191	38	55	11	191	38	116	23
		500	20	118	23	22	4	118	23	53	10
		600	24	78	15	7	1	78	15	25	5
		1000	40	20	4	NA	NA	20	4	NA	NA
12 (15)	1/2 (3.06)	300	12	507	100	263	51	507	100	NA	NA
		400	16	278	55	102	20	278	55	207	40
		500	20	173	34	45	9	173	34	99	19
		600	24	115	23	20	4	115	23	51	10
		1000	40	32	6	NA	NA	32	6	NA	NA
16 (20)	5/8 (4.08)	300	12	908	180	640	125	908	180	NA	NA
		400	16	502	99	258	50	502	99	NA	NA
		500	20	314	62	123	24	314	62	249	48
		600	24	212	42	62	12	212	42	136	26
		1000	40	64	12	NA	NA	64	12	14	2
19 (24)	3/4 (4.90)	300	12	1152	228	217	179	1152	228	NA	NA
		400	16	638	126	374	73	638	126	NA	NA
		500	20	400	79	180	35	400	79	361	70
		600	24	271	54	95	18	271	54	200	39
		1000	40	83	16	NA	NA	83	16	25	5
22 (27)	7/8 (5.72)	300	12	1727	342	1688	329	1727	342	NA	NA
		400	16	960	190	696	136	960	190	NA	NA
		500	20	604	120	343	67	604	120	NA	NA
		600	24	411	81	187	36	411	81	378	74
		1000	40	130	26	19	3	130	26	60	11
25 (31))	1 (6.34)	300	12	2058	408	NA	NA	2058	408	NA	NA
		400	16	1144	227	910	177	1144	227	NA	NA
		500	20	722	143	451	88	722	143	NA	NA
		600	24	492	97	248	48	492	97	NA	NA
		1000	40	158	31	30	6	158	31	84	16
28 (35)	1-1/8 (7.14)	300	12	2807	557	NA	NA	2807	557	NA	NA
		400	16	1563	310	1457	284	1563	310	NA	NA
		500	20	988	196	729	142	988	196	NA	NA
		600	24	675	134	407	79	675	134	NA	NA
		1000	48	221	44	60	11	221	44	145	28
32 (44)	1-1/4 (8.97)	300	12	3224	639	NA	NA	3224	639	NA	NA
		400	16	1797	356	1797	351	1797	356	NA	NA
		500	20	1137	225	902	176	1137	225	NA	NA
		600	24	778	154	506	98	778	154	NA	NA
		1000	40	256	51	80	15	256	51	185	36

[1] The maximum allowable load values indicated in this table *include* the weight of the panel. To obtain the maximum allowable live load, you must deduct the weight of the panel from the values indicated above.
[2] The maximum allowable load values indicated in this table do not take into account the amount of deflection that will occur due to the load. This maximum allowable load is based upon the maximum allowable stress in the panel.
[3] The L/360 allowable load values corresponds to a load causing deflection between the consecutive bearing supports of L/360.
[4] When NA appears in the table, it means that the load is governed by allowable shear and not by deflection.

Table 4
TESTS USED TO DETERMINE PERFORMANCE AS AN ALTERNATIVE TO PRESSURE-TREATED WATER-RESISTANT PLYWOOD

TEST	STANDARD	PERFORMANCE	RESULT
Report #1	ASTM D696	Coefficient of linear thermal expansion	6.06×10^{-6} per °F (1.09×10^{-5} per °C)
	ASTM D1037	Linear variation with change in moisture--from 50% to 90% relative humidity	Parallel to fiber 0.11%
			Perpendicular to fiber 0.14%
	ASTM E96	Water vapor transmission	W.V.T., 1.62 grains/hour-feet² (1.13 gms/hour-meter²)
			Permeance, 3.93 Perms
			Permeability, 1.80 Perm-Inches
Report #2	EN 112 Frost Resistance	Resistance to freeze/thaw cycles	Showed no signs of cracking or surface alteration after 50 freeze/thaw cycles.
Report #3	Similar to ASTM E96	Water vapor transmission	Permeance, 0.1311 g/m².h.mm.Hg
			Permeability, $1.97\ 10^{-3}$ g/m.h.mm.Hg
Report #4	Rot Resistance	Resistance to destruction due to fungi	100% resistant to damage due to rot caused by moisture and fungi.
Report #5	EN 120 Perforator Extractor Method	Determination of amount of formaldehyde contained in panel	Showed that this panel contained **no** formaldehyde.
Report #6	Similar to ASTM C630	Resistance to moisture and immersion in water for an extended period of time	Showed no signs of lost integrity, degradation, or other negative effect after exposure to water and immersion in water.

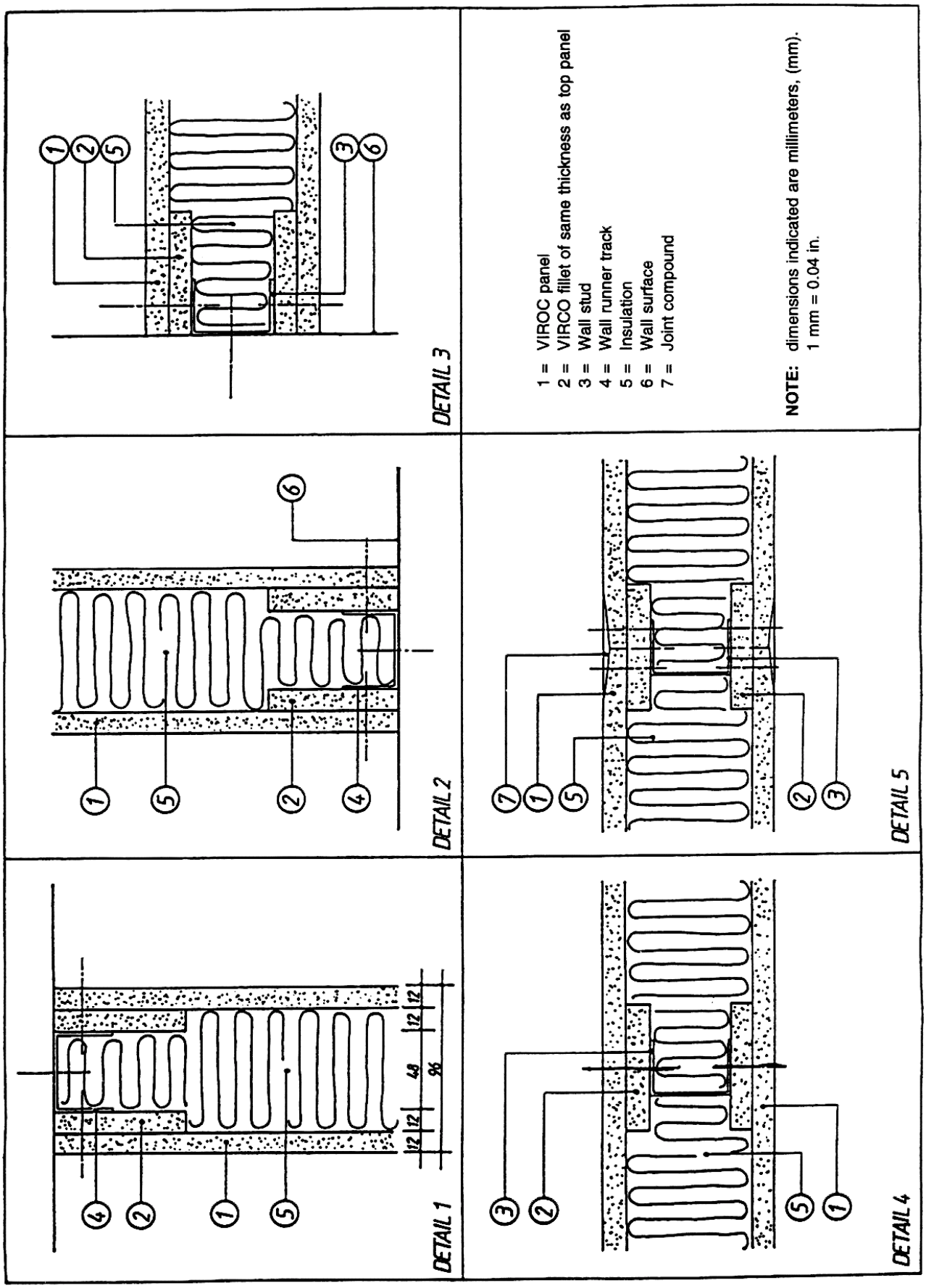


Figure 1*
FIRERESISTANT ASSEMBLY DETAILS

*THIS DRAWING IS FOR ILLUSTRATION PURPOSES ONLY. IT IS NOT INTENDED FOR USE AS A CONSTRUCTION DOCUMENT FOR THE PURPOSE OF DESIGN, FABRICATION OR ERECTION.