Base Materials Limited
Ashville Way,
Whetstone, Leicestershire
LE8 6NU, UK
Tel: +44 (0)116 286 5073
Fax: +44 (0)116 275 3128
Email: sales@base-materials.com
www.base-materials.com

978 EPOXY TOOLING BOARD

978 is a high temperature epoxy modeling material known for its superior surface finish, dimensional stability and its ability to maintain tolerances even after being subjected to temperature variations. Its excellent dimensional stability results from its low coefficient of thermal expansion and its high glass transition temperature.

APPLICATIONS

Master Models; Automotive Die Models; Vacuum Forming at Intermediate Temperatures; Lay-Up Tools for Low and Medium Temperature Curing Prepreg

TYPICAL PROPERTIES	VALUE	Tolerance	TEST METHOD
Colour	Blue		Visual
Hardness, Shore D	70	±3	ISO 868: 2003
Density, g/cm^3 (kg/m^3)	0.68 (680)	±0.02 (±20)	ISO 1183-1: 2012, Method A
Glass Transition Temperature (inflection point), ºC	145	±5ºC	DSC, 10ºC/min
Heat Distortion Temperature, ºC	145	±5ºC	ISO 75-2: 2013
Coefficient of Thermal Expansion, 10^{-6} cm/cm/ºC	39	±4	ISO 11359-2: 1999
Notched Charpy Impact Strength	0.7	± 0.05	ISO 179-1: 2010
Unnotched Charpy Impact Strength	5.3	± 0.3	ISO 179-1: 2010
Tensile Modulus, GPa	2.4	± 0.1	ISO 527-2: 2012
Tensile Strength, MPa	23	± 4	ISO 527-2: 2012
Flexural Modulus, MPa	2.2	± 0.1	ISO 178: 2010
Flexural Strength, MPa	38	± 4	ISO 178: 2010
Compressive Modulus, MPa	2.4	± 0.1	ISO 604: 2002
Compressive Strength, MPa	50	± 4	ISO 604: 2002

AVAILABLE BOARD DIMENSIONS (Length, width, depth) – tolerances L, w [± 1], d [±0.5]

1524mm x 608mm x 50mm
1524mm x 608mm x 75mm
1524mm x 608mm x 100mm
1524mm x 608mm x 125mm
1524mm x 608mm x 150mm

ANCILLARIES

ADHESIVES
551 Epoxy
560 Epoxy

MATCHED REPAIR PASTE
879R Epoxy

SURFACE COATING & RELEASE
Epoxy 2192 Board Sealer
Epoxy 2194 Board Sealer
Epoxy 2197 Board Sealer
HP2002 Board Sealer
TBS100 Board Sealer
HP7 release agent
220 release agent

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BONDING OF BOARDS

1. Cut, prepare and dry assemble blocks.
2. Key both surfaces of the joint use a 320 grit paper.
3. Once the entire bonding surface has been treated use a suitable solvent such as acetone to remove any contaminants from the surfaces to be bonded. Repeat this operation until satisfied the surface is clean
4. Allow any residual solvent to evaporate
5. Mix the appropriate adhesive as per the technical data sheet
6. Apply using a castellated spreader evenly across both surfaces of the joint
7. Bring together the two wet surfaces and apply an even amount of pressure until the adhesive starts to expel from the joint. Remove this excess and check the joint for uniform thickness and that it does not exceed 1mm.
8. Vacuum bagging is recommended during the bonding operation to ensure vacuum integral bond lines and uniform thickness. Mechanical clamping may be used but is not as effective.
9. A post cure is recommended in order to achieve the systems maximum thermal characteristics it is important to ensure that the relevant ramp, dwell and cool down conditions are suitable for substrate.
    i. When bonding and post curing tooling board it is important to consider the dimension of the pattern as this will affect ramp up, dwell, and cool down periods. We suggest that ramp up and cool down should be no more than 5°C (9°F)/hour.
    ii. The tooling board should be adequately supported to avoid any excessive gravity induced stresses. For large patterns it is recommended that a steel support frame is used to minimise deflections and ease handling.
10. When designing and constructing the pattern consideration should be given to the machining and wherever possible material should be removed from the end of blocks.

Precautions should be taken when selecting an adhesive for bonding tooling board. When selecting an adhesive, choose a product with a gel time that is long enough to provide time to mix the required amount of adhesive and to spread it onto the surfaces that will be bonded. Boards should be wet out on both sides of the stack. Boards should be held in position by light clamping or placing a weighted object over the entire top surface of the stack to ensure equal pressure throughout the board. Over-clamping will cause the adhesive to spread unevenly, which may result in stress build up in the board and lead to stress micro cracking and/or warping. Always allow adequate time for the adhesive to further machining or processing. Always use an adhesive that is capable of meeting the mechanical properties of the board. Precautions should be taken when post curing to ensure that the temperature is ramped up and down slowly. This will prevent thermal shock from occurring to the board and the adhesive, which will result in a poor bond and stress cracking in the board.

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BACK UP AND FRAMING STRUCTURES

Use one of the recommended adhesives for attaching back up or framing structures to the tooling board. Use caution when making mechanical attachments to higher temperature boards as variations in coefficients of thermal expansion may cause warping or micro cracking when subjected to heat. Variations in the coefficients of thermal expansion of boards, adhesives and back up or framing materials may introduce stress into composite structures when they are heated or cooled.

ADDITIONAL PROCESSING INFORMATION

A) **Sawing:** Cut 978 Tooling Board side to side on a band saw to form the required dimension. Use of carbide or diamond coated saw blades or cutting wheels are recommended.
B) **Bonding:** Laminate the cut pieces together using the recommended matched adhesive system. Apply adhesive to both sides of the glue joint.
C) **Supporting:** Attach the rough model to an appropriate base, i.e. Epoxy board. Removal of material from a large area of one face of a single block should be avoided unless the block is supported by, and bonded to at least two other blocks of equal un machined thickness, or is otherwise mechanically restrained to avoid distortion.
D) **Machining:** Optimum results are generally obtained by cutting from the edge towards the center of a block. However, whenever sharp edges are encountered, the final cut should always move back from the center towards the edge involved. When hand carving, the use of carbide coated rasps and files are recommended. Wood chisels may cause excessive chipping. A high gloss finish can be obtained by the use of successively finer grades of wet and dry abrasive paper and polishing compounds.
E) **Sealing:** Apply one of the recommended board sealers to the finished product.