

Application Guide

DME Vortex™ Core Pins and Plugs

(Porcerax II®)

IMPORTANT: Please read before using Porcerax II®

What is Porcerax II® ?

Porcerax II® is a sintered, porous metal that is heat-treated to 30-40 HRC with porosity in the range of 25% by volume. A system of interconnected pores with an average diameter of 7 (.0003"), or 20 (.0008") micron is dispersed throughout the Porcerax II® material. Using Porcerax II® in appropriate areas, eliminates gas buildup, reduces injection pressure, lowers cycle times, gloss levels, and substantially reduces scrap and reject rates.



General Properties

Average pore size: 7 or 20 microns

Porosity: 25% air by volume (approximate)

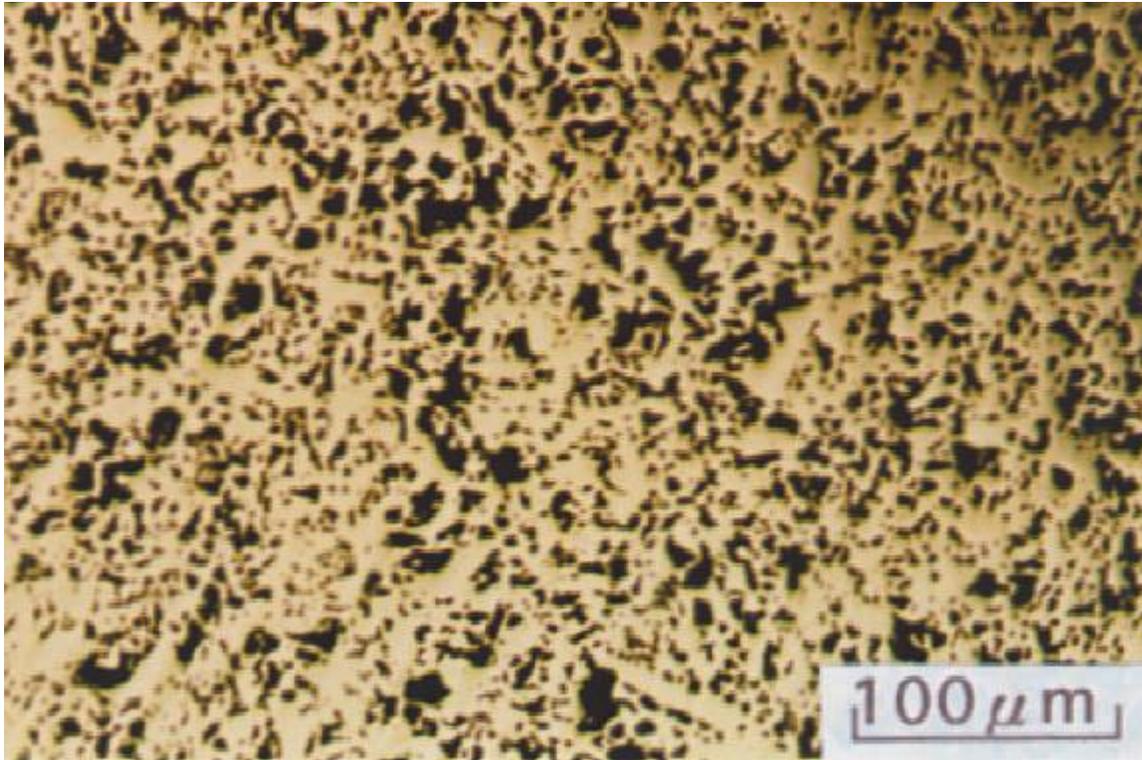
Thermal Linear Expansion Coefficient: (@68°F. - 302°F.) 6.67 - 6.94 E-06 in./in./ F°.

Heat transfer co-efficient (at room temperature): 16.93 - 19.35 BTU/ft. hr. F°.

Tensile strength: 64,000 - 71,000 lbs./sq. in.

Hardness: HVM 300 - 400 (30-40 HRC)

HSS Machinability: Good



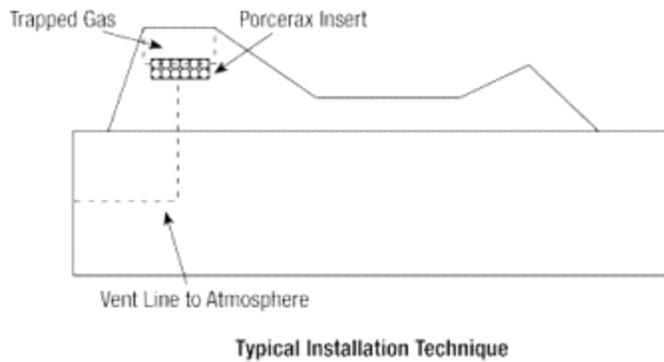
Microphotograph of Porcerax II® Material Surface

Benefits

The benefits molders derive from using Porcerax II® are primarily, but not limited to, the elimination of trapped gas problems that occur in inadequately vented areas within the mold. Frequently, it is difficult, if not impossible, to provide adequate venting in these hard to mold areas. Traditional methods of venting, such as parting line vents, vent plugs, and pins often do not provide sufficient surface area to accommodate the large volumes of gases that can be generated. Porcerax II® provides a location-specific method of venting gas in a targeted area. Since it is 25% air by volume, one-fourth of the surface area becomes a vent. The larger the surface area of the piece installed, the greater the venting capacity.

Prevention of Burning

Burning is a condition caused by compressed gasses trapped by the flow of molten resin in a cavity pocket. Using Porcerax II® venting steel, gasses are permitted to evacuate through the steel to the outside atmosphere, thus eliminating the burning condition. The enhanced venting capabilities of Porcerax II® are illustrated below. The illustration is taken from a current production application:



In a typical automotive console application, gasses have a tendency to settle in areas such as the cup holder recess area or the CD/cassette storage compartment. This causes short shots and/or material burning. The illustration above shows Porcerax II® inserted in the problem area and properly vented to the atmosphere. The scrap rate on this part prior to installation of the Porcerax II® insert was over 45%. Upon completion of the installation, the documented scrap rate dropped to 9% and the remaining scrap rate was unrelated to the previous burning problem.

Prevention of Knit Lines

Minimizing or eliminating flow and knit lines is an additional benefit for using Porcerax II®. Knit lines occur at points where resin flows converge after molding around an obstruction, or protrusion within the mold, usually away from the gate area. There are two primary reasons for this occurrence:

1. The failure of resin to sufficiently fuse due to the drop in temperature after flowing over long distances.
2. The presence of residual air at the resin flow convergence point at the cavity obstruction, prohibiting the proper fusion of the flows.

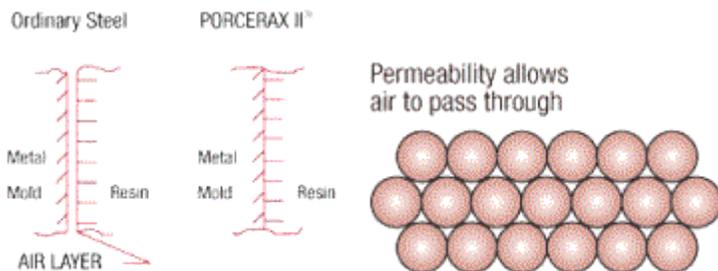
The permeability of Porcerax II® prevents defects arising from residual gases normally trapped inside the mold cavity. Also, using Porcerax II® reduces backpressure and improves the flow rate, allowing the resin flows to merge while still hot.

Reduction in Cycle Time

Because of the reduction in backpressure within the mold, the plastic fills the cavity faster, thus allowing for reduction in temperatures which shortens cooling and cycle times.

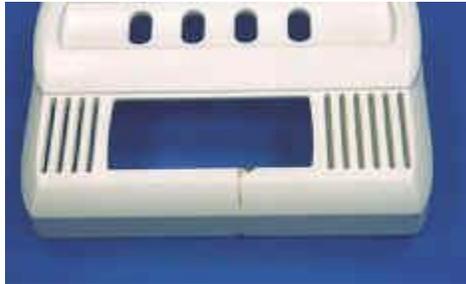
Eliminates Shrink

Trapped air bubbles between the resin and mold steel surface can cause shrinkage or sink that shows as a ripple in the otherwise straight plastic surface. Using Porcerax II® on the trapped air side of the cavity will eliminate shrink in most cases.



Eliminates Short Shots

Short shot is another condition caused by too low of an injection pressure, or trapped gasses, in pocket areas of the cavity. This results in the part not being completely filled out. Porcerax II® reduces backpressure, therefore, less injection pressure is needed, and because it vents trapped gasses, both causes of short shots are eliminated.



Before Porcerax II®

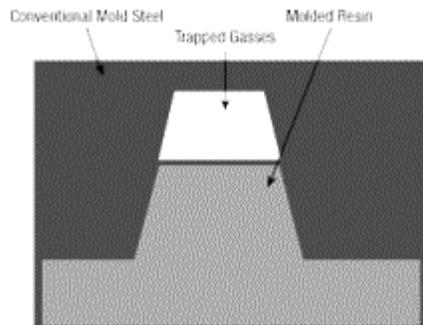
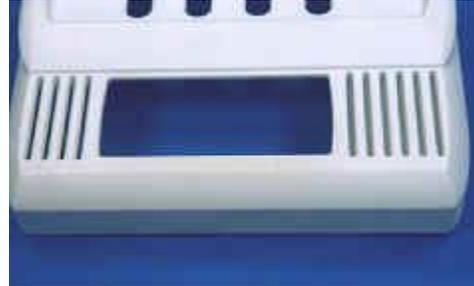


Illustration of Trapped Gasses in the Mold



After Porcerax II®

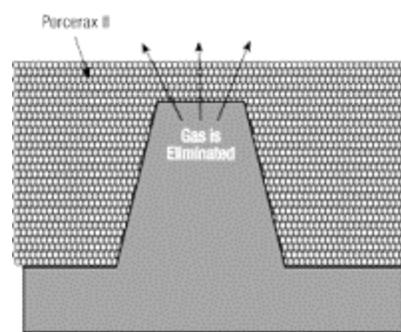
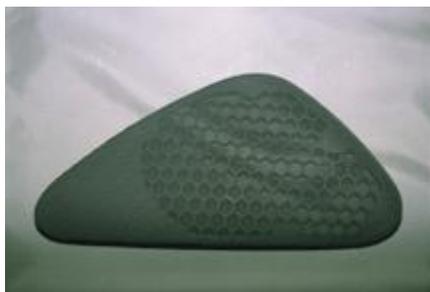


Illustration of Trapped Gasses in the Mold

Enhances Part Appearance

Webbed, ribbed, and other difficult to fill thin-walled designs are greatly enhanced and cosmetically defined using Porcerax II® in the mold. Molding these high-detailed, thin-walled, and aesthetic parts, like this automotive speaker grill, is easily accomplished with the reduced back pressure and added venting of Porcerax II®.



Gloss Reduction

When using Porcerax II® as a cavity (Contact DME for a special size quote) in an injection mold, the air typically trapped between the cavity and the resin (causing a gloss to show on the part) is allowed to escape through the pores, thus leaving a dull matte finish. This often eliminates the need for costly secondary spray painting operations.



Conventional Molding



Porcerax II®

Tool Simplification and Cost Reduction

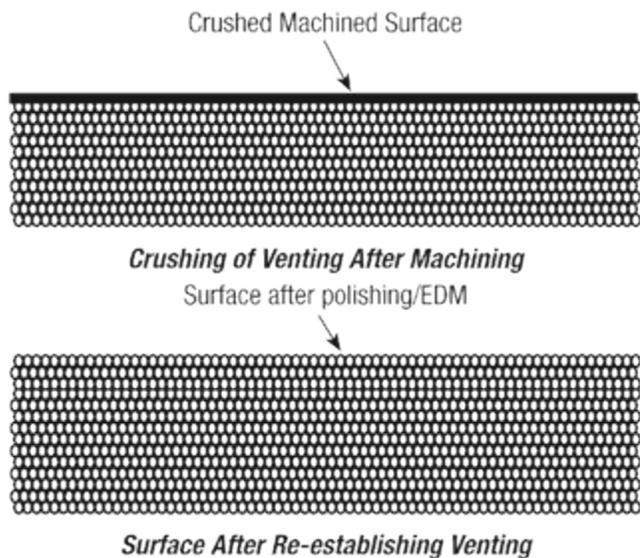
When back pressures, injection pressures, and cycle times are lowered, fewer drops are needed to assure proper filling of the cavity. Lowering the number of drops needed to fill a cavity simplifies design while saving tool costs.

Aiding in Part Ejection

In many situations, an air poppet is needed to help break the vacuum from the core in a molded part. Inserting Porcerax II® in the core with an air blow setup helps break the vacuum seal and aids the ejector pins in doing their job.

Machining and Polishing

Porcerax II® can be machined by conventional methods using cutoff saws, end mills, grinders, EDM methods, stoning, etc. It is important to remember this material is honeycombed with thousands of microscopic holes which are affected by metal removal. Machine wet with oil based coolant.



Grinding and milling closes the pores of this porous steel.

Grinding and milling will close the pores of all grades of this porous steel. EDM and texturing are the only effective ways to reopen pores after machining. If EDM finish is not acceptable, stoning or paper, after EDM, will improve to 800-1000 stone/paper finish, for the 7 or 20 micron. During the stoning and polishing process, it is important to occasionally flush the pores at the surface to prevent packing the pores with debris. Professional cleaning is required afterwards to remove compound and grit. (Also see the Frequently Asked Questions (FAQ) for DME Vortex Core Pins & Plugs at www.dme.net/)

Electric Discharge Machining is the best way to re-establish permeability.

This method will burn away the metal fragments that are crushed over the pores by milling and/or grinding. (NOTE: It is important the Porcerax II® be cleaned by a professional after EDM and/or polishing process. Also see the Frequently Asked Questions (FAQ) for DME Vortex Core Pins & Plugs at www.dme.net/)

Note: When using an electrode for EDM, it is important to program a peak-to-valley burn rate that exceeds the pore size; i.e. ≤ 7 micron depth for 7 micron pore size is desirable.

Because of its powdered metal origin, when using a wire EDM machine, **it is important to increase the wire speed about 10 % to prevent arcing from the particles produced. Because a wire EDM machine uses water, the pin, plug, or insert must be dried in an oven after EDM, or rust and pore closer will ensue.**



The illustrations above show how particles created by the wire EDM process carry the electrical current across to the work-piece, creating the potential for a discharge that can break the wire. Increasing the wire winding speed not only greatly reduces the potential for wire breakage but also increases machining times.

Design Guidelines

When designing for Porcerax II® venting steel, the following guidelines should be considered:

Resins Used

Depending on the emissions or gas residue given off during the molding process, the molder will have to evaluate whether to use 7 or 20-micron pore size. Resins such as ABS, polypropylene, soft type PVC, polyethylene, acrylic, polyurethane, and styrene work very well with a 7-micron (.0003") pore size. For low viscosity or talc-filled resins, it may be necessary to have an automated system reverse the airflow after each shot to purge the impurities from the pores. Rigid PVC resins will work, but only until the corrosive gasses close the pores. This can still be a feasible method if disposable inserts are used. The 20-micron pore size (.0008") will vent about 20% more gas than the 7 micron pore size. Where extreme venting is

needed, a 20-micron pore size is recommended. However, using the 20-micron pore size material and maintaining the 20-micron pore size, by EDM and polishing after milling, will vent better than 7-micron.

Size of Area to be Vented

The producing mill recommends that at least 10% of the cavity area be Porcerax II® to insure proper venting. While this is not always possible, it is important to remember the more square inches used in the cavity area, the lower the back pressure will be in the cavity. Due to the larger surface area, the insert will not require cleaning quite as often as a smaller piece. If Porcerax II® is used as a core or cavity half, instead of as an insert, there may not be a need for parting line vents. DME can quote Porcerax II® as a special for cavities or cores.

Note: The thinner the Porcerax II® or the shorter the distance air has to travel to the exhaust line the better the venting will be. Keep in mind the physical properties of Porcerax II®.

Note: Porcerax II® is typically inserted on the core side of the mold in the problem area in order to hide insert lines.

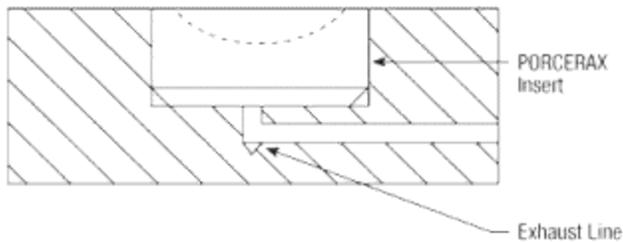
Surface Finish Requirements

Since most applications can be addressed using inserted pieces on the core side, an EDM finish is acceptable and will vent better than any other surface finish. Should EDM finish not be acceptable, a stoned or polished surface will provide the next best venting surface after EDM process is performed. The 7 micron pore size provides the best polished finish. It is important to remember that if the venting steel is used on the cavity side of a mold, the gloss level will be severely reduced (from #9 to #3 with PP), so matching should be considered. If a low gloss level on a textured part is desired, it can be accomplished with the 7-micron Porcerax II®.

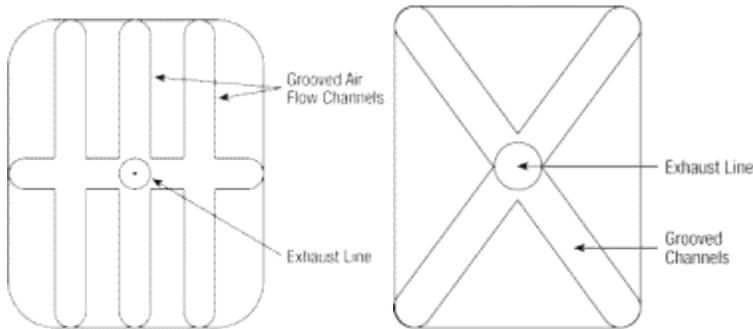
Slide/Lifter Applications

Porcerax II® can be used in slide or lifter applications. However, it is important to consider lubrication requirements on such a design. Lubricants will, in all likelihood, reduce or eliminate permeability in areas that coming into contact with Porcerax II®.

Porcerax II® Insert Installation (Contact DME for special size Porcerax II® quotes)



Various designs for the bottom of a Porcerax II® insert pocket.



Porcerax II® Vortex® Pin Installation

Best results can be achieved by drilling a vent hole into the bottom of the Vortex® pin (Figure #1). This procedure considerably shortens the "escape route" for gas.

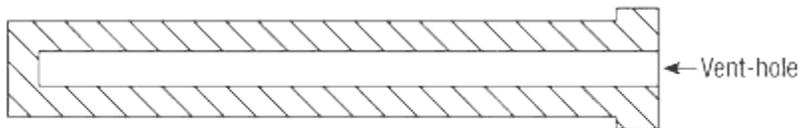


Figure #1

Since highest permeability can be achieved with an EDM finish, it is desirable to EDM the bottom and sides of the drilled hole for better efficiency (Figure #2). Be sure all EDM and cutting fluids are cleaned out by a professional cleaner before installing the Vortex® pin into the tool. (Refer to the section within this document: "Cleaning, Maintenance, and Resin Removal.")

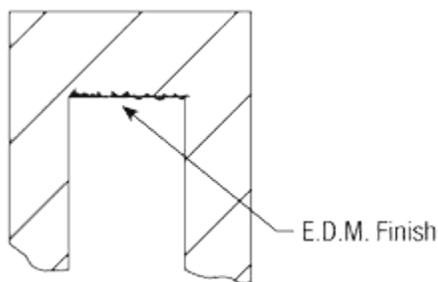


Figure #2

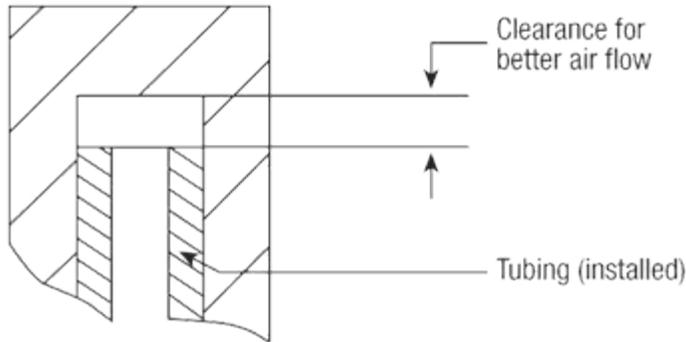


Figure #3

Post-Machining Treatments

Heat Treatment

Heat treating of Porcerax II® should be done in a vacuum furnace. As supplied, Porcerax II® has a hardness of 35-40 HRC. It can be heat treated to 50-52 HRC; however, Porcerax II® carries a fairly high potential for movement.

Hardness

Porcerax II® is 25% porosity by volume and will give false or misleading readings if tested with either a Rockwell or Brinell hardness tester. As the load of either of these testers is applied, the pores beneath the surface will collapse and render a false reading. It is recommended that a micro Vickers hardness tester (50 or 30g load) be used to test the hardness of Porcerax II®.



Texturing

Porcerax II® (7 micron grade) can be textured. In order to prevent the possibility of destroying the internal vent structure of the material, certain procedures must be strictly adhered to. It is imperative the chosen texture source know they are working with Porcerax II®. If they don't, the likelihood for permanent, irreparable damage to the piece is virtually assured.

The pores of the material must be thoroughly cleaned and properly sealed prior to texturing. Failure to do so results in the etchants used in the texturing process leaching into the pore structure and rusting the venting closed. This rust is permanent and cannot be removed once it has occurred. The piece will be useless and must be replaced.

Thousands of molds worldwide have been successfully textured. **However, it is imperative the molder and/or moldmaker's texture source be supplied with the information needed to properly process the piece.** We strongly advise against inserting Porcerax II® into an already textured surface. The excellent venting of Porcerax II results in much higher resolution of the grain at the inserted area and a dramatic reduction in gloss. It is recommended the entire textured surface be Porcerax II®. Also, due to the pre-treatment procedure required for texturing Porcerax II®, expect longer deliveries and higher costs. Please consult your graining source for more information.

Surface Reproduction

Porcerax II® provides venting of all gases from the mold. While this is desirable in most cases, the venting of the Porcerax II® produces a perfect "marriage" between the resin and the molding surface, thus producing a dull, matte finish. If Porcerax II® is used as an insert on the cavity side, the result will be

two dissimilar appearances due to differences in gloss and texture definition. This may be acceptable if the parts are painted after molding.

Water Lines

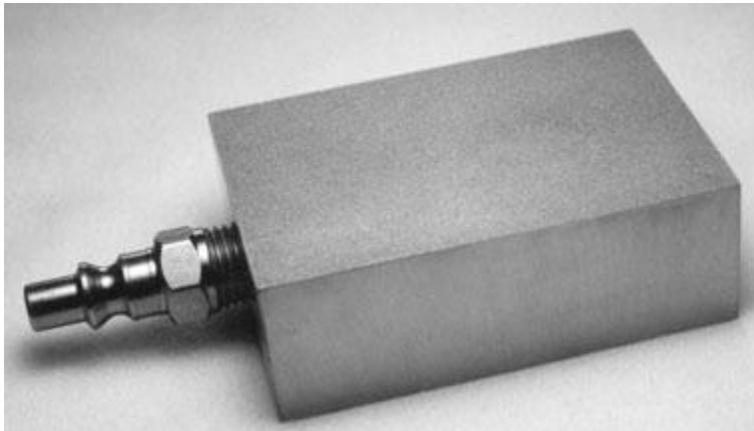
DME Company LLC does NOT recommend running water through Porcerax II® due to its porous microstructure.

Cleaning, Maintenance, and Resin Removal

There are two times cleaning must be performed to Porcerax II®:

The first time is when the tool shop has prepared the insert or cavity. The material is 25% air by volume and the cutting fluids will displace the air, thus filling and clogging the pores. After the permeability has been restored, by EDM-ing the venting surface, Porcerax II® must be professionally cleaned. **This is the only recommended type cleaner for cleaning Porcerax II.**

The steel should have a drilled, tapped, and EDM-relieved hole in the side of the insert or cavity. This clean-out or back-flush hole should be designed to accept a shop air fitting. This will be very useful over the life of the insert, in back-flushing fluid and future residue from the insert, and for checking restored permeability with filtered shop air. (See photo below.) If the cleaning operation is not completed, due to the trapped fluids, inside permeability will not exist.



The second time cleaning is needed is after the insert or cavity has been in operation and a film, a thin layer of mold release agent, resin residue, shop oil or any other contaminate has partially or totally blocked the air flow.

Porcerax II® Success Tips

Porcerax II® can be machined, but it should be machined wet to prevent work hardening. Because Porcerax II® is porous and will corrode, an oil-based

coolant should be used if possible.

Finish machining should be done at a slower feed rate than other mold steels due to its tendency to chip or splinter as the tool exits the work piece “Picture framing” or machining the parameter of the insert first will also help in this matter.

Traditional welding of Porcerax II® is not recommend by the manufacturer of Porcerax II® due to its tendency to crack. It is best to re-machine the Porcerax II® insert and the weld or shim in the core pocket. Silver soldering or brazing is acceptable, however it is important to realize that where the material is soldered it will lose permeability. Laser welding is also acceptable due to its low heat properties.

The machining process will smear the pores closed on the surface of Porcerax II®. After machining the pores must be reopened by EDM.

Be aware of your resins flash points. Seven (7) micron Porcerax II® has pores that average .0003” in diameter, twenty (20) micron has pores that average .0008” in diameter. Nylon 6 for instance will flow into the pores that are .0008” but polypropylene and ABS will not.

Texturing the 7 micron Porcerax II® is possible, however your texture house must be aware that they are working with Porcerax II® and if not familiar with the material they should contact your Porcerax II ® supplier immediately.

Mold releases such as silicon mold release will clog the surface pores of Porcerax II® if sprayed onto the material. Therefore positive air pressure should be blown back through the exhaust line while the tool is being sprayed. Inserts protected with mold saver must be cleaned before use unless BioCorr® is used.

Strategically placed high-pressure clean out or back flush/exhaust holes drilled & EDM machined into the Porcerax II® insert help to vent as well as assure proper cleaning.

The more square inches of Porcerax II® used in the cavity area the better the venting will be. The thinner the Porcerax II® or the shorter the distance the distance air has to travel to the exhaust line the better the venting will be. Keep in mind the physical limitations of Porcerax II®.

An exhaust line through the core block must be adjacent to an EDM machined area on the side or back of the Porcerax II® insert. The cavity side of the Porcerax II® must also be EDM machined.

Porcerax II® must be cleaned both before it goes into production for the first time to remove EDM cutting fluids and periodically (after 20,000-30,000 shots) during production to remove resin gas buildup.

Because of health safety and fire risks it is recommended that Porcerax II® be professionally cleaned by Molder's World, Inc. This is the only way to ensure renewed life for your Porcerax II® inserts.

Avoid running water lines through Porcerax II®, since they are difficult to seal and Porcerax II® will rust.

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