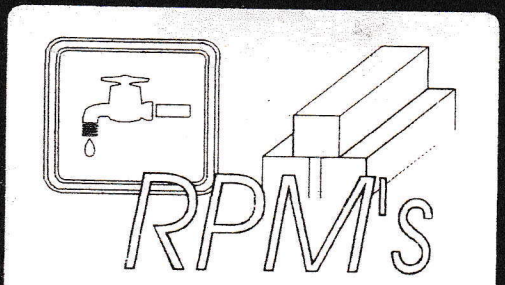
A GUIDE TO DIAMOND TOOL USAGE

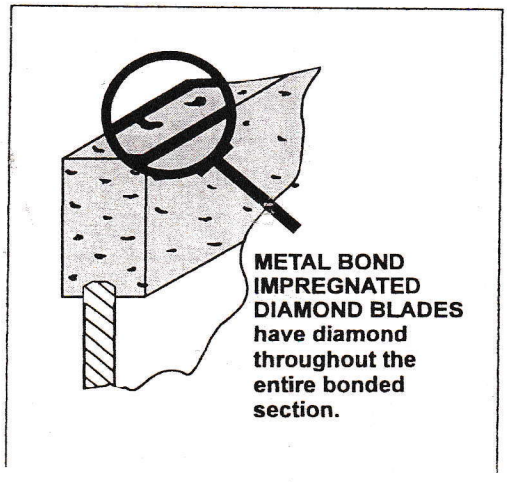
Steps to Optimum Diamond Tool Usage



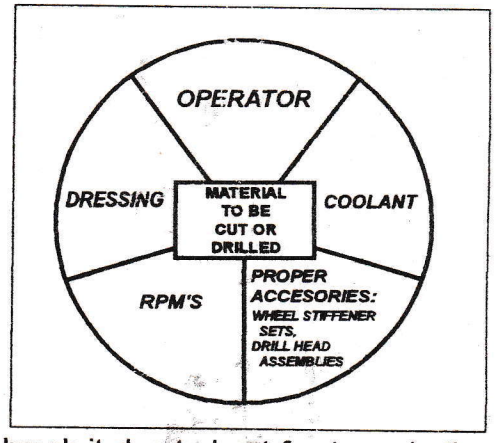
Water, RPM's, & Dressing

AN INTRODUCTION TO DIAMOND TOOLS

Industrial diamond tools are manufactured for a variety of uses. We have designed your tool to give long life, quality workmanship, and good performance. Metal bonded diamond tools are "impregnated" with diamonds. This means that selected diamonds are mixed and sintered with specific metal alloys to achieve the best cutting performance possible on any specific piece of material such as glass, granite, tile, etc. When speaking with our staff, we will always ask many questions about the material you wish to cut. They are very specific questions about what the material is, how do you plan to cut it, what machine you'll be using, the RPM's of that machine, coolant, flange size, etc. You may wonder why we need to know this information. Since diamond tools are designed and used for many applications, each tool reacts differently under different conditions. All tools have one thing in common, they are metal based products being used to cut either metals or hard materials. There is friction generated, which can generate heat. That will damage your diamond tool. However, there are a number of basic procedures that, if followed each and every time, will allow each tool to operate successfully no matter what material you are cutting. For example, would you drive your car without oil or water in the crankcase or radiator? Of course you would not. If you did, how far could you go before the heat in the engine became so intense, that it would sieze up and the car would no longer work? The principles behind diamond tool cutting are not very different. The diamonds in the tool perform all of the cutting action. They are "impregnated" throughout the diamond section of the tool meaning they are dispersed throughout the metal bond. The metal bond surrounding the diamonds must wear away to continuously keep re-exposing the diamonds for the tools to continue cutting. If the tool becomes overheated, the metal bond does not wear away, instead it "glazes over" the diamond. This means it coats or covers the diamond. The metal bond then becomes the cutting agent rather than the diamond. The heat continues to generate. The tool will eventually chip the material and/or break it due to heat fractures in the material and/or damage the tool by causing heat cracks in the diamond section. Optimum performance can be achieved through the proper running and basic care of your blade before and during usage. This instruction guide has been written to avoid these frustrations and achieve optimum success with your blade.



METAL BOND IMPREGNATED DIAMOND BLADES have diamond throughout the entire bonded section.



KEYS TO THE SUCCESSFUL USE OF DIAMOND TOOLS

When using metal bonded diamond tools we will always try to help you reach the "optimum" performance level of your tool. We realize that in many circumstances, there are a variety of factors that may prevent the consumer of a tool from doing all of the things we will

suggesting. Not all jobs or operations can be done in controlled environments such as a shop or lab. Some equipment on the market cannot be adjusted suitably to accomodate the special needs of a diamond tool. The "best" performance is frequently the "optimum" performance. This can be achieved by following the following four steps as closely as possible.

USE THE RIGHT TOOL FOR THE JOB:

Tell us as much information about the material and your job as possible. We can then help you define your need so you purchase the right tool for the job to avoid down time from ordering the wrong item.

USE THE CORRECT RPM'S:

If the RPM's on your equipment run either too fast or too slow, excess heat will be generated that will damage your blade. Charts are provided that will help you identify the correct RPM's for your tool and make suggestions on ways to achieve it.

USE OF THE RIGHT COOLANT AT THE POINT OF CONTACT:

Depending on the application, there are a variety of coolants available from water to a variety of oils. Specific applications are a determining factor in recommending coolants. No matter what coolant you are using, they must always be used at the point of contact where the material and the tool intersect.

KEEP THE DIAMONDS THOROUGHLY EXPOSED AT ALL TIMES:

Before using your new tool, it should be dressed. While using the tool, it should be redressed frequently. Always use a recommended dressing stick.

USE THE PROPER TOOL ACCESORIES:

Use Wheel Stiffener Sets with all thin diamond blades to stabilize the blade. This will help prevent the blade from "walking". Use Drill Head Assemblies with core drills to bring water down the center of the drill to the point of contact.

THE RIGHT TOOL FOR THE JOB

Diamond tools are used to cut a range materials from soft and abrasive to very hard and dense. Each application can vary depending on the quality of cut, production needs, and/or a variety of specialized needs. Diamond Systems manufactures over 35,000 different shapes, styles, sizes, and matrix combinations of diamond tools to cover these needs. The following information will help us to determine your specific needs:

A thorough description of the material to be cut:

a) Name and description of material (hardness, density, softness, or abrasiveness)
b) Depth and quality of cut desired.(fast, hogging off, fine, chip free)

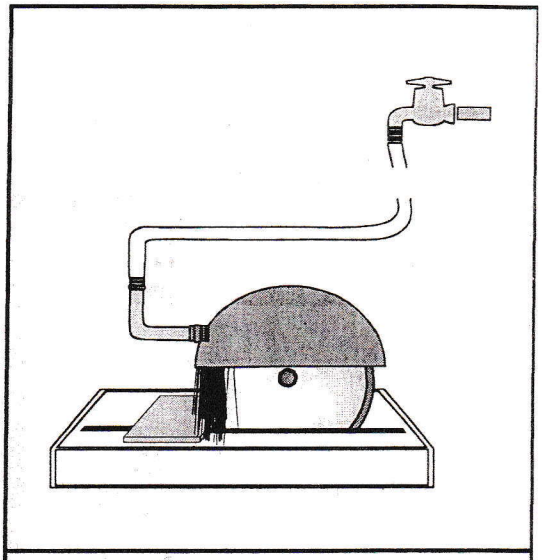
Information on the machinery to be used:

a) Type of equipment (mill, drill-press, handheld equipment, etc.)
b) Wet or Dry application
c) Type of coolant and application (flood, mist, etc.)
d) Flange Size
e) Machine RPM's

THE CORRECT RPM'S

One of the most critical factors to the successful use of diamond tools is RPM's. If the tool rotates to slow, it drags and creates heat. If it spins to fast, it causes friction and creates heat. Heat is the worst enemy of the diamond tool, the correct RPM becomes a critical factor. Unfortunately, this can also be the most

Unless you have a machine with variable speed capability, most machines will only run at 1725 RPM's or 3450 RPM's. Diamond tools can require RPM's from 100 to



WATER AT THE POINT OF CONTACT helps control heat generation which improves diamond exposure.

23,000. If you use diamond tools on a regular basis, you may want to check into altering your machinery to accomodate variable speed capability. If you cannot adjust your machinery, this will affect the performance of the blade causing heat generation, warping, walking, and/or breakage. *Dressing frequently, using proper coolants, and using wheel stiffener sets can help but will not completely substitute for correct RPM's.* To determine the correct RPM's for the optimum performance of your diamond tool, you must know the Surface Feet per Minute (SFM) required to cut your material. The following "Guide to Operating Speeds for Diamond Wheels" chart includes a broad range of materials and the Surface Feet per Minute (SFM) required to cut them. Locate the SFM needed, determine the size of the blade or drill and cross reference it to the SFM to RPM chart.

COOLANTS AND METAL BOND TOOLS

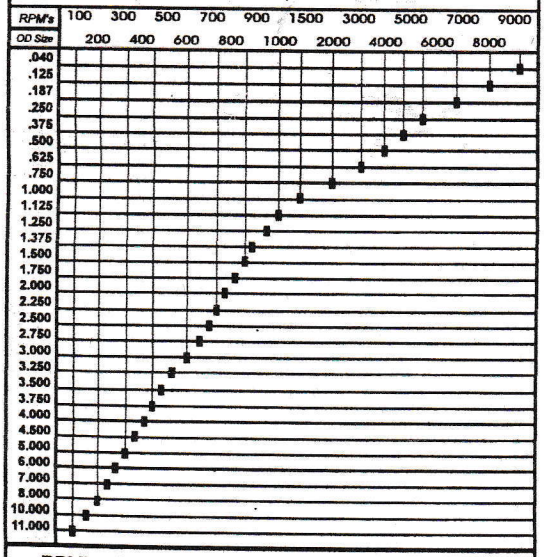
All metal bond tools require some form of coolant flooded at the point of contact to keep the tool cool. *The best option is to have the coolant flooded at the point of contact of a blade or down the center of a drill by using a Drill Head Assembly.* Water can be used as a cooling agent for some materials, such as granite or marble, even though water has no "lubricity." Lubricity is the degree a given substance is able to lubricate another substance. When the temperature exceeds 212 degrees farenheit, the water turns to steam, no longer providing any coolant. Adding a nonsudsing detergent, will help the water have more lubricity. The harder and more dense a material becomes, it is necessary to move from water to water soluable oils. A variety of industrial materials and glass are cut with water-soluable products. The ratio of oil to water varies depending on the application. The most dense of materials such as agate and carbide must be cut with oil. If coolants cannot be used, possibly a resin or plated product may be the solution. It is also equally important that the coolant be delivered at the point of contact where the blade and the material intersect. When a tool is turning at the proper RPM's, momentum will throw the coolant out and away from the point of contact. If the coolant is not delivered as close to the point of contact as possible, when the tool begins to rotate it will never reach that point, heat will begin to be generated, the tool will "glaze over" with the metal bond, no longer allowing the diamonds to perform the cutting operation.

Diamond Blade Speed Conversion Chart: Surface Feet/Minute to RPM's

Surface Feet Per Minute	2"	3"	4"	5"	6"	7"	8"	10"	12"	14"	16"	18"	20"	24"
2,000	3,800	2,500	1,900	1,500	1,300	1,100	950	750	650	560	490	425	385	325
3,000	5,700	3,800	2,900	2,300	1,900	1,600	1,400	1,150	950	820	735	650	575	485
4,000	7,600	5,100	3,800	3,000	2,500	2,200	1,900	1,500	1,300	1,120	975	850	770	650
5,000	9,500	6,400	4,800	3,800	3,200	2,700	2,400	1,900	1,600	1,375	1,225	1,070	965	810
6,000	11,200	7,600	5,700	4,400	3,700	3,200	2,800	2,200	1,850	1,590	1,475	1,275	1,150	975
7,000	13,100	8,700	6,700	5,200	4,400	3,800	3,200	2,600	2,200	1,890	1,700	1,490	1,350	1,130
8,000	15,000	10,000	7,600	6,000	4,900	4,300	3,700	3,000	2,500	2,150	1,950	1,700	1,550	1,290
9,000	16,800	11,200	8,600	6,500	5,500	4,800	4,200	3,300	2,800	2,410	2,200	1,925	1,730	1,450
10,000	18,700	12,500	9,550	7,500	6,300	5,300	4,600	3,700	3,100	2,670	2,450	2,125	1,925	1,625
11,000	21,000	13,900	10,600	8,300	7,000	6,000	5,100	4,100	3,400	2,925	2,700	2,350	2,125	1,775
12,000	23,000	15,200	11,500	9,100	7,500	6,500	5,500	4,400	3,800	3,270	2,950	2,550	2,300	1,935

RECOMMEMDED RPM'S OF DIAMOND CORE DRILLS

For Soft, Abrasive Materials, RPM Should Increase.
For Hard, Dense Materials, RPM Should Decrease.

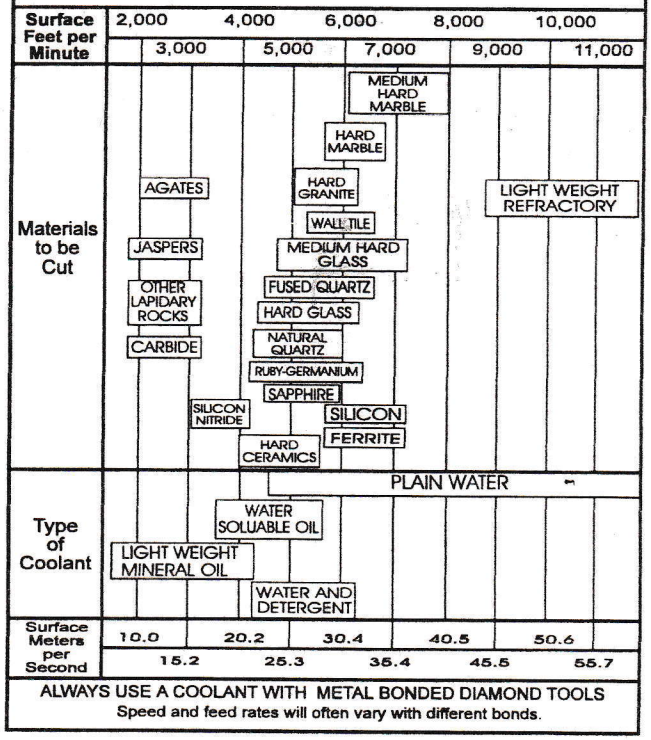


RPM's will vary depending on the OD size of the drill.
To improve drill life and help reduce breakage,
it is important to run drills at the proper RPM's and keep the diamonds exposed through frequent dressing

DRESSING DIAMOND TOOLS

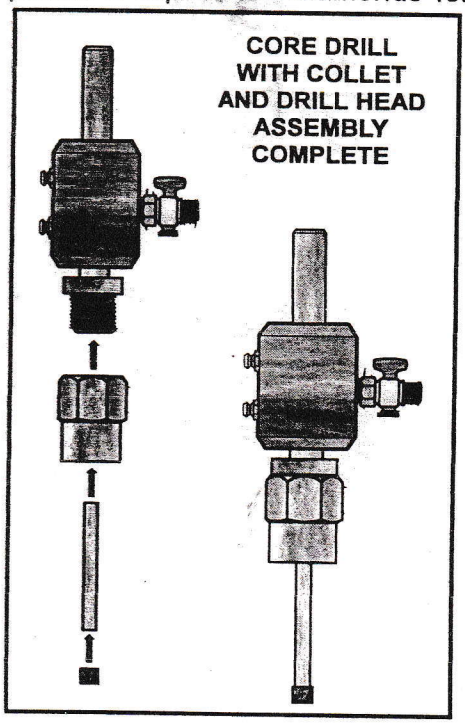
When using a diamond tool, it must be both trued to and dressed on the machine on which it will be used. This will guarantee two things, the diamonds in the tool will be thoroughly exposed and the tool will be "true in running (T.I.R.)" on your machine. Every individual machine will run differently. Even if the tool is trued at the factory, it can still "run-out" of tolerance when you place it on your machine. Blades must be trued and drills must be indicated in. Trueing a tool is the operation of squaring a tool so that it runs within your tolerances. This is done with a hard stone that will knock the diamonds out. This differs from dressing. It is necessary to dress the tool after truing as the diamonds will no longer be sticking-up. After trueing the tool, it is important to dress it to make sure the diamonds are exposed. The diamonds must be sticking up out of the metal bond matrix. If they are not, you will experience difficulty with your new tool. A tool that is thoroughly dressed will have metal bond "tails" extending from the back of the diamond. The tool is now

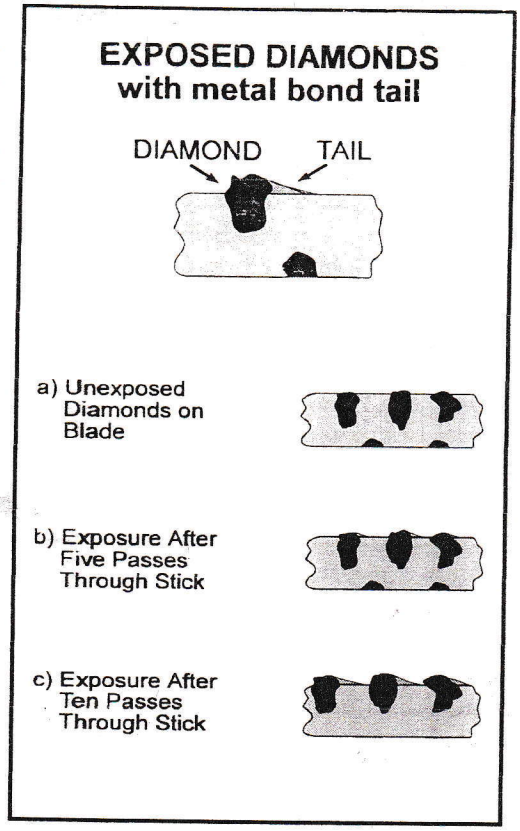
Guide to Operating Speeds for Diamond Tools



ALWAYS USE A COOLANT WITH METAL BONDED DIAMOND TOOLS
Speed and feed rates will often vary with different bonds.

"directional". That means it should always run in the direction of the leading edge of the diamond, away from the tail, so the sharper, leading edge of the diamond can do the cutting action desired. When your diamond tool is new, it should be dressed thoroughly by the operator. Never assume because the tool is new, that it does not need this step. Dressing diamond tools is similar to dressing a knife with a stone. You want your knife as sharp as possible when you begin cutting as you do your diamond tool. In much the same way you make passes across the stone with the knife, you make several cuts into the dressing stick with the diamond tool. Using the correct, soft dressing stick, it is recommended that the tool is passed through the stick five to ten passes to expose the diamonds for optimum cutting performance. If the dressing stick is too hard, it will "knock the diamonds out". Diamond Systems, Inc. can provide the proper stone to avoid this problem. The more the diamonds are "sticking up", the better the performance of the blade. Give you new blade the "Thumb Nail Test". After thoroughly dressing the blade, you should be able to snag your thumb nail on the diamonds. This will let you know they are sticking up in order to cut properly.



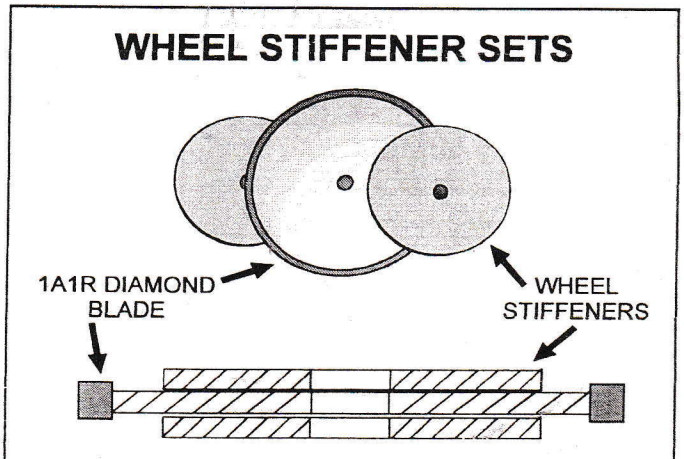


After using your blade for a while, it may seem to cut more slowly or begin to chip your material. The diamonds are no longer exposed. *Do not force the tool. If you feel "resistance" in cutting, that the tool is not cutting as easily or slowing down, it is important to stop and dress the wheel again, following the same procedure as before.* This will restore the blade to it's original condition. Depending on the material to be cut, this procedure will need to be repeated with varying frequency. Without the proper dressing, your blade will stop cutting which will break or chip your material or the tool. This is because you are no longer cutting with the diamond but are using the metal bond to do the cutting.

USE THE PROPER ACCESSORIES

With some materials, you may need to use a very thin diamond blade to cut into the material. You may wish to avoid the "resistance" of a thicker blade, need to hold tight tolerances or have an expensive piece of material you do not want to waste. Even though your cut may not be very deep your machine may only accomodate a specific diameter blade. When your blade cuts into your material, it may not have the rigidity to maintain the tolerance. The blade may begin to walk. By using wheel stiffener sets with your diamond blades, you can provide an extra degree of rigidity to the blade, helping the blade run true. They should be used at 2/3'rd's the outside diameter of the Diamond blade and can be manufactured in all sizes needed.

To achieve optimum performance when using core drills, water should be used down the center of the drill. We recommend that a sealed bearing Drill Head Assembly be used. They are also refered to as Water Jackets. We manufacture a variety of sizes to accomodate a the different collets and chuck sizes on the market. Water down the center of the Drill Head Assembly insures that the diamond section has a constant flow to keep the diamonds exposed.



WHEEL STIFFENER SETS Provide Stability to Thin Diamond Blades which helps prevent the blade from "walking". Stiffeners should be used at 2/3rd's the Outside Diameter of the Diamond Blade.