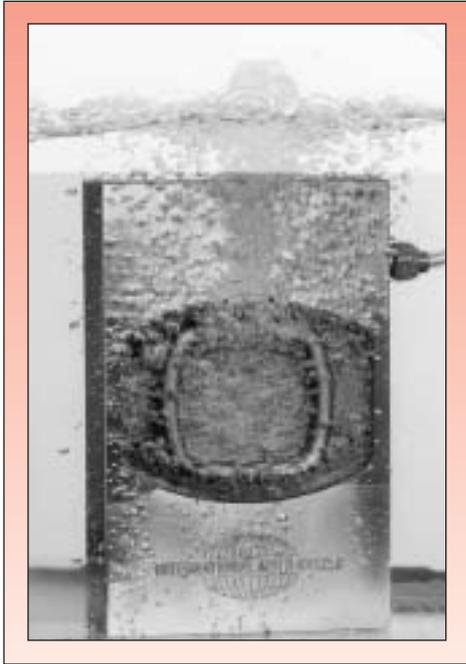


PORCERAX II®

Porcerax II

Porcerax II is a sintered, porous metal with porosity in the range of 20 to 30% by volume. A system of interconnected pores with an average diameter of 7 or 20 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.



UNIQUE CHARACTERISTICS

- ❑ Sintered, porous mold steel that is 25% air by volume.
- ❑ Interconnected pore structure allows trapped gasses to escape directly through the steel.
- ❑ Pre-hardened to 35-40 HRC for wear resistance.

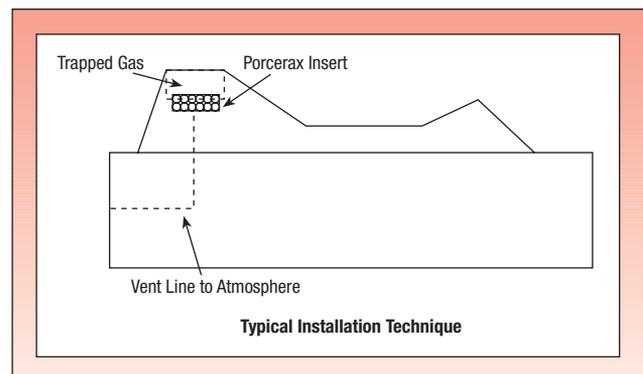
BENEFITS

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 gases trapped by the flow of molten resin in a cavity pocket. Using Porcerax II venting steel, gases 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, gases 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 was unrelated to the previous burning problem.

Prevention of Knit Lines

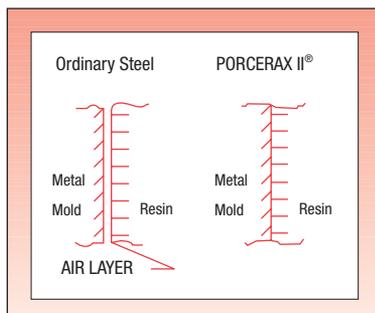
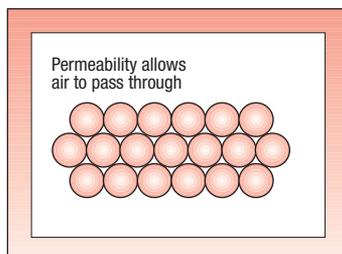
Minimizing or eliminating flow and knit lines is an additional benefit for using Porcerax II. Knit lines occur at points where resin flows converge after molding around an obstruction, or protrusion within the mold, usually away from the gate area. There are two primary reasons for this occurrence:

- 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 back pressure and improves the flow rate, allowing the resin flows to merge while still hot.

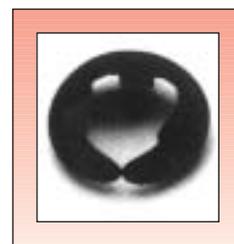
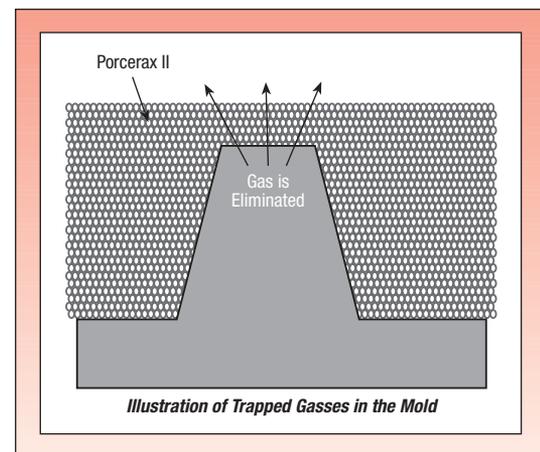
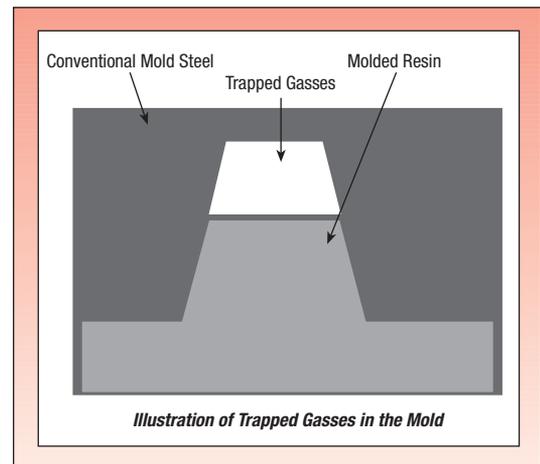
Eliminates Shrink

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.



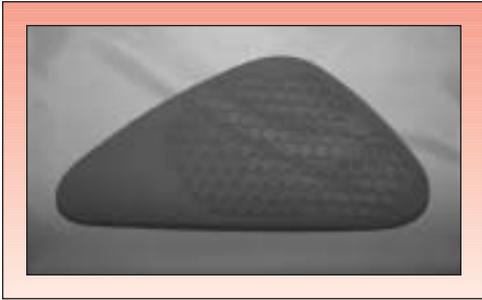
Eliminates Short Shots

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



❑ 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 is easily accomplished with the reduced back pressure and added venting of Porcerax II.



Automotive Speaker Grill

❑ Gloss Reduction

When using Porcerax II as a cavity 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. In some cases the entire hot runner manifold is eliminated.

❑ Aiding in Part Ejection

In many situations, an air poppet is needed to help eject the molded part from the cavity. Inserting venting steel in the cavity with an air blow setup accomplishes the same result. This helps break the vacuum seal and aids the ejector pins in doing their job.

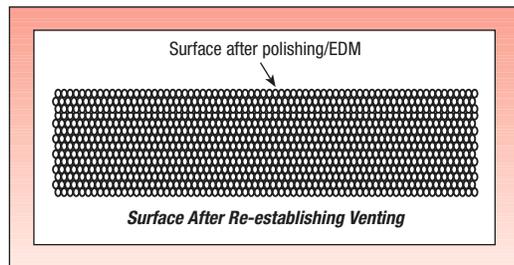
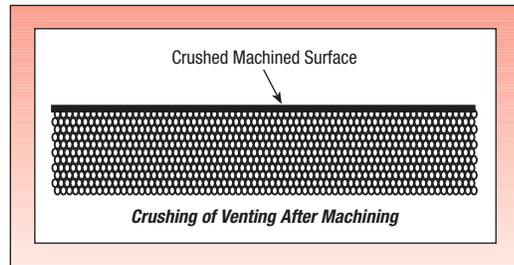
GENERAL PROPERTIES

Average pore size:	7 or 20 microns
Porosity:	25% air by volume
Linear Expansion:	(@20 - 150°C) 6.67 - 6.94 in./in F
Heat transfer co-efficient (at room temperature):	16.93 - 19.35 BTU/ft. hr. F
Tensile strength:	63990-71100 lbs./in. ²
Hardness:	HMV 350 - 400 (35-40 HRC)
HSS Machinability:	Good
Polishability:	Good



❑ 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 that this material is honey-combed with thousands of microscopic holes which are affected by metal removal. Oil coolant is recommended.

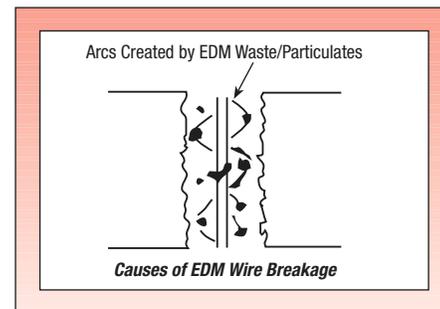
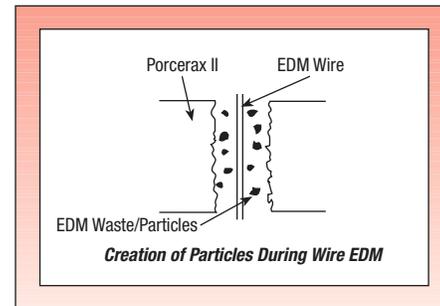


Grinding closes the pores of all grades of this porous steel. Milling will close the pores of 7 micron and reduce the pore size of the 20 micron material down to about 7 microns (when done correctly) by partially closing the pore opening at the surface. Stoning, using a back and forth/side to side method, will re-establish permeability by removing the metal that is crushed over the pores. Stoning and polishing, up to about a number 800 - 1000 stone/paper finish, is possible. During the stoning and polishing process, it is important to occasionally flush the pores at the surface to prevent packing the pores with debris.

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: When using wire EDM machining methods, Porcerax II is porous and generates waste particles that can create “arcing” conditions between the wire and the work-piece. This arcing can cut the wire. As a countermeasure, increase wire winding speed.

Note: When using an electrode for EDM, it is important to program a peak-to-valley burn rate using maximum AMPs and minimum metal removal.



The illustrations above show how particles created by the wire EDM process carry the electrical current across to the workpiece, 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.

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. Strict guidelines are supplied by International Mold Steel and should be followed.



❑ Hardness

Porcerax II is approximately 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 that 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 that the molder and/or moldmaker's texture source be supplied with the information needed from International Mold Steel to properly process the piece.** We strongly advise against inserting Porcerax II into an already textured surface. The perfect 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 that the entire textured surface be Porcerax II. Please consult your graining source for more information.

❑ Surface Reproduction

Porcerax II provides perfect venting of all gases from the mold. While this is desirable in most cases, the venting of the Porcerax 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

Occasionally the need will arise, due to size or application considerations, to water-cool Porcerax II. There are a number of ways to accomplish this. In designs that involve a straight-through water line pattern, a simple, effective way to seal the line and prevent leakage is electroless-nickel plate the water lines. In complex circuit-type patterns, it is advisable to use an acceptable sealant such as Dichtol. Electroless nickel has a tendency to pull away from sharp corners such as those at intersections of crossing water lines. However minutely this pulling away from corners may be, it will eventually cause some leakage into the material and reduce permeability through oxidation. Improper use of the Dichtol sealant will produce the same results. Regardless of which sealing process is used, be absolutely certain the material has been thoroughly cleaned of any residual machining fluids or other contaminants. If possible, water lines should be avoided because of the porous material structure and the possibility of leaks.

Sealing Water Lines in Porcerax II with Dichtol

Before applying Dichtol to water lines in Porcerax, it is imperative that all EDM fluids and other cutting oils be completely removed from the pores of the steel. Failure to do so greatly increases the risk of water leaks due to the inability of the Dichtol to leach into the pores; the contaminants will occupy the pores of the steel or will prohibit the Dichtol from bonding to the surfaces.

Cleaning Procedures Before Sealing Water Lines:

- Step 1** Heat the block of Porcerax II to 300°F for at least (1) one hour. This will open the pores and thin the fluids, allowing most of the trapped material to wick from the steel.
- Step 2** *After cooling to room temperature*, soak the Porcerax II insert in an ultrasonic cleaner (built for flammable solvents) filled with acetone. These units have spark-proof switches, water chillers and are temperature monitored. **This is the only recommended type cleaner for cleaning Porcerax II.**

Clean for approximately 1 to 4 hours, depending on insert size, back flushing with filtered shop air and changing the acetone after every hour. When the acetone remains clear the insert should be clean.

Step 3 Dry with filtered shop air, and let stand overnight.

Note: In addition to the other cleaning methods, it may be necessary to back-flush the Porcerax II inserts with acetone, using air pressure, in order to thoroughly clean the inserts. Care should be taken when using solvents under pressure.

Note: Any hot substance introduced to acetone will cause a flash fire! *Make absolutely sure the Porcerax II block is at room temperature!*

Applying Dichtol Sealant to Porcerax II Water Lines:

Step 4 Cover all water line inlets but one with a suitable tape. After tape has been applied, stand piece on edge and fill water line through the one remaining open line with Dichtol "WFT." Apply tape over the one remaining water line inlet.

Step 5 Slowly rotate the piece in all directions to insure the Dichtol is evenly distributed throughout the water line circuit. Let stand for 15-20 minutes.

Step 6 Remove the piece of tape from the water line where Dichtol "WFT" was first poured into the insert. Pour the Dichtol from the insert into the container for reuse.

Step 7 Let stand empty 2 hours.

Step 8 Re-tape the original hole, and uncover a hole on the opposite side of the insert.

Step 9 Fill water line with Dichtol "WFT."

Step 10 Repeat steps 5 & 6

Step 11 Allow 24 hours drying time before applying water pressure to the piece.

Note: Dichtol that has cured can only be removed with Methylene Chloride, Acetone or Dichtol Remover.

** Dichtol can be obtained from Diamant Coating Systems, Franklin, OH (513-746-7632).*

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, and the flash point of the resin, 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 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 gases close the pores. This can still be a feasible method if disposable inserts are used. Where extreme venting is needed, a 20 micron pore size is recommended. The 20 micron grade was developed to be used with a milled finish. When milled properly this process with the 20-micron material leaves a pore that is partially open (about 40-50 %). However, using the 20 micron pore size material and maintaining the 20 micron pore size, by EDM or polishing after milling, will vent better than 7 micron, but cannot be used if the resin flashes below .001".

❑ Size of Area to be Vented

The producing mill recommends that at least 10% of the core and cavity area be Porcerax II to insure proper venting. While this is not always possible, it is important to remember that the more square inches used in the core and cavity area, the lower the back pressure will be in the cavity. Due to the larger surface area, the insert will not require cleaning 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.

Note: The thinner the Porcerax 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 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 be impractical, a stoned or polished surface will provide the next best venting surface. The 7 micron pore size provides a better polished finish than the 20 micron, Porcerax. 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 (#9 to a #2-3 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. Certain procedures must be followed to prevent the possible, irreversible damage to the internal pore structure of the material. The texturing house selected for this procedure must be advised that they will be texturing porous, venting steel. The pores must be thoroughly cleaned and sealed prior to texturing. This insures the acid used to etch the surface does not run through the material corroding the interior structure. Performed properly, texturing Porcerax II will give the molder an unmatched finish in terms of definition.

❑ 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 come into contact with Porcerax II.

Cleaning, Maintenance and Resin Removal

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

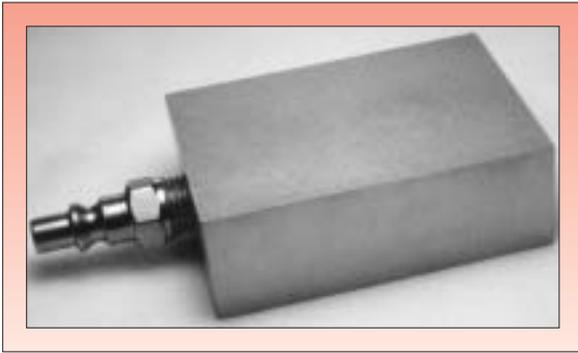
The first time is when the tool shop has prepared the insert or cavity. The material is 25% air by volume and the cutting fluids will displace the air, thus filling and clogging the pores. After the permeability has been restored, by either stoning or EDMing the venting surface, the steel should be placed in an oven at about 350°F for approximately 2-3 hours. This will thin and remove most of the fluids in the pore structure. Once cooled to room temperature, place the insert in an ultrasonic cleaning unit (built for flammable solvents) filled with acetone. These units have spark-proof switches, water chillers and are temperature monitored. This is the only recommended type cleaner for cleaning Porcerax II.

The steel should be thoroughly blown dry through 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 on next page.*) If the cleaning operation is not completed, due to the trapped fluids, inside permeability will not exist.

Note: In addition to the other cleaning methods, it may be necessary to back-flush the Porcerax II inserts with acetone, using air pressure, in order to thoroughly clean the inserts. Care should be taken when using solvents under pressure.

Note: These cleaning steps may need to be repeated.

Note: Do not use any heating device that may be supplied with the ultrasonic cleaner.



The second time cleaning is needed is after the insert or cavity has been in operation and film, a thin layer of mold release agent, resin residue, shop oil or any other contaminate has partially or totally blocked the air flow. There are two primary ways to clean this surface:

- 1) Spray or brush a liberal amount of acetone, mold cleaner or solvent onto the contaminated surface of the steel, wait a few minutes, then back flush the insert with filtered compressed air. This can be done through the drilled and tapped hole previously discussed. Or, if material is inserted, by tapping the exhaust line that exits the core block and attaching an air fitting there.
- 2) **The second and preferred way to clean the porous material is to remove the insert or take the small cavity and place the insert in an ultrasonic cleaning unit (built for flammable solvents) filled with acetone.** These units have spark-proof switches, water chillers and are temperature monitored. **This is the only recommended type cleaner for cleaning Porcerax II.**

Note: In addition to the other cleaning methods, it may be necessary to back-flush the Porcerax II inserts with acetone, using air pressure, in order to thoroughly clean the inserts. Care should be taken when using solvents under pressure.

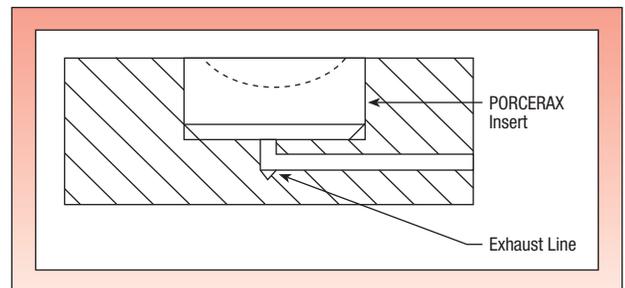
Note: Either of these steps may need to be repeated several times.

Note: When cleaning Porcerax II, if Dichtol sealed waterlines are present, the need to reseal these waterlines will be required.

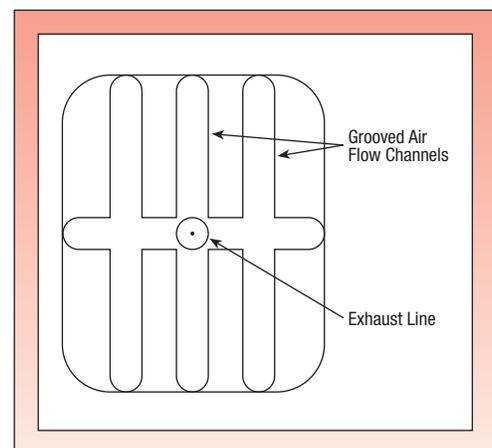
Note: With some engineered resins it may be necessary to clean Porcerax II inserts with other chemicals such as 6 to 8% Sodium Hydroxide solution. This can be used in an ultrasonic cleaner with temperatures up to 160°F, for a period not to exceed 40 minutes. Immediate flushing with water as a neutralizer should take place in order to prevent corrosion within the Porcerax II insert. A 45-minute ultrasonic cleaning in water should follow this. Then remove the insert and dry with filtered compressed air. **Consult your chemical supplier for the necessary safety instructions!**

For further information and questions regarding Porcerax II cleaning please call: International Mold Steel, Inc. at 1-800-625-6653.

Porcerax II Insert Installation

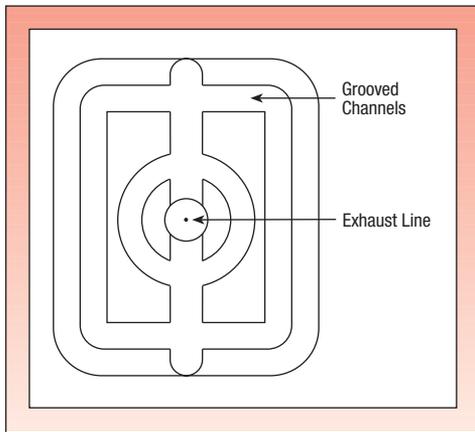
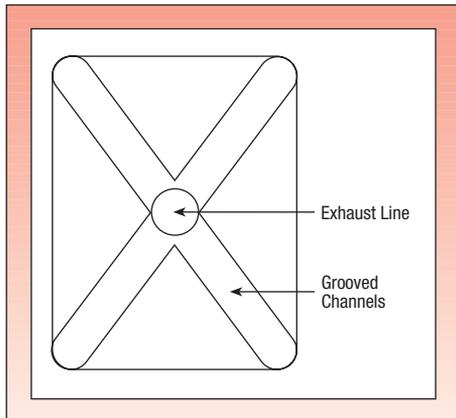


Various designs for a Porcerax insert pocket.



Bottom of Insert Pocket

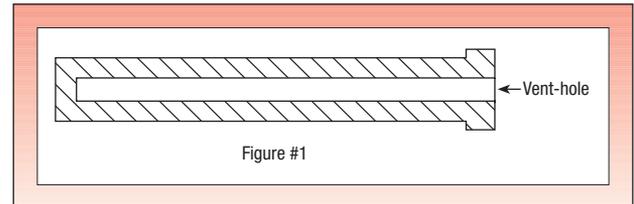




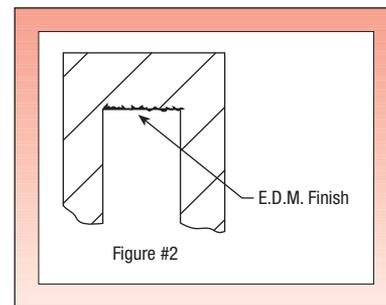
Note: Consult your resin manufacture to determine if acetone is an effective solvent for your resin.

Porcerax II Pin Installation

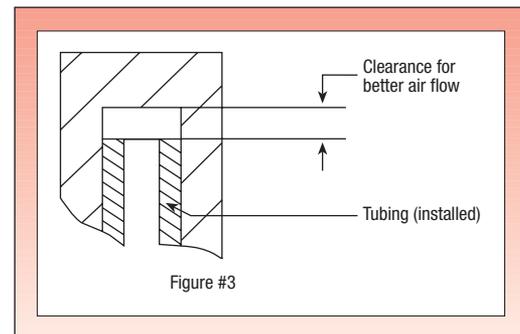
Best results can be achieved by drilling a vent hole into the bottom of the pin (Figure #1). This procedure considerably shortens the "escape route" for gas.



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 fluids are cleaned out before installing the pin into the tool.



It is best to grind the outside diameter of the pin, or install a copper, brass, or plastic tube inside the drilled hole if a blowback system is used (Figure #3). This allows concentration of air pressure in an area where it is needed most (next to the molding surface).



Conclusion

The age-old venting problems that have faced molders for years have been solved using Porcerax II venting steel. Better mold cavity venting adds many benefits, from reduction of scrap to better cycle times. Whether it is a retrofit or engineered into the tool from the start, Porcerax II adds value to all molds.

Porcerax II Stock List

Porcerax II Rounds (7 micron)

International Mold Steel offers the following sizes of Porcerax II in round bar:

- 3/8" diameter x 6" long
- 1/2" diameter x 6" long
- 5/8" diameter x 6" long
- 3/4" diameter x 6" long
- 1" diameter x 6" long

All rounds are +. 010 - .000 and will only be sold in full length pieces.

7 Micron and 20 Micron

Rectangles are cut from a master block approximately 8" x 12" x 27" (call for sizes).

Note: It is imperative that anyone coming into contact with Porcerax II during the mold building or molding operations understand the characteristics and sensitivity of this material. Any questions or uncertainties should be directed to, International Mold Steel at 1-800-625-6653.

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