

Security Classification	Document Approval Status
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Product Sizes:

360 is available in a standard board size of 1,300 mm x 800 mm and thicknesses of 5 mm, 10 mm and 20 mm.

Health and Safety:

This technical document should be read in conjunction with the current **360** material data sheet (MSDS), which is available at www.cfpcomposites.com. It is also advised that users familiarise themselves with the current regulatory regulations, Health and Safety policies and operating guidelines for the required machinery and tools to be used.

Precautions should be taken to ensure all local health and safety guidelines have been met. Personal Protective Equipment (PPE) should consist of a minimum of a suitable rated breathing apparatus, safety overalls or disposable overalls, suitable gloves and safety glasses/goggles to meet the requirements of the materials/chemicals you will be using.

Storage:

- Keep away from direct sunlight
- Do not let material freeze
- Store between 5 - 25 °C / 41 - 77 °F
- Store the product in a clean and dry place
- Store flat and fully supported
- Handle in accordance with good hygiene and safety practices
- Move mechanically where possible
- If manually handling/moving, do so in a safe manner in accordance with current manual handling guidelines for your county/country

Prior to Cutting and Blocking up:

As a precautionary measure, **IT IS RECOMMENDED THE SURFACES OF 360 WHICH ARE TO BE BONDED ARE CHECKED FOR FLATNESS AND SKIMMED FLAT IF NECESSARY.**

- Do not use cutting fluids – dry cut only
- See Machining Advisory section for full details

Materials Required:

- IPA (isopropyl alcohol)
- Lint free cloths
- 60, 240, 400, 600 and 1200 grit paper
- Chemlease® 2710
- Your chosen structural bonding adhesive

TECHNICAL PROPERTIES		
Property	Typical Data	Test Method
Colour	Black	Visual
Shore D Hardness	84	According to ISO 868: 2003
Density	1.290 g/cm ³	Acc. to BS EN ISO 1183-1:2012, Method A
Flexural Strength	186 MPa	According to ISO 178: 2010
Flexural Modulus	21.0 GPa	According to ISO 178:2010
Tensile Strength	153 MPa	According to BS EN ISO 527-2: 2012
Compressive Strength	285 MPa	According to BS EN ISO 604: 2003
Compressive Modulus	19.6 GPa	According to BS EN ISO 604: 2003
Maximum Air Temp. Stipulated	200 °C / 392 °F	

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Pre-cutting your blocks prior to bonding:

Cutting equipment CFP have used

Cold, dry airline blowing during cutting helps to cool the cutting blades

Bench / Table Saw:

- SIP 12" Professional Cast Iron Table Saw or similar
- Freud LP60M 006 305 X 30 X 96T Pro Industrial Blade with 96 teeth or similar. The more teeth the better the cut.

Circular Saw:

- Makita 5903RK or similar
- Freud LP40M 023 235X2.8X30MM Blue Line Blade with 48 teeth or similar. The more teeth the better the cut

Jig Saw:

- Makita 4350FCT 720W or similar with variable speed control
- For cutting Perspex, nylon, plastic - Bosch T101A or similar

Bevel Sliding Mitre Saw:

- Evolution R255SMS 255mm Electric sliding mitre saw or similar
- Freud Pro LP60M 001 - 250mm x 30mm x 80T blade with 80 teeth or similar. The more teeth the better the cut.

Do not use cutting fluids – dry cut only
Do not use diamond cutters



CNC cutting your blocks prior to bonding:

- For CNC machine cutting method and settings, refer to the CNC cutting section within this guide (see page 5)

Water jet cutting your blocks prior to bonding:

- **360** has successfully been water jet cut
- You will need to carry out your own trials for settings on the machine you will be using

Laser cutting your blocks prior to bonding:

- Laser cutting is not suitable for this material

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Adhesives tested to date:

CFP have been working with industry leading adhesive manufactures to independently test 360 with their suitable structural adhesives.

The following adhesives have tested well with our 360 material and it is the users choice to which they decide to use.

Independent suppliers test reports for bonding our material are available upon request.

Cure temperature up to 180 °C / 356 °F

- **Huntsman Araldite® AV 4415 / Hardener HV 4416-1 - Two component epoxy paste adhesive (also known as Araldite® AW 4510 / Hardener HW 4511-1)**
- **PERMABOND® ET5441 - Thermally conductive two component adhesive based on epoxy resin.**
- **LOCTITE® EA 9394 AERO – Two part epoxy structural paste adhesive**

If you are curing at a much lower temperature, lower cost, structural adhesives could be used subject to end user trials.

Mixing your chosen adhesive:

IF THESE CRITICAL STEPS ARE NOT FOLLOWED AND YOU DEVIATE, YOUR TOOL BOND LINES WILL FAIL

- Read your chosen adhesive manufacturer's guide and fully comply
- Ensure adhesives are stabilised at room temperature, ideally above 23 °C / 73 °F prior to using
- Do not mix two-part adhesives by hand, you will trap air in the mix which will weaken the bond. If hand mixing is your only choice, vacuum bag the mixed adhesive prior to use to extract all the trapped air (re: De-gas)
- If your chosen adhesive comes in dual cartridges you must ensure you use the correct mixer nozzle to ensure the correct A + B mix ratio
- When using a new cartridge / nozzle in your dispensing gun, the first gram squeezed out should be discarded as it will be the incorrect mixed ratio. This will also balance the pistons
- If using a two-part epoxy meter mix dispensing machine, you must ensure the mix ratio is correct
- An approximate guide is that for every 10 °C / 50 °F rise in temperature the viscosity halves and reaction time speed doubles (types of adhesives may differ)
- Low viscosity may cause too much adhesive to flow out and leave gaps, voids in the bond
- High viscosity may cause the adhesive not to flow, spread correctly and leave gaps, voids in the bond

YOUR ADHESION PREPARATION AND APPLICATION IS CRUCIAL TO YOUR END TOOL PERFORMANCE AND LONGEVITY

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Blocking up preparation:

As a precautionary measure, **IT IS RECOMMENDED THE SURFACES OF 360 WHICH ARE TO BE BONDED ARE CHECKED FOR FLATNESS AND SKIMMED FLAT IF NECESSARY.**

- Do not use cutting fluids – dry cut only
- See Machining Advisory section for full details
- **360** boards should be stabilised at room temperature, ideally above 23 °C / 73 °F prior to using
- Each mating surface to be bonded should be abraded using a very coarse sanding paper (i.e. 60 Grit) this is to ensure that the surface is suitably keyed
- Prior to adhesive application, all surfaces to be bonded must be grease and contaminant free
- You **MUST ONLY** use Isopropyl alcohol (IPA) and lint free cloths to wipe clean and take care not to re-contaminate the surfaces prior to bonding

Blocking up:

- Mixed / dispensed product should be applied, and the bond closed well within the end of open time of the mixed adhesive
- Contact pressure should be applied to the closed bond well within the end of open time of the mixed adhesive until full cure is achieved
- It is important that no release sprays / silicones are in the factory where the mixing / bonding is taking place as these will affect the bonding
- Surfaces to be bonded, **MUST ONLY** be cleaned with Isopropyl alcohol (IPA) and wiped clean with lint free cloths. Take care not to re-contaminate the surfaces while blocking up
- Using alternative products may cause bonding issues or deformation in the surfaces to be bonded

- The adhesive should be applied to both surfaces (degreased and dust free) using a notched spatula to evenly apply 0.1mm per surface
- The surfaces should be brought together, and a uniform clamping pressure applied by either mechanical or vacuum means to ensure a correct interlaminar bond is achieved

Post cure of blocks prior to CNC machining:

IF THIS PROCESS STEP IS NOT CORRECTLY FOLLOWED AND YOU DEVIATE, YOUR TOOL BOND LINES WILL FAIL DURING USE

200°C / 392 °F maximum air and tool temperature stipulated
(accounting for the variability between autoclaves and ovens)

- It is essential the adhesive is fully cross linked prior to machining
- Ensure there is enough air gap around the tool
- Thermocouples should be attached at the thickest and thinnest parts of the tool to ensure cure temperature is reached to all sections of the adhesive, but does not cause any parts/areas to exceed 180 °C / 356 °F
- Ramp up rates should not exceed 1.0 °C / 38.8 °F per minute during post cure
- Recommended post cure process

Cool a maximum of 2.0 °C / 35.6 °F per minute to ambient

Stage 1. 24 hours at Ambient, ideally above 23 °C / 73 °F

Stage 2. Ambient – 130 °C / 266 °F and dwell for 1 hour

Stage 3. 130 °C / 266 °F – 180 °C / 356 °F and dwell for 2 hours

Stage 4. Cool back down to ambient

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CNC Machining to create final tool profile:

Do not use cutting fluids – dry spindle cut only

Do not use diamond cutters

In order to avoid board distortion, it is recommended that stock removal should be taken equally from opposing faces. Where this is not possible, then the board should be supported by and bonded to additional layers.

To minimize distortion when machining large flat boards, it is advisable to rough cut one face, invert the board and machine the rear face, re-invert and complete machining. The board can be finished by the use of successively finer grades of wet and dry abrasive paper as detailed on pages 6 and 7.

The machining information provided is for guidance purposes only. It is advised that individual users should determine the appropriate speeds, feed, cutters and depths for their own specific application.

Machine cutter selection guide:

The below information is based on trials carried out by a supplier of cutting tools and the full report is available on request.

Addition information and assistance is also available on request.

TYPICAL MACHINING SETTINGS					
OPERATION	TOOL	RPM	FEED RATE mm/min	DOC mm	STEP OVER
Board Skim	40mm TR4 carbide Insert	12,000	10,000	1.5	15mm
Face Mill	16mm End Mill	2,785	1,253	2.5	70%
Wall Profile	16mm End Mill	2,785	1,253	8	2mm
Rough Cavity Mill	12mm End Mill	3,714	1,114	3	70%
Semi-Finish Mill	12mm Ball Nose	5,308	3,184	0.2	0.2mm
Finish Option 1	6mm Ball Nose	15,924	9,554	0.2	0.2mm
Finish Option 2	12mm Ball Nose	13,986	14,685	0.5	0.4mm

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Tool Preparation: STANDARD FINISH

- You **MUST ONLY** use Isopropyl alcohol (IPA) and lint free cloths to wipe clean and take care not to re-contaminate the surfaces
- Start with 400 grit paper down to desired surface finish
- Finish with 600 grit paper

New Tool Release: STANDARD FINISH

- You **MUST ONLY** use Isopropyl alcohol (IPA) and lint free cloths to wipe clean and take care not to re-contaminate the surfaces

Application – Wipe-On Method

Single Stage - Use Chemlease® 2710 – 5 coats as detailed below

1. Lightly dampen a lint free clean 100% cotton cloth with the release agent.
2. Apply a light, even coat to the mould surface. In normal temperature conditions, the film should evaporate in less than 30 seconds after applying. If the film remains longer, the product was applied too heavily and will produce streaks on the mould. To remove streaks, promptly reapply release agent to the affected area then immediately wipe off.
3. As soon as the wiping action appears not to be forming a film, add more product to the cloth as described above.
4. Continue wiping across the mould until its entire surface has been coated.
5. Allow the coat to dry and cure for 15 minutes.
6. Using the same technique, apply a further 4, so 5 coats in total.
7. After the final coat has been applied, allow to cure for a minimum of 30 minutes before moulding.

New Tool Release: STANDARD FINISH

Application – Spray-On Method

Single Stage - Use Chemlease® 2710 – 5 coats as detailed below

1. Use a HVLP spray gun fitted with a small spray nozzle, 0.013 – 0.021 in. (0.3 – 0.5 mm). As a general guideline, fluid pressure should be set to 7-10 psi (0.5 – 0.7 Bar) and air pressure set to 20-30 psi (1.5 – 2.0 Bar).
2. Position the spray gun 8-10 inches away from the mould surface while spraying approximately two linear feet (0.6 meter) per second.
3. Spray a light, even coat to the entire mould surface. No cure time between coats is necessary when spraying; simply allow to dry.
4. Spray subsequent coats perpendicular to one another, known as a cross-hatch (0/90) pattern, to ensure full coverage.
5. Using the same technique, apply a further 4 coats, so 5 coats in total.
6. After the final coat has been applied, allow to cure for a minimum of 30 minutes before moulding.

Touch up coats between components: STANDARD FINISH

- Apply 2 coats of Chemlease® 2710 as per the Wipe-On method or Spray-On method prior to a new component been laid up in tool

If the tool has been abraded, flattened or any surface preparation carried out in any way, you will need to start the Tool Release process again from the beginning 'Tool Preparation: STANDARD FINISH'

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Tool Preparation: GLOSS FINISH

The materials and method to create a gloss finish are still under development.

Please contact CFP Composites directly for more information.

CFP Composites Limited

Unit 3-5, Pedmore Road, Dudley
West Midlands, DY2 0RF, UK

Stephen Philipson

Business Development Director

Tel: +44 (0)779 500 5813

Email: stephen.philipson@cfpcomposites.com

Materials currently under test: GLOSS FINISH

Note:

None of the below have currently been approved to use with 360 as they are still undergoing thorough testing.

Marbocote Limited

Marbocot are investigating which products in their portfolio provide the best results on our 360 material.

Products being trialled are:

- Tool sealer - HP2002
- Tool Sealer - HP3181
- Release Agent - HP7

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Materials used contact details:



Henkel Limited
Wood Lane End
Hemel Hempstead
Herts HP2 4RQ
UK

Tel: +44 (0) 1442 278000
Email:

<https://www.henkel-northamerica.com/global-websites-henkel>



Enriching lives through innovation

Huntsman Advanced Materials
Ickleton Road
Duxford
Cambridgeshire
CB22 4XQ, UK

Tel: +44 (0) 1223 493130
Email:

<https://www.huntsman.com/locations>



Permabond Engineering Adhesives Ltd
Wessex Business Park,
Wessex Way, Colden
Common, Hampshire
SO21 1WP, UK

Tel: +44 (0) 1962 711661
Email:

Web: <https://www.permabond.com/contact-us/>

UK Distributors

Silmid Limited

Tel.: +44 (0) 1675 432850
Web: <https://www.silmid.com>
Email: info@silmid.com

AMI-CON Limited

Tel.: +44 (0) 1322 224726
Web: <https://www.ami-con.co.uk>
Email: sales@ami-con.co.uk

UK Distributors

Antala Limited

Tel.: +44 (0) 161 4941345
Web: <https://antala.uk>
Email:



Marbocote Limited

Unit 9 Dalton Way
Middlewich
Cheshire
CW10 0HU, UK

Tel: +44 (0)1606 738737
Email: info@marbocote.co.uk

<https://www.marbocote.co.uk/contact/>



Chem-Trend UK

Unit 10 Pennine Business Park
Longbow Close
Huddersfield, West Yorkshire
HD2 1GQ, UK

Tel: +44 (0) 8703 504708
Email: uksales@chemtrend.de

<https://chemtrend.com/contact/>



Quickgrind Limited

Unit 5701, Shannon Place
Shannon Way
Tewkesbury, UK

Tel: +44 (0) 1684 294090

Email: contact@quickgrind.com

Web: <https://quickgrind.com>



CFP Composites Limited

Unit 3-5, Pedmore Road, Dudley
West Midlands, DY2 0RF, UK

Stephen Philipson - Business Development Director

Tel: +44 (0)779 500 5813

Email: stephen.philipson@cfpcomposites.com

Web: <https://www.cfpcomposites.com>

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