BNZ Materials, Inc.

Marinite® I

Refractory Products

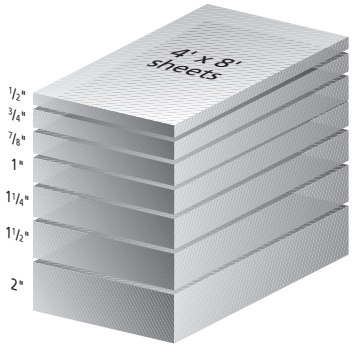
Fire-Resistant Thermal, Structural Insulation

Marinite I structural insulation is a non-asbestos incombustible material manufactured in 4' x 8' panel form. These boards are designed to combine structural strength and high thermal insulating values in a variety of fireproofing and heat processing equipment applications. Formed from calcium silicate with inert fillers and reinforcing agents, Marinite I panels provide structure and insulation in a single, easily erected material.

In addition to high strength and excellent thermal insulating characteristics, Marinite I structural insulation is highly damage-resistant, noncorroding, and extremely water-resistant. Marinite panels also provide fire safety, uniform temperature control, minimal maintenance, and fast, easy fabrication.

Standard Sizes

Machined shapes are easily fabricated from 4 ft. x 8 ft. boards that range in thickness from ½" to 2."



CERTIFIED ISO9002 QUALITY SYSTEM

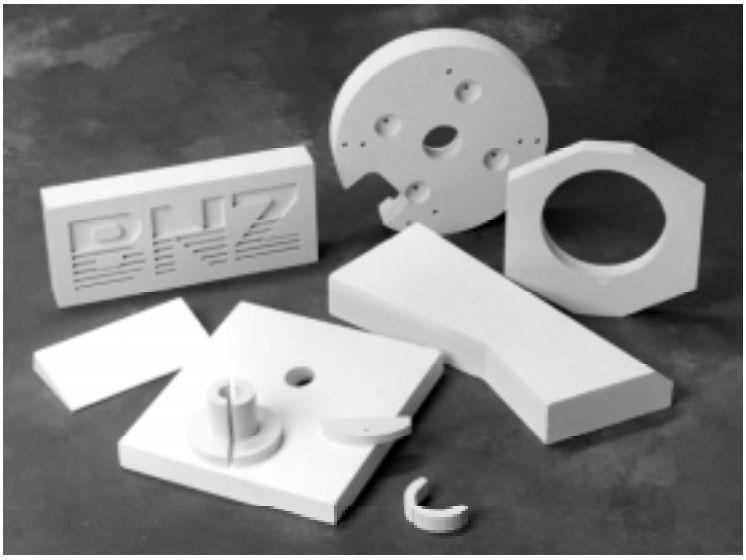
Available Forms

Marinite I has a sanded finish on both sides, and is furnished in 46 lbs/ft³ nominal density, in thicknesses of ½" through 2".

Typical Applications

Since it is both a structural and an insulating material, Marinite I in full size 4' x 8' panels offers major economic advantages in the construction of ovens, dryers, and other insulated housings for the retention and control of heat. Because of its machinability, Marinite I can be readily fabricated into various sizes and shapes for heat baffles and all types of insulating parts. In addition, Marinite I can be used in fire safety applications such as fire stops, fire walls, cable trays and fire doors, and provides an ideal, incombustible base for melamine veneers.

The maximum service temperature of Marinite I is dependent upon the application, and application parameters vary greatly in size, thickness, temperature, heat flow equilibrium and construction — carefully review the enclosed data and also consult your sales representative/distributor for application recommendations.



Marinite I panels can be machined into a variety of shapes

Advantages

Uniform Temperature Control. Marinite I structural insulation is a solid, self-supporting material suitable for broken joint construction. It will not settle or sag to cause voids within the housing. The lack of through-metal support reduces heat loss and prevents localized hot spots. These characteristics provide uniform temperature control throughout the equipment, allowing better process control.

Eliminates Refractories. Because Marinite I panels provide excellent heat capacity and resistance to heat flow, resulting in a concentrated and steady heat impact on the charge, potentially expensive refractory linings can often be eliminated.

Easily Erected. Only a light steel frame is required to support the large panels.

Fire Safety. Marinite I panels have flame spread and smoke developed ratings of 0, 0, and are not damaged by flammable charges that are subject to occasional flaming.

Minimal Maintenance. Marinite I structural insulation is not affected by moisture or high humidity, and will not rust or corrode. In addition, the panels will not disintegrate even after prolonged immersion in water. While panels can be painted if desired, preservative treatments are not required for interior applications.

Finishes

Marinite I panels can be painted either in the as-received condition or after suitable surface preparation, if aesthetics are extremely critical. Dents, scratches and sander marks should be pre-moistened and filled with a drywall patching compound. For a surface entirely free of sander marks and other blemishes, it is advisable to treat the entire surface with a wall glaze.

The same finishing systems used for interior plaster walls are suitable. When painting the outside of a dryer housing, however, a flat, breathing-type paint should be used to avoid trapped moisture and subsequent blistering and peeling. The following paints are recommended for interior use, in order of preference: water emulsion paints made with polyvinyl acetate, acrylic or latex emulsions; synthetic resin paints such as the alkyd type; rubber-base solvent-type masonry paints made with chlorinated rubber or rubber resin; and aluminum paints.

Marinite I panels should be painted when excessive, external moisture is prevalent, especially accompanied by freeze-thaw conditions. Care should be exercised to keep the panels dry before painting. Proceed by sealing with one coat of Sherwin-Williams Masonry Conditioner A5V2, Glidden 5206, or equivalent. Then one coat of either a chlorinated rubber such as Sherwin-Williams Chlorinated Rubber B63 or Glidden 5501 Chlorinated Rubber, or top quality acrylic latex is applied.

Attachment Considerations

Marinite I is often mechanically attached using screws or nuts and bolts to materials having different thermal expansion characteristics, such as steel or concrete. Under these conditions it is imperative that drilled holes in the Marinite be at least ¼" oversize and screws or bolts be used with oversize washers. Do not overtighten the fasteners or even begin to pin the Marinite to the steel or concrete, as this will create thermal stresses upon heating which will cause cracking.

Typical Data

Properties

Density, pcf (kg/m³)	46 (737)
Moisture Content, (normal),* % of dry weight	3
Modulus of Rupture, (dry),* psi (kg/cm²)	**800 (56)
Modulus of Elasticity, (dry), psi (kg/cm²) (From Modulus of Rupture Test)	300,000 (21,092)

Compressive Strength, psi (kg/cm²)

For 5% deformation	1000 (70)
For 10% deformation	1350 (95)

Consolidation Under Load, (normal), in/in

Pressure, psi (kg/cm²)	Deflection Under Load	Permanent Consolidation
200 (14)	0.019	—
500 (35)	0.032	—
1000 (70)	0.058	0.025
2000 (141)	0.179	0.132
3000 (211)	0.299	0.235
4000 (281)	0.366	0.320
5000 (352)	0.418	0.369
6000 (422)	0.462	0.400
7000 (492)	0.483	0.430

Tensile Strength, (normal), psi (kg/cm²)

Normal to face of sheet	55 (3.9)
Parallel to face of sheet	200 (14.1)

Shear Strength, (normal), psi (kg/cm²)

Normal to face of sheet	1000 (70)
Parallel to face of sheet	405 (28)

Pandux, Durometer hardness	60
Brinell Hardness No., (dry) 45.5 kg load, 19.05 mm ball, 15 sec.	1.2

Screw Holding Strength, (normal), lb (kg)

½" penetration	75 (34)
⅞" penetration	200 (91)

Standard Sizes

Type	Thickness, inches (mm)	Sheet Size, feet (mm)
Marinite I	½, ¾, ⅞, 1, 1¼, 1½, 2 (12.7, 19.1, 22.2, 25.4, 31.8, 38.1, 50.8)	4 x 8 (1219 x 2438) 4 x 4 (1219 x 1219) 2 x 4 (610 x 1219)

Dimensional Tolerances, inches (mm)

Length and Width	Thickness	Squareness (max. difference between diagonals)
± 1/32 (± 0.79 mm)	± 1/32 (± 0.79 mm)	⅛ (3.175 mm)

Thermal Conductivity, Btu-in/ft², hr, °F (W/m°K) per ASTM C 177

Mean Temperature, °F (°C)	
75 (24)	0.88 (.13)
300 (149)	0.82 (.12)
400 (205)	0.81 (.12)
500 (260)	0.80 (.12)
600 (316)	0.79 (.11)
700 (371)	0.80 (.12)
800 (425)	0.81 (.12)
900 (482)	0.83 (.12)
1000 (538)	0.86 (.12)

Specific Heat

Temperature, °F (°C)	Btu/°F/lb
200 (93)	0.28
400 (205)	0.30
600 (316)	0.32
800 (425)	0.34

Thermal Expansion, in/in/°F	2.3 x 10^{-6}

* (normal) refers to normal conditions of 75°F and 50% R.H.
(dry) refers to oven-dried material.

** Value may be somewhat lower for thicknesses over 1". Also, moisture pickup will cause some drop-off from the dry value.

Properties after 24 hours soaking heat exposure at indicated temperature

Temperature °F (°C)	Shrinkage, % Length	Width	Thickness	Weight Loss, %	Modulus of Rupture, psi (kg/cm²)	Reduction in Modulus of Rupture after Temperature exposure, %
400 (205)	0.1	0.1	0.4	5.4	580 (41)	20
500 (316)	0.2	0.2	0.7	8.0	486 (34)	33
800 (425)	0.3	0.3	0.9	9.0	471 (33)	35
1000 (538)	0.3	0.4	1.2	9.9	464 (33)	36
1200 (650)	0.4	0.4	1.4	10.0	413 (29)	43
1400 (760)	0.4	0.4	1.9	10.2	—	—
1600 (870)	0.7	0.9	6.4	10.5	—	—
1800 (982)	1.8	2.2	13.2	10.7	—	—

Minimum Thickness (inches) of Marinite I Required to Provide Indicated Surface Temperature and Heat Loss (with 80°F ambient still air). Make final check against Warpage Control Table.

	Operating Temperature – °F (°C)								
	200 (93)	300 (149)	400 (205)	500 (260)	600 (316)	700 (371)	800 (425)	900 (482)	1000 (538)
125° Surface Temperature (Heat Loss: 87 Btu/ft²/hr)	¾	1¾	2⅝	3⁹⁄₁₆	4⁷⁄₁₆	5⅜	6¼	7⅛	8
150° Surface Temperature (Heat Loss: 142 Btu/ft²/hr)	*⁵⁄₁₆	¹⁵⁄₁₆	1½	2¹⁄₁₆	2⅝	3⅛	3¹¹⁄₁₆	4¼	4¾
175° Surface Temperature (Heat Loss: 203 Btu/ft²/hr)	*⅛	⁹⁄₁₆	¹⁵⁄₁₆	1⅜	1¾	2⅛	2½	2⅞	3¼

* Minimum available thickness of Marinite I is ½"

Electrical Properties

Marinite I panels possess relatively good electrical insulating properties when dry. Because the material is hygroscopic, however, moisture absorption lowers its electrical resistance. To minimize this effect, some users treat Marinite I with linseed oil or a similar moisture proofing.

As moisture pickup may be expected to cause problems under high-humidity ambient conditions or following the shutdown of equipment, Marinite I panels are not recommended for direct mounting of current-carrying parts. Despite this stipulation, treated Marinite I is used for this purpose, particularly at low voltage and at elevated temperatures. The decision to use the panels for elecrical purposes must rest solely with the user, but it is suggested that protection be provided against electrical shock hazard.

Volume Resistivity, per ASTM D 257 — taken at 100 volts DC and 1 minute electrafaction time using painted silver electrodes (ohm-cm)

Condition	1" thick Marinite I
600°F – Dry	815 trillion
75°F – 50% RH	98,300,000
71°F – 91% RH	3,490,000

Dielectric Breakdown, per ASTM D 149 — taken at 500 volts per second rate of rise and 60 HZ (volts per mil)

Condition	1" thick Marinite I
600°F – Dry	50.5
75°F – 50% RH	45.3
71°F – 91% RH	32.0

Fire Hazard Classification

Listed under Underwriters' Laboratories Inc.Guide Numbers:

Guide No. BQJT
Surface Burning Characteristics

Flame Spread†	0
Smoke Developed	0

† This numerical flame spread rating is not intended to reflect hazards presented by this or any other material under actual fire conditions.

Guide No. CERZ
Two hour wall and partition fire resistance rating.

Guide No. XHKU
Form board for multiple cable penetrations in System Nos. 1, 2, 3, 4, 5, 7, 10, 18, 23, 51, 52, 53, 85, 86, 88 and 89.

Specifications

Marinite I can meet the stress corrosion cracking requirements for stainless steel of N.R.C. Regulatory Guide 1.36 and MIL-I-24244.

The physical and chemical properties of BNZ's Marinite I represent typical average values obtained in accordance with accepted test methods and are subject to normal manufacturing variations. They are supplied as a technical service and are subject to change without notice.

Warpage Control

Most insulating materials, including Marinite I panels, shrink at temperatures above 300°F. When heat is applied to only one side, the inner face of each layer will have a higher temperature and, consequently, will shrink more than the outer face. This causes the sheet to bow outward at the center. The greater the differential in temperature between the inner and outer face, the greater will be the warpage Also, the larger the panel size, the greater will be the warpage. To minimize warpage, use the table below to select the minimum number of 1" thick layers for the operating temperature and corresponding largest panel dimension. This number is the minimum design thickness required based on those parameters — not heat flow or cold flow temperature.

Longest Panel Dimension, feet (mm)	Operating Temperature – °F (°C)							
	100 (38) to 200 (93)	201 (94) to 300 (149)	301 (150) to 400 (205)	401 (206) to 500 (260)	501 (261) to 600 (316)	601 (317) to 700 (371)	701 (372) to 800 (425)	801 (426) to 900 (482)
	Minimum Number of 1"-thick Layers							
3 (914)	1	1	1	1	2	2	3	3
4 (1219)	1	1	1	2	2	3	3	4
6 (1829)	1	1	2	3	3	4	4	5
8 (2438)	1	1	2	3	4	5	6	6

Marinite I Fire-Resistant Structural Insulation Panels: Heat Loss, Heat Storage and Outside Surface Temperature

Thickness, inches	Hot Face Temperature, °F (°C)															
	100 (38)				200 (93)				300 (149)				400 (205)			
	HL	HS	ST		HL	HS	ST		HL	HS	ST		HL	HS	ST	
1	11	14	88	(31)	69	83	120	(49)	128	155	148	(64)	189	222	173	(78)
1½	8	19	86	(30)	51	117	111	(44)	94	219	133	(56)	138	316	152	(67)
2	7	25	85	(29)	41	151	105	(41)	75	283	123	(51)	109	407	139	(59)
3	5	35	84	(29)	29	216	99	(37)	53	406	112	(44)	77	586	124	(51)
4	4	46	83	(28)	23	280	95	(35)	41	528	106	(41)	60	763	116	(47)
5	3	56	82	(28)	19	343	93	(34)	34	648	102	(39)	49	939	110	(43)
6	3	66	82	(28)	16	406	91	(33)	29	768	99	(37)	41	1113	106	(41)
	500 (260)				600 (316)				700 (371)				800 (425)			
1	250	298	196	(91)	311	378	217	(103)	373	447	237	(114)	435	515	256	(124)
1½	181	425	170	(77)	225	541	187	(86)	268	641	203	(95)	312	740	218	(103)
2	143	549	154	(68)	176	699	168	(76)	210	830	181	(83)	244	959	194	(90)
3	100	793	135	(57)	124	1011	146	(63)	147	1201	156	(69)	171	1390	166	(74)
4	78	1033	125	(52)	96	1318	133	(56)	114	1567	141	(61)	132	1816	149	(65)
5	63	1271	117	(47)	78	1624	125	(52)	93	1931	132	(56)	107	2238	139	(59)
6	54	1509	112	(44)	66	1928	119	(48)	78	2294	125	(52)	90	2659	131	(55)
	900 (482)				1000 (538)				1100 (593)				1200 (649)			
1	499	603	275	(135)	564	694	292	(144)	633	767	310	(154)	704	839	327	(164)
1½	356	866	232	(111)	401	999	246	(119)	447	1140	260	(127)	496	1209	274	(134)
2	278	1124	206	(97)	313	1298	218	(103)	347	1434	229	(109)	385	1571	241	116)
3	194	1631	175	(79)	218	1885	184	(84)	240	2084	193	(89)	226	2285	202	(94)
4	150	2132	157	(69)	168	2465	165	(74)	184	2726	171	(77)	204	2991	179	(82)
5	122	2630	145	(63)	136	3041	152	(67)	150	3364	157	(69)	165	3691	164	(73)
6	103	3125	136	(58)	115	3614	142	(61)	126	4000	147	(64)	139	4389	153	(67)

HL = Heat loss at steady state conditions, Btu/ft²/hr with 80°F ambient still air.
HS = Heat storage, Btu/ft².
ST = Outside surface temperature, °F, (°C).

BILLERICA 50 Quality Boards For More Than 50 Years

BNZ Materials manufactures and is a worldwide supplier of a range of specialty industrial insulations. Our calcium silicate insulation has been manufactured continuously at Billerica, Massachusetts for over 50 years. Prior product identification was under the Johns-Manville JM trademark.

In addition to our calcium silicate product line, BNZ also manufactures Insulating Fire Brick and refractory specialties at the world's most advanced IFB plant located in Zelienople, PA. Over sixteen types of IFB are available for use in applications from 2000°F to 3200°F to meet the specific needs of a variety of industries.

Contact BNZ for more information on these products and their applications.

BNZ

BNZ Materials, Inc.

Corporate Headquarters

Denver
6901 South Pierce Street
Suite 260
Littleton, CO 80128
Phone: (303) 978-1199
(800) 999-0890
FAX: (303) 978-0308
www.bnzmaterials.com

Marinite® I Plant Location

Billerica
400 Iron Horse Park
North Billerica, MA 01862
Phone: (978) 663-3401
(800) 888-0061
FAX: (978) 663-2735

Insulating Fire Brick Plant Location

Zelienople
191 Front Street
Zelienople, PA 16063
Phone: (412) 452-8650
(800) 955-8650
FAX: (412) 452-1346

Warranty

BNZ Materials warrants that its products are manufactured in accordance with its applicable material specifications and are free from defects in workmanship and materials using BNZ's specifications as a standard. Every claim under this warranty shall be deemed waived unless in writing and received by BNZ within thirty (30) days of the date the defect was discovered and within one (1) year of the date of the shipment of the product.

BNZ MAKES NO OTHER REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, IN FACT OR IN LAW, INCLUDING WITHOUT LIMITATION, THE WARRANTY OF MERCHANTABILITY OR THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, OTHER THAN THE LIMITED WARRANTY SET FORTH ABOVE.

Limitation of Liability

It is expressly understood and agreed that the limit of BNZ's liability shall be the resupply of a like quantity of non-defective product and that BNZ shall have no such liability except where the damage or claim results solely from breach of BNZ's warranty.

IT IS ALSO AGREED THAT BNZ SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES FOR ANY ALLEGED NEGLIGENCE, BREACH OF WARRANTY, STRICT LIABILITY, OR ANY OTHER THEORY, OTHER THAN THE LIMITED LIABILITY SET FORTH ABOVE.

BNZ R-3261-W 11/97

Printed in USA