PLEASE – BEFORE YOU TRY IT YOUR WAY, TRY IT OURS!

METAPOR® Machining & Handling Guide

Overview

METAPOR® is available in 4 standards sizes of 19.7" x 19.7" x 0.6" / 0.8 / 1.2 / 2.4 (500 x 500 x 15 / 20 / 30 /60mm). After the sawing process, the air permeability of the slab surface is reduced due to partial closure of the pores. It is essential to **mill both surfaces of the slab** by cutting off approximately 0.02" (0.5 mm), to ensure complete air permeability.

Storage

Store dry, protect against jolts and impacts. Avoid contact with grease and fluids.

Grinding / Polishing

Grinding and polishing of the machined surfaces may be performed by hand or with a vibrating grinder. Use corundum paper with grains of 400 / 600 / 1200 in the ascending order. **METAPOR® must be polished dry and without any polishing paste.**

Cleaning of areas, contaminated with grease, fluids or dust

Thoroughly rub light dishwashing liquid into the affected area. Rinse with water until cleared of foam. Heat METAPOR® for approximately 3 hours in an oven. Temperature setting: 176^0 – 212^0F (80^0 -100^0C).

The pores of METAPOR® may also be cleaned by ultrasonic cleaning. Good results have already been achieved after 15 minutes at a frequency of 33kHz.

Sealing of pores

In some cases, non air-permeable areas within a METAPOR® tool are required. The pores in those areas may be sealed with synthetic enamel, adhesive or epoxy resin.

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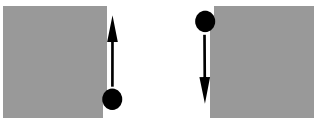
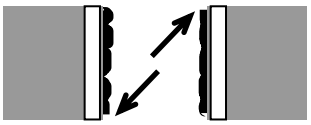
Adhesive bonding

For METAPOR® BF 100, and HD 100 products, we recommend usage of **ARALDITE 2014,** available through CMT Materials, Inc. for bonding. For the high temperature material HD 210, we recommend use of HYSOL EA 9394/C-2 from DEXTER Corp.
In order to achieve best bonding results while minimizing witness-lines, preheating of METAPOR® and adhesive to a temperature of 40-50°C is recommended!

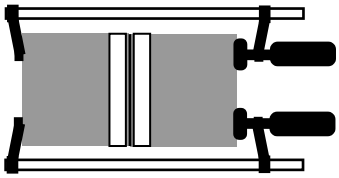
Mill the surfaces to be connected.



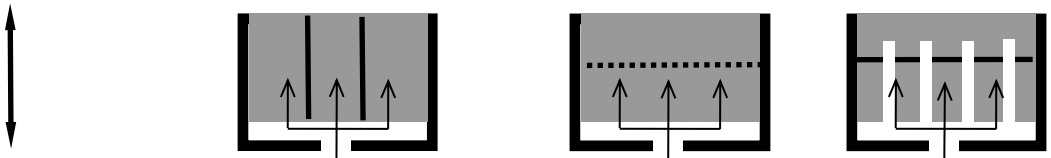
Cover frame segments with tape and apply adhesive on both sides



Press parts together. Allow adhesive to harden.



Effect of bonded areas on air permeability



Air stream

Vertical bonding: no effect

Horizontal bonding: bond on a point basis or drill holes from below

Using screws with METAPOR®

Drywall screws may be used with METAPOR®. Drill pilot holes with a reduced diameter of approximately 0.04" (1 mm) compared to the diameter of the screws. Inserts bonded into METAPOR® segments, provide good durability and strength. HYTAC Inserts, available from CMT work well and are available for US or metric thread.

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METAPOR Machining Tools

<table>
<tr><td>Cutter Type</td><td>

Solid Carbide.
2 Flute, Aluminum Cutting Tools
SHARP TOOLS are required.
See Tool selection guide on next page

</td></tr>
<tr><td>Speed and Feed</td><td>

Varies by tool geometry and size.
Use “Chip Load” (the measurement of thickness of material removed by each cutting edge during a cut) from tooling manufacturer to develop feed rate.
Calculate Feed Rate (inches/minute) using the formula:
Feed Rate = Chip Load x Spindle RPM x # of flutes.
For CMT supplied tools from this guide, the following feed rate calculations apply:

Number shown in bold is feed rate in inches/minute. Use formula above for metric tool calculations.
<table>
<tr><td></td><td></td><td colspan="8">Spindle RPM</td></tr>
<tr><td></td><td></td><td>2500</td><td>5000</td><td>7500</td><td>10000</td><td>12,500</td><td>15000</td><td>17,500</td><td>20,000</td></tr>
<tr><td rowspan="10">Chip Load</td><td>0.002</td><td>10</td><td>20</td><td>30</td><td>40</td><td>50</td><td>60</td><td>70</td><td>80</td></tr>
<tr><td>0.003</td><td>15</td><td>30</td><td>45</td><td>60</td><td>75</td><td>90</td><td>105</td><td>120</td></tr>
<tr><td>0.0035</td><td>18</td><td>35</td><td>53</td><td>70</td><td>88</td><td>105</td><td>123</td><td>140</td></tr>
<tr><td>0.004</td><td>20</td><td>40</td><td>60</td><td>80</td><td>100</td><td>120</td><td>140</td><td>160</td></tr>
<tr><td>0.005</td><td>25</td><td>50</td><td>75</td><td>100</td><td>125</td><td>150</td><td>175</td><td>200</td></tr>
<tr><td>0.006</td><td>30</td><td>60</td><td>90</td><td>120</td><td>150</td><td>180</td><td>210</td><td>240</td></tr>
<tr><td>0.007</td><td>35</td><td>70</td><td>105</td><td>140</td><td>175</td><td>210</td><td>245</td><td>280</td></tr>
<tr><td>0.009</td><td>45</td><td>90</td><td>135</td><td>180</td><td>225</td><td>270</td><td>315</td><td>360</td></tr>
<tr><td>0.01</td><td>50</td><td>100</td><td>150</td><td>200</td><td>250</td><td>300</td><td>350</td><td>400</td></tr>
</table>

</td></tr>
<tr><td>Optimization techniques</td><td>

Experiment with the maximum possible chip size. Use feed rate as determined from the chip load rating and your machine RPM.
Increase feed rate until the part finish begins to deteriorate. Decrease feed rate 10%.
Decrease RPM by some set increment until surface finish begins to deteriorate. Once this happens, increase RPM until finish is again acceptable.
Speed and feed are now optimized in your process.
Usage of separate tools for roughing and finishing allows rotation of finish tool into roughing position when part finish deteriorates.

NOTE: Too low a feed rate will generate excess heat and reduce tool life. Proper settings will result in a tool operating at or near room temperature.
</td></tr>
<tr><td>Coolant</td><td>

None, or air
Avoid contact with grease or fluids

</td></tr>
<tr><td>Protection</td><td>

Enclose chip space, dust extraction, safety goggles, dust mask, protective gloves

</td></tr>
</table>

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METAPOR Machining Tools

2 Flute Aluminum Cutting Tools

Open flute geometry is optimized for slotting or profiling of METAPOR materials.

Climb cutting for roughing and finishing is recommended.

Available from Onsrud Tool or CMT Materials.

Part # (Available from Onsrud Tool or CMT Materials)	Cutting Diameter	Flute Length	Shank Diameter	Corner Radius	Overall Length	Roughing Parameters		Finishing Parameters			
						Slotting RDOC[i]= 100% ADOC[ii] = up to ½ x D[iii]	**Profiling** RDOC[i]= 33% ADOC[ii]= up to 1xD[iii]	**Walls** RDOC[i] = below ADOC[ii] = up to 4xD[iii]		**Floors** RDOC[i]= 40-65% ADOC[ii] = below	
						Chip load	Chip load	Chip load	RDOC	Chip load	ADOC
400002	1/8”	1/4”	1/8”	Square	2”	.002	.002	.002	.006	.002	.005
400020	1/8”	1/2"	1/8”	Square	2”	.002	.002	.002	.006	.002	.005
400008	3/16”	5/16”	3/16”	Square	2”	.003 - .004	.003 - .005	.003	.009	.003	.005
400026	3/16”	9/16	3/16”	Square	2-1/2”	.003 - .004	.003 - .005	.003	.009	.003	.005
700102	1/4”	3/8”	1/4"	Square	2”	.003 - .004	.003 - .005	.003	.013	.003	.01
701402	1/4”	1-1/4”	1/4”	Square	2-1/2”	.003 - .004	.003 - .005	.003	.013	.003	.01
700202	3/8”	1/2"	3/8”	Square	2-1/2”	.003 - .005	.003 - .007	.004	.020	.004	.01
701502	3/8”	1-1/2”	3/8”	Square	4”	.003 - .005	.003 - .007	.004	.020	.004	.01
700302	1/2"	5/8”	1/2"	Square	3”	.004 - .007	.004 - .009	.004	.020	.004	.01
701602	1/2"	2”	1/2"	Square	4”	.004 - .007	.004 - .009	.004	.020	.004	.01
700402	5/8”	3/4”	5/8”	Square	3”	.004 - .008	.004 - .010	.004	.025	.004	.01
701702	5/8”	2-1/4”	5/8”	Square	5”	.004 - .008	.004 - .010	.004	.025	.004	.01

[i] RDOC: Radial Depth of Cut – the depth of the tool along its radius in the work piece as it makes its cut. Parameters referenced as a percentage (%) mean the tool should engage an amount of material equal to the % specified of the tool diameter. Areas referenced with a specific dimension should engage the dimension listed.

[ii] ADOC: Axial Depth of Cut – the depth of the tool along its axis in the work piece as it makes its cut. Parameters referenced as a percentage (%) mean the amount of material surface cut away will equal the cutting tool diameter at the % specified. Areas referenced with a specific dimension should cut the depth material at the depth dimension listed.

[iii] D: Cutting Diameter of Tool.

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METAPOR Machining Tools

2 Flute Aluminum Ball nose Cutting Tools

Special design for 3D contour results in a smooth finish. Climb cutting is recommended.

Available from Onsrud Tool or CMT Materials. Other sizes or necked design may be available upon request.

Part # (Available from Onsrud Tool or CMT Materials)	Cutting Diameter	Flute Length	Shank Diameter	Corner Radius	Overall Length	RDOC[i] = 33% ADOC[ii] = up to 1 X D[iii] Chipload
400006	1/8”	1/4”	1/8”	Ball	2”	.002
400024	1/8”	1/2"	1/8”	Ball	2”	.002
400012	3/16”	5/16”	3/16”	Ball	2”	.003 - .005
400030	3/16”	9/16	3/16”	Ball	2-1/2”	.003 - .005
700138	1/4”	3/8”	1/4"	Ball	2”	.003 - .005
701438	1/4”	1-1/4”	1/4”	Ball	2-1/2”	.003 - .005
700238	3/8”	1/2"	3/8”	Ball	2-1/2”	.003 - .007
701538	3/8”	1-1/2”	3/8”	Ball	4”	.003 - .007
700338	1/2"	5/8”	1/2"	Ball	3”	.003 - .007
701638	1/2"	2”	1/2"	Ball	4”	.003 - .007

General Troubleshooting for METAPOR Machining	
Excessive Tool Wear	Increase feed rate
	Decrease RPM
	Increase DoC
Chipping	Increase RPM
	Decrease Feed Rate
	Increase DoC
Build Up on Cutting Edge	Double check feeds and speeds
	Adjust RPM
	Increase Feed Rate
	Increase DoC
Poor Quality Finish or Chatter	Shorten Tool Length
	Ensure Rigidity of Tool and METAPOR holders
	Check for Tool Wear
Tool Breakage at Shank	Decrease DoC
	Decrease Feed Rate
	Shorten Tool Length

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