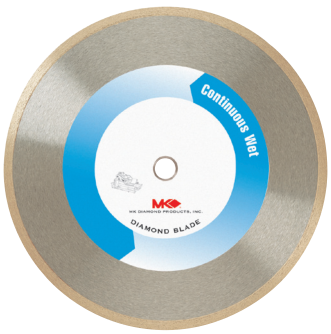
DIAMOND BLADE OVERVIEW

Variables in Cutting

The **segment** is the part of the blade that actually does the cutting. A measured quantity of manufactured diamonds are mixed together with a specific combination of powdered metals (the matrix) and processed in graphite molds at a high temperature and high pressure to form individual segments.

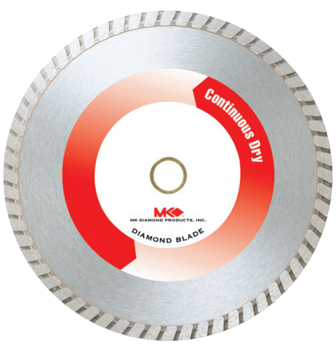
- Diamond blades do not really cut, instead they grind through material.
- The diamond crystals remove material by scratching out particles of hard, dense materials, or by knocking out larger particles of loosely bonded abrasive material.

CONTINUOUS SMOOTH RIM



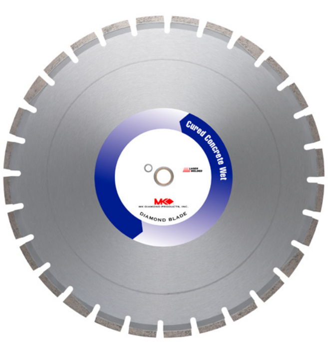
- Provides clean, smooth cuts on:
  Glazed ceramic tile, marble, granite, porcelain and quarry tile
- Wet and dry specs available
- Sizes: 4" – 14" diameters

SERRATED / TURBO RIM



- Provides fast cutting with minimal chipping on:
  Roof tile, unglazed tile, masonry, brick, block, paver, stone and concrete
- Dry specs (can be used with water)
- Sizes: 4" – 16" diameters

SEGMENTED RIM



- Provides maximum life and cutting strength:
  Concrete, reinforced concrete, asphalt, masonry, brick, block, paver and stone
- Wet and dry specs available
- Sizes: 4" – 60" diameters

WET & DRY CUTTING

TYPES OF CUTTING

- There are two basic types of cutting – dry or wet.
- The best choice of blade depends upon:
  - the requirements of the job
  - the machine/tool utilizing the diamond blade
  - the preference of the operator

DRY CUTTING DIAMOND BLADES

Because of the overwhelming popularity of handheld saws, and the flexible nature of MK diamond blades to professionally handle most ceramic, masonry, stone and concrete materials, the dry cutting blade is very attractive. Dry cutting blades are also used where water is not permitted or not convenient or where so little cutting is required that set-up of water cooled equipment would be inefficient. In cold weather, the saw operator doesn't have to worry about the water freezing. From 4" to 16", MK blades for hand-held saws allow you to slice through these materials while maintaining full depth of cut for the life of the blade.

MK Dry cutting blades, are designed for faster cutting, longevity and safety in mind, no matter what the application. Remember, MK dry cutting blades cut up to 3 times as fast as abrasive blades, last 100 times longer, and provide a continuous accuracy and depth of the cut.

WET CUTTING DIAMOND BLADES

Most contractors prefer to use Wet cutting diamond blades whenever possible because the water used to cool the steel core enhances the longevity of the blade, improves the cutting process, and adds to the safety factor by keeping the dust signature down.

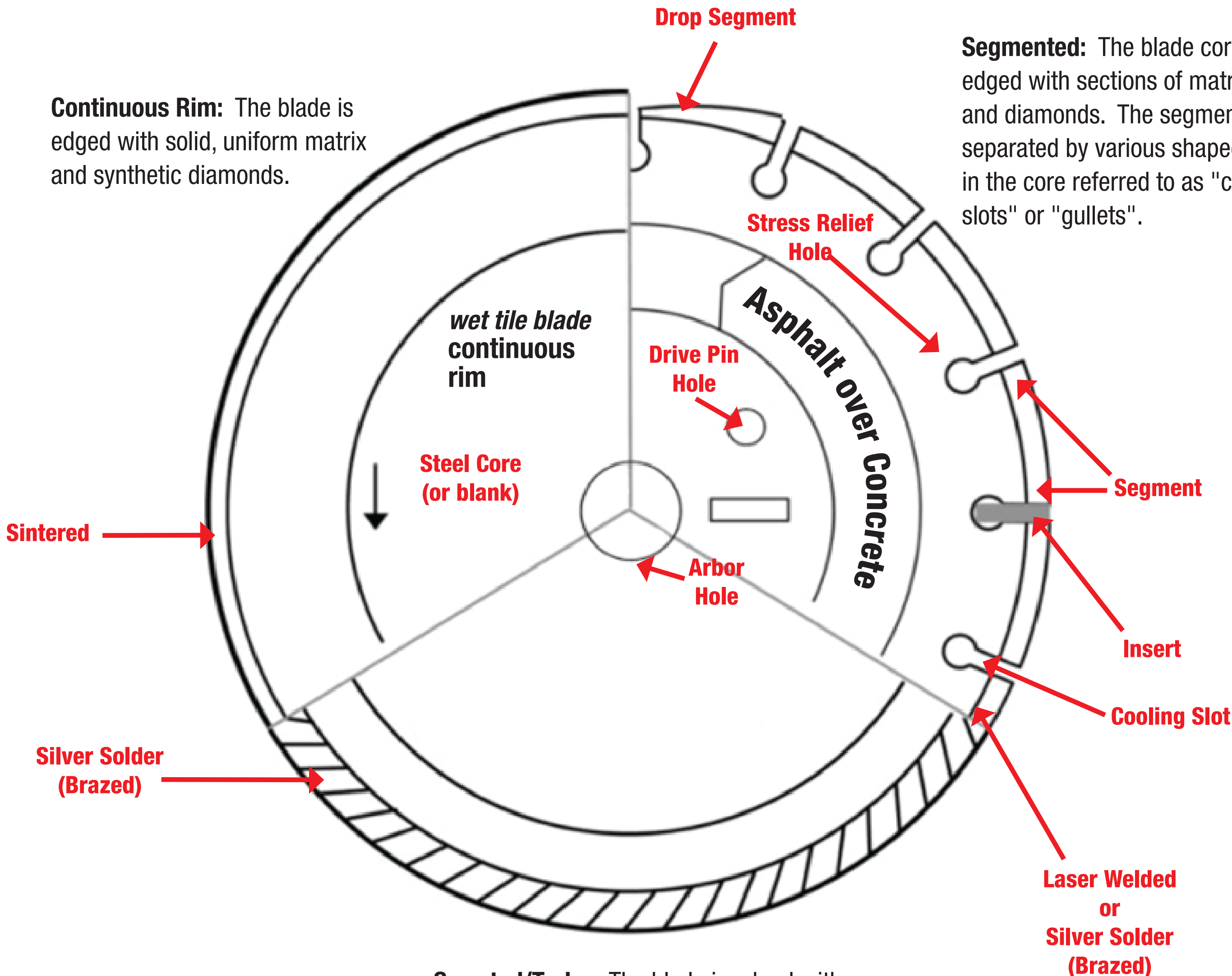
MK Diamond Products offers a host of diamond blades specifically engineered to handle all ceramic, masonry, stone, or concrete applications. The design of the steel core, bonding matrix, and diamond partial strength/crystallanity/wear behavior make our Wet cutting blades the leader in the industry. They always perform regardless of the demanding nature of the wet cutting environment. Because of unique situations, MK can always respond to the needs of the customer by recommending the proper blade, or by custom manufacturing blades specifically required for whatever material is being cut.

NOTE: Water can be used with dry cutting blades but wet cutting blades can never be used dry.

TERMINOLOGY

Continuous Rim: The blade is edged with solid, uniform matrix and synthetic diamonds.

Segmented: The blade core is edged with sections of matrix and diamonds. The segments are separated by various shaped slots in the core referred to as "cooling slots" or "gullets".



Serrated/Turbo: The blade is edged with notched, tooth-like segments.

DIAMOND BLADE FABRICATION

Diamond blades consist of four components: diamond crystals, a bonding system, a segment and a metal core.

DIAMOND CRYSTALS

- The diamond crystals in MK blades are synthetic.
- Synthetic diamonds are more consistent and can be relied upon during enormous stress.
- The performance factor in diamond-blade sawing is the type, concentration and size of these diamond crystals.

BONDING MATRIX

- Diamond crystals are held in place by a sintering or laser welding process of specially blended metal powders.
- Bonding Matrix serves several vital functions:
  - Disperses and supports the diamonds
  - Provides controlled wear while allowing diamond protrusion
  - Prevents diamond "pull-out"
  - Acts as a heat sink
  - Distributes impact and load as the diamond attacks the cutting surface

METAL BONDS

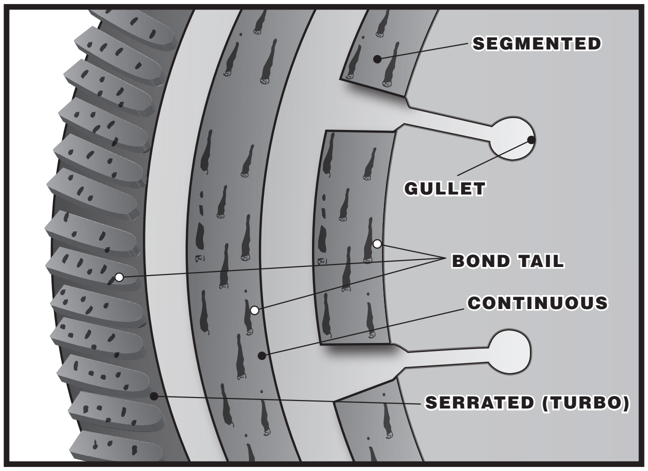
- Commonly used bonds for diamond blade manufacturing are Cobalt, Iron, Tungsten, Nickel and Copper.
- Diamond crystals and bonding matrix are heated and shaped into specially engineered rims/segments.
- Rims/segments are wider than the blade core to which they will be attached.
- Rims/segments are specifically designed to wear at a rate appropriate to the material being cut.
- Softer, more abrasive materials require a "tough to wear" (hard) bond; less abrasive materials require an "easy wear" (soft) bond.

PREMIUM STEEL CORE

- Diamond saw blade cores are made from high alloy, heat-treated steel.
- The steel cores are specifically designed to support the appropriate rim or segment.
- Various rims or segments are affixed through a brazing or laser welding process.
- An arbor hole is precisely bored in the center.
- The entire core is "tensioned" or tuned so that the stresses of centrifugal force are minimized.

DIAMOND CUTTING TOOLS

Types of Diamond Blades



A diamond blade is a circular steel disc with a diamond bearing edge. The edge or rim can have either a segmented, continuous or serrated (turbo) rim configuration.

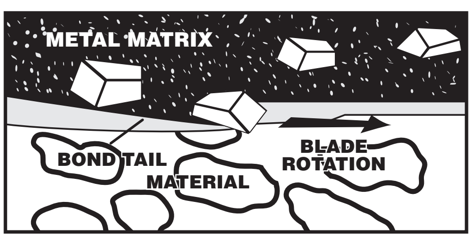
The blade core is a precision-made steel disc which may have slots called "gullets". These provide faster cooling by allowing water or air to flow between the segments. These slots also allow the blade to flex.

Blade cores are tensioned so that the blade will run straight at the proper cutting speed. Proper tension also allows the blade to remain flexible enough to bend slightly under cutting pressure and then go back to it's original position.

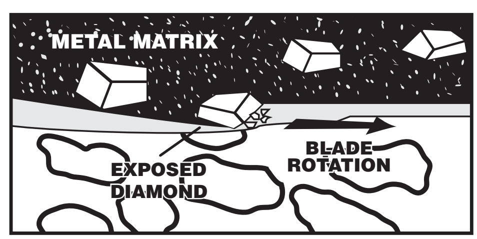
Diamond segments or rims are made up of a mixture of diamonds and metal powders. The diamonds used in bits and blades are man-made (synthetic) and are carefully selected for their shape, quality, friability and size. These carefully selected diamonds are then mixed with a powder consisting of metals such as cobalt, iron, tungsten, nickel, copper and other materials. This mixture is then molded into shape and then heated at temperatures from 1700° to 2300° under pressure to form a solid metal part called the "bond" or "matrix". The segment or rim is slightly wider than the blade core. This side clearance allows the cutting edge to penetrate the material being cut without the steel dragging against the sides of the cut. There are several methods of attaching the segments to the steel core.

- **Brazing** - silver solder is placed between the segment and the core and then heated until the solder melts and bonds the two together. This method is used for wet cutting blades only.
- **Laser welding** - The diamond segment and steel core are welded together by a laser beam. This process is for segmented blades and ensures the highest standard of exacting tolerances, performance and user safety.
- **Mechanical bond** - A notched, serrated or textured blade core may be used to "lock" the diamond rim or segments onto the edge of the blade. Mechanical bonds usually also include brazing or other metallurgical bonding processes to hold the rim or segments in place.

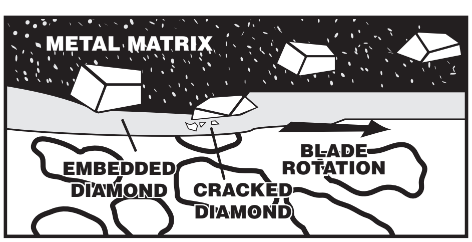
After the blade is assembled it is "opened", "broken in" or "dressed" by grinding the edge concentric to the center. This exposes the diamonds that will be doing the work and establishes the cutting direction as noted by the direction arrow stamped into the blade.



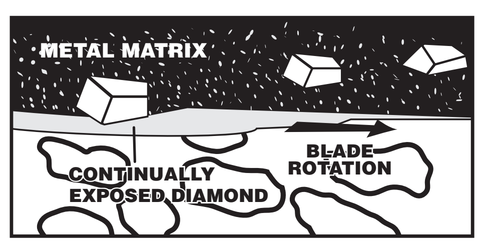
Diamond blades don't cut they grind! The exposed diamond crystals do the grinding work. The metal matrix or bond holds the diamonds in place. Trailing behind each exposed diamond is a "bond tail" which helps to support the diamond. As the blade rotates through the material the exposed surface diamonds grind the material being cut into a fine powder.



After several thousand passes through the material being cut the exposed diamonds begin to crack and fracture. The matrix holding the diamond also begins to wear away.



Eventually, the diamond completely breaks up and it's fragments are swept away with the material that it is grinding.



As the old diamonds are worn down they are replaced by new ones and the process continues until the blade is worn out.

UNDERSTANDING MATERIALS

Ceramic Tile

Ceramic products are varied and depending on their manufacturing processes, they exhibit their own special qualities and properties. The hardness of the ceramic material is directly attributed to its manufacturing process, and generally references the Mohs Scale to categorize its hardness.

The Manufacturing Process

Ceramic tile production begins with the excavation of clays to be used in the manufacturing process. Depending on the type of tile being produced, any number of two to six different types and colors of clay may be necessary to blend together in a mixture.

The selected bulk clays are mixed with water and this mixture is pumped into large, rotating cylindrical mills, where extreme grinding action pulverizes the clay into uniform and homogenous particles. This substrate is called "body-slip," and has the consistency of a milk shake.

Next, moisture from the body-slip is evaporated by a spray dryer burner, creating fine particles of uniformly sized dry clay called "powder." The powder is then fed into molds within a hydraulic press, where it is molded under pressure (approximately 4,000 PSI) to form "green ware" (what the tile is called prior to being fired). The green ware is dried again to further reduce the moisture content, and then travels down "glaze lines" where various types of glazes are applied to the surface.

The glazed green ware travels through a kiln and undergoes a 45-50 minute firing where temperatures can reach 2300°F causing the glaze to fuse to the body. The tile that emerges from this process is very hard, durable and impact resistant.

Hardness of Ceramic Tiles

- Water absorption rate, glazes, compression and material all determine the hardness of ceramic tile.
- The percentage of water absorption by the tile body determines whether the ceramic tile is Impervious, Vitreous, Semi-Vitreous, or Non-Vitreous. From Impervious, where absorption rates of 15% and higher, hardess factors change.
- Most glazes fall in the 5 to 6 Mohs Scale range. However, certain types of floor and porcelain tiles can have compressive strengths of 10,000 PSI and a Mohs hardness factor of 8.

Stone

Natural and precast stones vary significantly in their geographic origin, mineralogical composition, and physical and mechanical properties. There are numerous types of stone to select, with each one exhibiting specific qualities of compressive strength and abrasive resistance.

- Marble
- Granite
- Slate/Flagstone
- Sandstone
- Limestone
- Precast Stones

Additionally, these qualities would dictate appropriate diamond-blade selection to effectively handle cutting requirements. Your choice of stone requires a specific type of Diamond Blade.

General Characteristics of Stone

The complex nature and variables of Natural and Precast stone make it difficult to generalize their overall physical and mechanical properties. Unless the operator has had experience in cutting a particular stone, there are methods that can help predict the stone's sawability, and so determine the "best" diamond blade. The American Society of Testing and Materials (ASTM) recognizes several physical property measurements that can identify a stone's hardness:

Uniaxial Compressive Strength (UCS)

Measuring basic rock strength parameters. Commonly measured in Pounds Per Square Inch (PSI).

Cerchar Abrasivity Index (CAI)

Measuring a rocks abrasivity for determining cutting wear rates. Defined by a graduated numerical scale: lower numbers indicating less abrasive qualities, and therefore greater hardness.

Mohs Hardness Scale

A scale of hardness applied to minerals that ranges from 1 to 10, and comparatively indicates a mineral's scratch potential. The higher the number the harder the mineral.

Shore Scleroscope Hardness Test
A dynamic indentation hardness test using a number to indicate the height of a rebounding hammer off the surface of the material. The higher the number the harder the material.

It is recommended to review all data relating to a stone's hardness and abrasive qualities to effectively choose the proper diamond blade. No singular Property Measurement Test can define the characteristics a stone would exhibit during the cutting process. As a general reminder for stone diamond blades: tests and industry experience has documented that stone exhibiting a greater degree of hardness and abrasive resistance require softer bond matrixes.

Masonry

Brick manufacturing today follows fundamental procedures pioneered centuries ago. However, better knowledge of raw materials and their properties, better control of firing and improved kiln designs have resulted in a superior product. The production of bricks centers around the type of clay that is used. Clays occur in three forms (Surface Clays, Fire Clays & Shales). Although they share similar chemical compositions, they will differ in their physical characteristics. All properties of brick are affected by the composition of the raw materials and the manufacturing processes. Essentially bricks are produced by: (1) mixing ground clay with water, (2) forming them into desired shapes, (3) then drying and firing them. Establishing a homogenous blend is necessary before subjecting the mixture to one of three forming processes (Stiff–Mud, Soft–Mud or Dry–Press). Next, the process continues with drying, firing and cooling. Kiln firing temperatures during manufacturing graduate from 400°F to 2400°F.

Hardness of Bricks

- There are many different types of brick (Building, Facing, Hollow, Paving, Ceramic Glazed and Thin Brick), and different scales of hardness. The strength of a unit is used to determine its durability and ease of cutting. Both compressive strength and absorption are affected by properties of the clay, method of manufacturing and degree of firing. Most bricks have a strength ranging from 3,000 PSI to over 20,000 PSI, with the average being around 10,000 PSI.
- Brick may also include different size, type and volume of aggregates to further strengthen the mix.

Concrete

Four essentials must be known about the concrete to determine proper diamond-blade selection.

1. Compressive Strength
The hardness of concrete is referenced by its compressive strength measured in Pounds per Square Inch (PSI). Cured concrete slabs vary widely in compressive strength; with moisture, temperature, design of mixture additives, cementitious materials, and curing processes often determining their measured level of strength. The higher the compressive strength, the harder the material.

Compressive Strength

Concrete Hardness	PSI	Typical Application
Very Hard	8,000 or more	Nuclear Plants
Hard	6,000 - 8,000	Bridges, Piers
Medium	4,000 - 6,000	Sidewalks, Patios, Parking lots

2. Age of the Concrete
The "age," or length of curing time, greatly affects how the diamond blade interacts with the concrete. Although methods exist to accelerate the curing process, the "state" of concrete from initial pouring to a period of 72 hours and over can be defined in 3 distinct increments, and is influenced by temperature, weather, moisture, aggregate, time of year, admixtures and composition.

State 1 – 0 to 8 hours
The concrete is considered in its "green" state 0 to 8 hours after the pour, meaning it has set but has not hardened completely. With green concrete, the sand in the mixture has not bonded to the mortar blend firmly and will cause extreme abrasive action and cracking once the physics of sawing begin. Further, the slurry generated by green concrete is equally as abrasive and will require special undercutting protection for the steel core of the diamond blade. Typically, sawing control joints of highways, industrial flooring, driveways, runways, and similar projects are performed during this state.

State 2 – 8 to 24 hours
The concrete is considered fairly cured, 8 to 24 hours after the pour. The sand is held firmly adhered to the overall mixture. Generally, control joints established in State 1 are widened during this time.

State 3 – 24 to 72 hours
The concrete is considered as completely cured 24 to 72 hours after the pour. The sand is held firmly in the mortar mixture, and the overall abrasive actions and properties of the concrete are greatly diminished. Now, consideration of the aggregates, compression strength and steel content of the concrete become important factors in determining proper diamond blade selection.

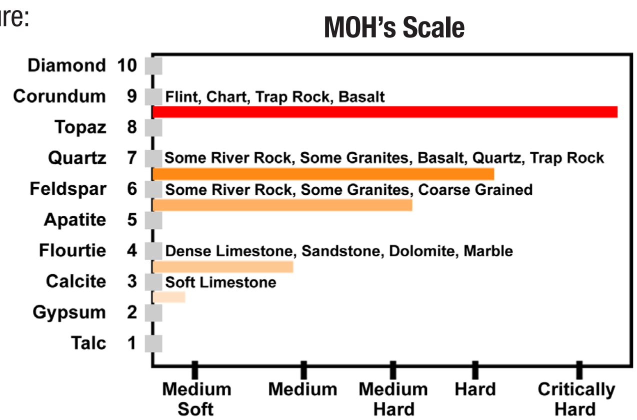
3. Aggregates and Sand
Aggregates are the granular fillers in cement that can occupy as much as 60 to 75% of the total volume. They influence the way both green and cured concrete perform. Aggregates can be naturally occurring minerals, sand and gravel, crushed stone or manufactured sand. The most desirable aggregates used in concrete are triangular or square in shape, and with hard, dense, well-graded and durable properties. The average size and composition of aggregates greatly influence the cutting characteristics and selection of the diamond blade. Large aggregates tend to cause blades to cut slower; smaller aggregates allow the blades to cut faster.

Difficulty	Average Aggregate Size
Harder to Cut (Blade wears slower)	1-1/2" or more 1-1/2" to 3/4" 3/4" to 3/8"
Easier to Cut (Blade wears faster)	Pea gravel (less than 3/8")

Aggregate hardness is referenced by the Mohs Scale. This scale assigns arbitrary quantitative units, ranging from 1 through 10, by which the scratch hardness of a mineral is determined. Each unit of hardness is represented by a mineral that can scratch any other mineral having a lower-ranking number. The minerals are ranked from talc or 1 (the softest), upward through diamond or 10 (the hardest). The harder the aggregate, the shorter the blade life and cutting speed is reduced. Hard aggregates shorten blade life and reduce cutting speed. Sand composition is another factor in determining the hardness characteristics of the cement and the abrasive properties of the mortar. Three types of sand are generally used in the mixture:

- River Sand (round nonabrasive)
- River Bank Sand (sharp abrasive)
- Manufactured Sand (sharp abrasive)

River Bank Sand and Manufactured Sand are more abrasive than River Sand. The more abrasive the sand is, the harder the bond-matrix requirements. Sharper, more geometrically defined sands also require harder bonds.



4. Steel Reinforcement
Further strengthening and structural integrity of concrete is accomplished by introducing concrete reinforcing steel bars (rebar), steel wire strand of wire meshing into the concrete. It costs more to cut concrete that contains reinforcing steel because cutting rates are slower and blade life is reduced. If the cross-sectional area of concrete is 1% steel, the blade life will be about 25% shorter than if no steel were present. Concrete with 3% steel can reduce blade life as much as 75%.

Metric Size (mm)	Diameter	Imperial Size	Diameter
10	9.5	#3	.375
13	12.7	#4	.500
16	15.9	#5	.625
19	19.1	#6	.750
22	22.2	#7	.875
25	25.4	#8	1.000
29	28.7	#9	1.128
32	32.3	#10	1.270

Heavy Rebar: #6 Rebar every 12" on center or 2 Mats of #4 Rebar every 12" on center
Medium Rebar: #4 Rebar every 12" on center
Light Rebar: Wire Mesh, single mat

CONCRETE AND ASPHALT APPLICATIONS

There are many costs involved in the sawing of the materials such as concrete and asphalt. Labor, fuel, the capitol expense of the saw itself, and of course the blade that performs the cutting. Each of these costs are significant in and of themselves, however, it appears that when sawing costs rise, the blade is given the blame.

This is an understandable reaction because inefficiency in any aspect of the sawing operation will manifest itself in poor performance out of the blade. Often times, poor performance from a blade is advance notice of other less obvious problems in equipment or technique that requires immediate attention. The following pages will contain an outline of the many factors that can affect the blades, blade section, sawing techniques and machine maintenance.

Maximizing efficiency = cost reduction

When cutting concrete and asphalt, reducing the cost per inch-foot of material cut is the main goal. Cost per inch-foot is the most accurate indicator of blade efficiency. This can also be determined by dividing the depth of the cut in inches, by the length of the cut in feet. You will then take a number and divide it into the cost of the blade.

Example: *If a blade costs $450 and cuts 4" deep for 1700 feet, the cost per inch-foot would be:*

4" x 1700' = 6800 inch-feet/$450 = 15.11 cents per inch-foot

To truly compare total cutting costs, there are formulas that will calculate capitol and labor costs per inch-foot. These costs are affected by blade efficiency. For more information on this, please call our office.

The concept of cost per inch-foot is not widely understood by a large portion of the market which uses diamond blades. Whenever you have a situation where a customer says he cut only 1500' with a cured concrete blade, make sure he understands that if he cut 3" deep, he actually attained excellent cutting efficiency by getting 4,500 inch-feet! Hours or even days of use is not a comparable basis for comparing blades. It is entirely possible to wear out a blade in less than a day and achieve excellent efficiency. Make your customer understand how all the variables can affect cutting costs. Show them how to correct problems and make better use of what they have, and their cutting costs per inch-foot will decline.

How Do Concrete/Asphalt Diamond Blades Work?

Diamond blades work in basically the same way that "Carborundum" type blades do; by abrasive action. Diamond blades will outlast and outperform abrasive type blades in many ways: they are safer to use, cut faster and last more than 100 times longer.

A diamond blade is a system of components integrated to achieve efficient cutting of concrete, asphalt and other building materials. The three basic components are:

1. Diamond bearing **SEGMENTS**
2. Silver solder, **BRAZING** or **LASER WELDING**
3. High grade steel **CORE**

The slot or gullet area of the blade serves more than one purpose. They permit better cooling during the sawing procedure. They allow for heat dissipation during welding or brazing process and allow for a certain degree of flex which otherwise could cause core fatigue and segment breakage.

FACTORS THAT EFFECT PERFORMANCE

The following factors effect the performance of a concrete cutting blade or bit and should be considered when making your selection.

COMPRESSIVE STRENGTH

Concrete may vary greatly in compressive strength which is measured in Pounds per Square Inch (PSI). Most concrete roads are approximately 4-5,000 PSI, while typical patios and sidewalks are about 3,000 PSI.

Concrete Hardness	PSI	Application
Critically Hard	8,000 +	Nuclear power plants
Hard	6-8,000	Bridge Piers
Medium	4-5,000	Highways
Soft	3,000 or less	Sidewalks & Patios

SIZE OF AGGREGATE

Larger aggregates tend to make a blade cut slower while smaller aggregates tend to allow a blade to cut faster. The most common aggregate sizes are:

Size	PSI
Pea Gravel	Usually less than 3/8" in diameter
3/4"	Sieved size
1-1/2"	Sieved size

TYPE OF SAND

Sand is the component of the mix which determines the abrasiveness of the concrete. Sand can either be sharp (abrasive) or round (non-abrasive). Crushed sand or bark sand are usually sharp; river sand is usually round.

HARDNESS OF AGGREGATE

There are many different types of rock used as aggregate. Generally hard aggregate breaks down the cutting diamonds faster which means the bond must be softer to expose new diamonds. Softer aggregate generally does not break down the cutting diamonds as quickly and therefore requires a harder bond to hold the diamonds in place to use their full potential. The Mohs' scale is used to measure the hardness of aggregate and has a range of 1-10. Most aggregates fall into the 2-9 range:

Mohs' Range	Description	Application
8-9	Critically Hard	Flint, Chert, Trap Rock, Basalt
6-7	Hard	River Rock, Granites, Quartz, Trap Rock
4-5	Medium/Hard	Granites, River Rock
3-4	Medium	Limestone, Sand Stone, Dolomite, Marble
2-3	Soft	Soft Limestone

REINFORCING STEEL

Steel reinforcing tends to make a blade cut slower. Less reinforcing allows the blade to cut faster. Heavy rebar can also result from different grades of steel. Typical rebar is grade 40 but grade 60 is also common. Rebar gauges are in eighths of an inch. #4 is 1/2" diameter, #5 is 5/8" diameter etc.

Size	PSI
Light	Wire mesh, single mat.
Medium	#4 rebar, every 12" on center each way (OCEW) Single mat, Wiremesh Multi-mat
Heavy	#5 rebar, 12" OCEW, single mat. #4 rebar, 12" OCEW, double mat.

GREEN OR CURED CONCRETE

The drying or curing of concrete greatly affects how the concrete will interact with a diamond blade. Green concrete is freshly poured concrete that has not yet cured. It is softer and more abrasive than cured concrete. A harder bond with undercut protection should be used in this application until it is cured at which point a softer bond would be appropriate. The definition of green concrete can vary widely. Water temperature, moisture in the aggregate, time of the year, and the amount of water in the mix all influence the curing time. It is generally considered "green" for 8 to 48 hour after it has set.

Variables		Change	Results	
			Cutting Speed	Blade Life
The Blade	Segment Bond Hardness	Harder	Slower	Longer
		Softer	Faster	Shorter
	Diamond Quality	Lower	Slower	Longer
		Higher	Faster	Shorter
	Diamond Concentration	Lower	Slower	Longer
		Higher	Faster	Shorter
	Segment Width	Thicker	Slower	Longer
		Thinner	Faster	Shorter
The Saw	Horsepower	Lower	Slower	Longer
		Higher	Faster	Shorter
	Blade Speed	Higher	Slower	Longer
		Lower	Faster	Shorter
The Job	Water Volume	Higher	Slower	Longer
		Lower	Faster	Shorter
	Cutting Depth	Deep	Slower	Longer
		Shallow	Faster	Shorter
	Cutting Pressure	Lower	Slower	Longer
		Higher	Faster	Shorter
The Material	Material Hardness	Harder	Slower	Longer
		Softer	Faster	Shorter
	Material Abrasiveness	Less	Slower	Longer
		More	Faster	Shorter
	Aggregate Size	Larger	Slower	Longer
		Smaller	Faster	Shorter
	Steel Reinforced	More	Slower	Longer
		Less	Faster	Shorter

MASONRY APPLICATIONS

There are several costs involved in the sawing of materials such as brick or block. Labor, the capitol expense of the saw itself, and of course the blades which preform the act of cutting. All of these costs are significant, but it always seems that when sawing costs get out of hand the blade is given the blame.

This is an understandable (though unfair) reaction because inefficiency in any aspect of the sawing operation will manifest itself in poor performance of the blade. Often times, poor results out of a blade are advanced notice of other less obvious problems in equipment or cutting technique that require immediate attention. In the following pages we will discuss the factors that can affect the blade and the sawing operation, blade section, sawing techniques and machine maintenance.

It is also important to note that buying the cheapest diamond blade available will in no way ensure economical cutting. Many times a more expensive blade specifically designed for the product being cut, or with a higher diamond content, will provide faster cutting (saving on expensive labor costs) and longer service life, yielding a lower net cost per cut.

Wet Cutting Blades for Masonry Saws

MK Diamond manufactures three different types of blades for use on masonry saws.

For 14" saws, if your prospect has a 1.5 HP saw, sell him the Standard or the Premium grade diamond blade. The Premium has a higher diamond concentration, and will cut faster and last longer. If he has a 2 or 3 HP saw, the best blade for him to use is the Supreme. This blade has the highest diamond concentration of the three blades. A key to remember is that each diamond blade is a cutting tool requiring a certain amount of power to move it through the cut. The more power available, the more diamonds you can push through. If he has a 20" saw, it will be either a 3, 5, 7, 13 HP. Since a mason with a 20" saw is obviously a professional to whom production is important, always sell the higher grade blades, either Premium or Supreme. If he has a 7 HP saw, the Supreme is the best choice.

The first type is our "10" series for brick. This blade has a soft matrix and is effective on all types of brick, especially those in the harder range such as Pacific Clay Products "Padres". This blade will give faster and efficient cutting, and a long life. Since it has a soft matrix, using it on an abrasive material such as concrete block will accelerate wear to an unacceptable rate.

The next blade is the "30" series. This blade is referred to as a "combination" blade because it has a medium - hard matrix and is designed to cut brick and block. A trade off is made in that by gaining the ability to cut both types of material, you sacrifice some cutting speed and some blade life.

The "50" series is designed especially for cutting block, both precision and slump. The abrasive nature of the product requires a hard matrix that wears more slowly than the 10 or 30 series. This enables the blade to last longer. This blade will work well only on block and will cut any brick product but very slowly.

MK also makes "Refractory" blades that were designed for use in cutting bricks which are extremely hard. With the advent of materials such as Endicott pavers and some PCP bricks that are extremely hard,we received complaints that the MK-10 blades were just not working effectively. We designed a new line of Refractory blades, which work very well on these products. The line includes the 410R Supreme Grade blades for Hard Acid Brick with a hardness of 5,000 to 8,000 psi, the 440R Supreme Grade Blades for 70% High Alumina Brick, the 450R Supreme Grade Blades for 50% Super Duty Hard Brick and the 480R Supreme Grade Blades for Soft Abrasive Mulite, Silica and Brick.

In recommending a blade to your customers, make sure you determine:

- What type of saw they have
- What type of material they work with
- What blade they are currently using

If you are not sure what to recommend, call us at MK Diamond, and we will be glad to assist you.

MASONRY APPLICATIONS

Dry Cutting Blades

MK Diamond manufactures all types of laser welded dry cutting blades. The MK-404D are Supreme Grade High Speed Blades are manufactured in diameters of 4" to 20". The most popular is the 7". This general purpose blade should be sold to every contractor who has a power saw, which is about 99% of them. It is an economical alternative to the masonry saw/wet blade cutting system in that it cuts many types of material ranging from concrete, brick, block, plaster and stucco and will cut them fast. The potential for abuse on the MK-404D blades is greater than for any other type in our line. The key to long life out of these blades is to let the blade do the cutting and to let it cool periodically. To force the blade into the cut, or to make a sustained, long cut in cured concrete will over-heat the blade. This can create a potentially dangerous situation that could cause segments to come off or the core to fracture. Cutting on a radius is also a common cause for failure in this blade.

The MK-414D Standard Grade High Speed Blades for brick and block are available in diameters 4"-24" and were developed for cold weather climates where water in the tray may freeze. It is also popular in the sun-belt states for use on stone and some types of block. Some block may become discolored even when using clean water, and on colored block that contains a high level of calcium that is drawn out by hydration or capillary action. These blades work well on any material and have been extremely well accepted by contractors all across U.S.A. MK offers many other types of segmented diamond blades for all types of masonry.

Dry cutting Turbo Rim Blades are an excellent recommendation for fast, smooth cuts in masonry material. The newest MK Diamond blade in this line is the MK-TLX, a general purpose turbo rim with super high segments for long life. They cut concrete, brick, pavers, sandstone, roof tile and block.

The most common problem with dry-cutting blades is that of over-heating. You can tell if blade has become over-heated by a "blueing" which is evident on the core just under the segment. If a blade has reached this state, it should be returned to our plant for inspection. Excessive heat can cause the blade to lose tension, which causes wobbling. Do not replace blades that had blueing without approval from our Repair Center! Over-heating is caused by operator inexperience or neglect, not product failure. To avoid this, the contractor must not do prolonged cutting in hard material and allow the blade to cool periodically.

When A Blade Stops Cutting

If a customer complains that his blade is "worn-out" or "not cutting", but appears to have plenty of segment left, suggest this solution: *Have the contractor put the blade on his saw, and run some material such as a firebrick or concrete block repeatedly through the blade. Nine times out of ten, this will bring life back into the blade.*

Why does this happen? Diamond blades, especially continuous rim blades are subject to "closing up" because of the hardness of the material they are asked to cut. Diamond blades rely on a certain degree of abrasion to wear away, at a regular pace, the matrix that holds the diamonds in place. If the material is dense with little abrasiveness, the diamonds are wearing out faster than the matrix, so it becomes like trying to saw wood with a dull hand saw. Running a highly abrasive material like a concrete block, wears the matrix away fast, exposing new, sharp diamonds which will contribute to much faster cutting.

Machine Maintenance

A saw with a misaligned head, worn blade shaft bearings, worn blade flanges, worn belts or pulleys, or improperly tracking conveyor cart, will generally still cut material, but puts stresses on the blade that will result in cuts that are not square. This will also cause a short blade life or a blade that wears unevenly. These problems are not always apparent to the naked eye. If you have a problem with a blade that is not related to misapplication, take a look at your customers's saw. Check the main points listed above.

Service

The one factor that will guarantee your reputation as a reliable supplier of diamond blades is service. You can be sure that we at MK will do our part to support you, even when a problem arises. One Contractor commenting adversely about a product in the field can do severe damage to a carefully built reputation. You are the "Front Line" and we trust your good judgement in handling a returned product when you are presented with a problem. We can repair almost any blade that is damaged, and generally do so at no charge, and within a few days, regardless of fault. At least 90% of all returned blades have either been abused or used on an incorrect application.

TILE AND STONE APPLICATIONS

Tile and Stone materials are generally cut using a wet cutting continuous rim diamond blade. The hardness of the material determines the type of blade needed. The best smooth cut finish is usually achieved with continuous rim diamond blades and are used when cutting glazed, ceramic tiles and other easily chipped materials like porcelain.

Wet Cutting Blades

MK-215 Premium Grade Blade is a fast cutting for smooth finish cuts on tile and other stone materials. Excellent on dense floor materials.

MK-415 Supreme Grade, Super Hi-Rim Blade has been designed with a thicker core for high production jobs that require straight and fast cuts. The high rim provides longer life than standard tile blades of similar quality.

MK-225 Hot Dog thin-rim blade is designed for wet cutting of hard materials, especially porcelain, granite, and vitreous tile. The laser cut cooling slots and ultra-thin kerf allows it to cut with less drag and resistance than any other tile blade.

Granite and Marble blades include the MK-62G and MK-62M and are segmented blades especially engineered for cutting hard stone. They provide superior cutting speed and aggressive cuts.

Dry Cutting Blades

MK-404CR Supreme Grade Thin-rim Blades for dry cutting hard and vitreous ceramic tile. Designed to ensure chip-free cutting of tile and other hard materials with minimal heat build-up.

MKS-935D is a super fast dry cutting blade that is designed for cutting stone and other hard materials. It is engineered with a newly developed bond that guarantees improved life. The V-slant segments provide additional side clearance to prevent binding in the cut and protect the steel core during circular cutting.

Cutting

When using continuous blades, it is very important to apply light to medium pressure when feeding the material into the blade. Feed the material slowly into blade until it begins to cut at its own speed; never should the blade slow down from too much pressure. Excessive pressure can cause your blade to bend or dish.

A diamond blade may occasionally require dressing with a dressing stick made specifically for this purpose or an abrasive block. Dressing the blade causes the glazed diamonds to be cleaned and recover the diamond sharpness.

PRINCIPLES OF DIAMOND BLADES

Type of Material to Be Cut

The most common material walk behind saws encounter are asphalt and cured concrete. In some case you may need to cut green concrete, which is concrete that has set and hardened (less than 72 hours). It is very soft and abrasive when Green, but needs to be cut as soon as possible. Why cut green concrete? Cracking occurs as the concrete cures and water in the slab dissipates. Cracks come from the base of the slab and seek the weakest points in the surface. Cutting creates a "weakened plane" where the crack will seek the bottom of the cut. Most often there are no visible surface cracks. Never cut green concrete with a cured concrete blade for reasons previously discussed. Occasionally, asphalt over cured concrete must be cut. MK Diamond does have blades that are designed to do this, but never sell this as an all-purpose blade because it is not. If these blades are used in this manner, all you will have is an unhappy customer. The 600 Series blades are the best blades for cutting asphalt today and cured concrete tomorrow.

Concrete and asphalt vary in hardness and abrasiveness depending on where the aggregate or sand for the mix was quarried. Conditions that affect blade life are different in every part of the country. Some of the hardest conditions in the USA can be found in San Diego, CA. Therefore, a blade that yields excellent life in the areas of soft aggregate may not perform nearly as well in areas of harder aggregate. This is why "average life" predictions about blades are usually just guesswork. The only way to compare two blades fairly is to cut exactly the same type and amount of material at the same time, with the same machine and operator and under exactly identical conditions. Since this rarely happens, the best we can ever estimate once we know all the facts, is a ball-park figure.

Blade Specifications

The most frequent problem encountered is the user cutting the wrong material with the wrong blade. MK Diamond has different types of blades for walk behind saws. All of our blades are stamped with the appropriate series number and are color coded for easy identification. The groups are:

1. 500 or **Blue Series** for **Cured Concrete**
2. 600 or **Green Series** for **Green Concrete**
   600 or **Yellow Series** for **Asphalt over Concrete (Combination)**
3. 700 or **Black Series** for **Asphalt**

Within these parameter of blades, we offer several grades of blades to choose from. The low numbers in each series are the blades which cost less initially, and are designed for lower horsepower saws. Although the initial cost is low with these low series numbered blades, actual costs per inch-foot are higher than a better quality blade with higher initial cost. Sell your customers what they need to give them the greatest total efficiency. ***Beware of selling price only.***

Since blades look similar, it is quite possible to forget which blade is on the saw. This may result in an unfortunate situation:

Example: Cutting green concrete with a cured blade.

If this happens, it is not the fault of the blade or your company if the blade wears out prematurely. We recommend that you suggest to your blade users that it is a good idea to remove the diamond blade from their saw every night. This will also prevent damage when you are transporting the saw. It is also a good idea to remind your customers to mount a different blade if the material they are cutting has been changed. This will also give your customers an opportunity to inspect the blade for damage.

Remember: **Match the diamond blade to the type of material to be cut!**

PRINCIPLES OF DIAMOND BLADES

Undercutting

Undercutting occurs when loose abrasive particles that mix with water form a slurry that acts to grind away the core just under the segments. The outer edge of the core is worn down to a knife edge, reducing the contact area between the segment core. Undercutting will occur and quickly get to the point where the blade becomes useless when well over half of its segment life remains. Over and above the economic effect of undercutting, is the fact that using a severely undercut blade is dangerous to the saw operator and those around him due to the increased change of segment loss. Undercutting can be slowed by the addition of wear reducing segments or inserts, and the operator can take steps to eliminate it by following these steps:

- **Use plenty of water to thin the slurry**
- **Reduce the depth of the cut to reduce suspended cuttings**
- **Taking great care to not cut into the sub-base which can be very abrasive**

It is recommended to cut through half of the material instead of all the way through it. Dirt and sand can ruin a blade in very little time. Watch the water while it is flowing away from the saw. If the water is dirty, raise the blade, because you have cut into the sub-base.

Depth of the Cut

When making an especially deep cut, it is a lot more efficient to make several "step" cuts than one deep pass. This is because each diamond in contact with the material being cut takes a percentage of the available power to move through the cut. The more diamonds that are cutting at one time, the less power there is behind each diamond. If you reduce the contact area, there is more power behind each diamond and the cut is more economical in terms of blade wear and machine life. Cutting too deep is a common problem because the deeper you go, the less effective a fixed supply of water can be functioning to cool the blade and flush the cuttings out of the cut, which may result in undercutting.

Water

Water is very important to the cutting operation, therefore use it in generous amounts. Its function is to cool the core and the bonding agent and to flush the cuttings out of the cut. The only time to reduce the amount of water used in the cutting operation is when you desire to "open up" the blade and expose new diamonds. This is a trick used by experienced cutters and should be performed only by qualified operators using extreme care.

Operator Technique Variables

This is a very sensitive area to deal with because no one ever likes to be told that they are doing something wrong. This is, however, the right thing to do if in fact operator technique needs improving.

The most common problem as it relates to techniques is cutting speed. The operator must allow the blade to do the cutting. If you force it to cut, it causes the blade to "close up" or "glaze over". This prevents new diamonds from becoming exposed. When this occurs, segments may crack or shatter. The core can also fracture or split.

When cutting on a grade, the saw must begin the cut at the low point of the grade. Pointing the blade downhill into the cut has the same effect of increased intolerable pressure on the blade as forcing it through a flat cut.

Generally, the first reaction of the saw when it is being forced is for the blade to "walk" up the cut. If this occurs, **SLOW DOWN**! Putting a weight on the front of the saw helps to keep the blade in the cut.

PRINCIPLES OF DIAMOND BLADES

Saw Variables

There are a tremendous number of saws on the market with varying features of blade capacity, horsepower and overall quality. The only thing these saws have in common is that they can cut. When you find out what your customer uses, base your recommendations on all the information at your disposal. As a rule, higher horsepower machines can use a better grade of blade and will cut faster than a low horsepower saw. For example, the blade that works well cutting concrete on a 8 HP saw will not be efficient on a 35 HP saw. The bigger saw required a harder matrix of the same application. Diamond blades are designed to run at about 9500 SFPM (Surface Feet Per Minute). Therefore, the blade shaft speed must be matched to the blade diameter. The larger the blade, the lower the blade shaft speed.

Engine RPM is also crucial to getting maximum performance out of your diamond blades. Power curves are different for each machine. (Specific data for each of your saws may be obtained from the manufacturer or their dealers). Bear in mind, that HP available to the blade is usually 60% of the rated HP. It is a rule of thumb that one horsepower per inch of blade diameter is required for efficient sawing. It pays to keep your saw engine in peak condition.

Blade shaft and drive wheel alignments are crucial to efficient sawing. Having either one or both of these out of alignment will cause uneven side wear. Check these alignments often.

Inspect the blade flanges for wear. Cutting to full depth causes the flanges to contact the surface of the cut material. This can cause a decrease in their diameter. Since the contact points of the flanges are only about 1/2" wide at the outer edges, a reduction in their diameter will decrease the efficient transmission of power to the blade. If you ever replace a flange, replace the pair to ensure they are of exactly equal diameter. Failure to do so could cause uneven clamping pressure, leading to bowed blade.

BLADE PERFORMANCE

There are a great many parameters or variables with a direct affect on blade performance. They are: Material being cut, saw being used (horsepower), and the blade itself. These can best be described and understood in graph or chart form.

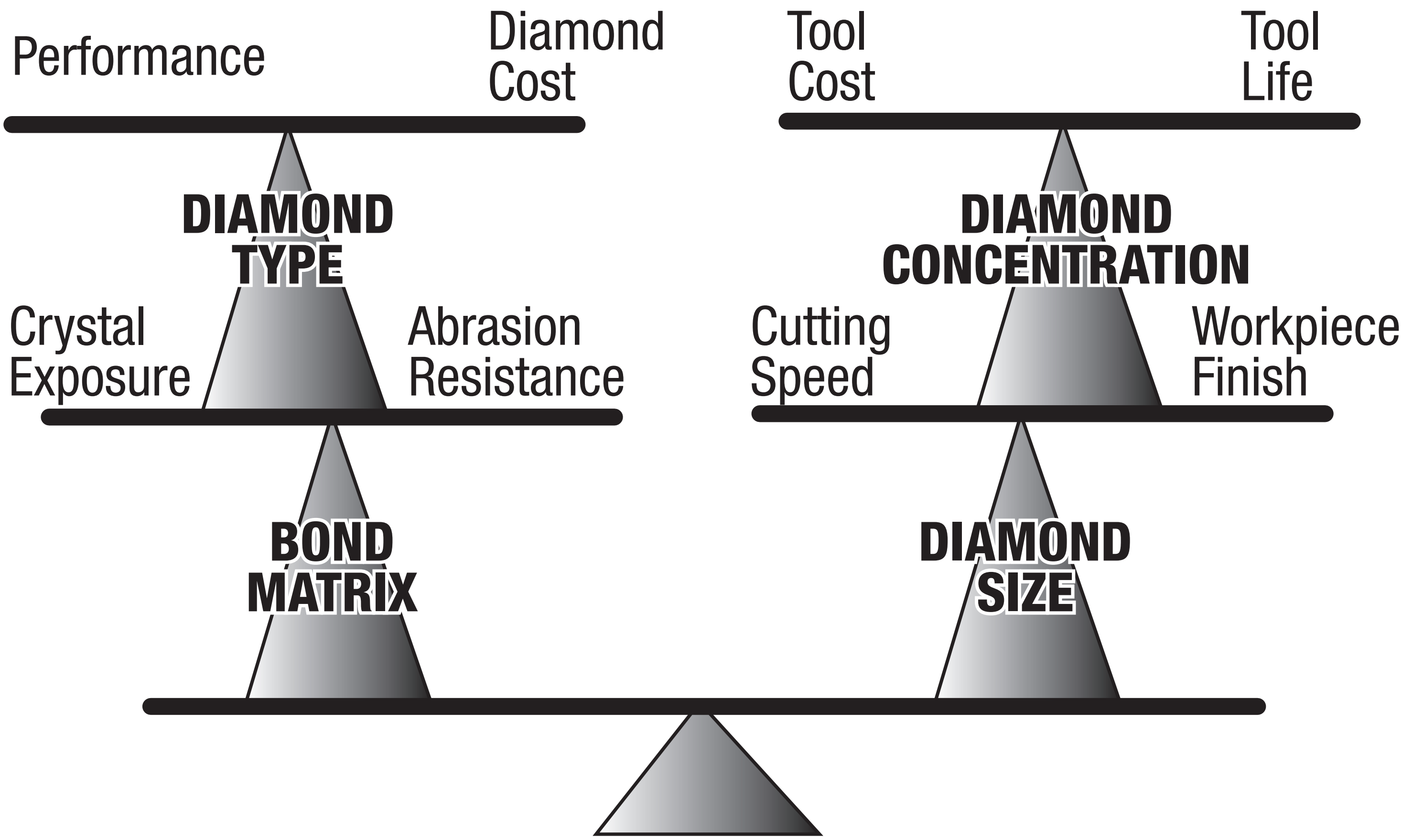
Parameter	Variation	Speed of Cut	Blade Life
Material hardness	Harder	Slower	Longer
	Softer	Faster	Shorter
Saw Horsepower	Lower	Slower	Longer
	Higher	Faster	Shorter
Bond hardness of blade	Harder	Slower	Longer
	Softer	Faster	Shorter
Diamond quality of blade segment	Lower	Slower	Shorter
	Higher	Faster	Longer
Segment diamond concentration	Lower	Faster	Shorter
	Higher	Slower	Longer

While there are many more variables which come into play, these are the most important and tend to simplify the learning process.

It should be mentioned in many instances people seem interested in a "general purpose" blade. "General purpose" is one of the most overused phrases in the construction/industrial marketplace. It should be understood that there is always a trade-off in cutting speed and blade life when using a given product as "general purpose".

All things being equal, on a hard material the cutting speed will be slower with longer blade life experienced. On the opposite side of the spectrum, on softer more abrasive materials the cutting speed will be faster with shorter blade life experienced.

THE BALANCE OF DIAMOND TOOL DESIGN



Balance in diamond blade design is very important when you look at the aspects of what it takes to build the right blade for the right application.

Any shift in one positive unit creates a negative in another area (Increase diamond concentration and it will result in longer life. But will increase the cost of the blade and lower the cutting speed). This adds up to higher prices and unhappy customers.

A QUESTION OF QUALITY

DO YOU WANT TO KNOW THE PRICE OR HOW MUCH IT WILL COST

WHICH BLADE DO I BUY?

12 x .125 x 20MM

Supreme Grade

$575 (is the price)

Approximate

Life in Inch Feet - 10,000

Cost Per Inch Foot

$= \frac{\$575}{10,000} =$ .0575¢ per ft.

Inch Feet To Be Cut

25,000

= .0575¢ (Cost per ft.) x 25,000

= $1437.50 Cost of Blade

12 x .125 x 20MM

Premium Grade

$425 (is the price)

Approximate

Life in Inch Feet - 6,500

Cost Per Inch Foot

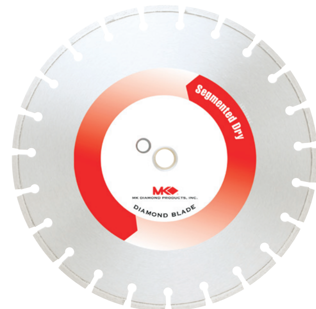
$= \frac{\$425}{6,500} =$ .0654¢ per ft.

Inch Feet To Be Cut

25,000

= .0654¢ (Cost per ft.) x 25,000

= $1635.00 Cost of Blade



12 x .125 x 20MM

Standard Grade

$325 (is the price)

Approximate

Life in Inch Feet - 4,5000

Cost Per Inch Foot

$= \frac{\$325}{4,500} =$ .0722¢ per ft.

Inch Feet To Be Cut

25,000

= .0722¢ (Cost per ft.) x 25,000

= $1805.00 Cost of Blade

THE BOTTOM LINE IS:

The higher the initial cost the lower the final cost!

CUTTING DEPTHS

Masonry Blades

Diameter		Cutting Depth	
10"	(254mm)	3-3/4"	(95mm)
12"	(305mm)	4"	(102mm)
14"	(356mm)	5"	(127mm)
18"	(457mm)	7"	(178mm)
20"	(508mm)	8"	(203mm)
24"	(610mm)	10"	(254mm)

Hand-Held High Speed Blades

Diameter		Cutting Depth	
4"	(102mm)	1"	(25mm)
5"	(127mm)	1-1/2"	(38mm)
6"	(152mm)	2"	(51mm)
7"	(178mm)	2-1/2"	(64mm)
8"	(203mm)	3"	(76mm)
10"	(254mm)	3-3/4"	(95mm)
12"	(305mm)	4"	(102mm)
14"	(356mm)	5"	(127mm)

Cured Concrete and Asphalt Blades

Diameter		Cutting Depth	
12"	(305mm)	4"	(102mm)
14"	(356mm)	5"	(127mm)
18"	(457mm)	7"	(178mm)
20"	(508mm)	8"	(203mm)
24"	(610mm)	10"	(254mm)
26"	(660mm)	10-5/8"	(270mm)
30"	(762mm)	11-5/8"	(295mm)
36"	(914mm)	14-3/4"	(375mm)
42"	(1067mm)	17-3/4"	(451mm)
48"	(1219mm)	20-3/4"	(527mm)

Green Concrete Blades

Diameter		Cutting Depth	
6"	(152mm)	2"	(51mm)
7"	(178mm)	2-1/2"	(64mm)
8"	(203mm)	3"	(76mm)
10"	(254mm)	3-3/4"	(95mm)

DIAMOND BLADE SPEEDS

DATA FOR 12" TO 36" DIAMETER SAW BLADES
(RPM VS SFPM)

SFPM	12' dia.	14' dia.	16' dia.	18' dia.	20' dia.	22' dia.	24' dia.	30' dia.	36' dia
	RPM	RPM	RPM	RPM	RPM	RPM	RPM	RPM	RPM
4000	1273	1091	955	849	764	694	641	509	424
4500	1432	1228	1071	955	859	781	716	573	477
5000	1592	1364	1194	1061	955	868	796	637	531
5500	1751	1501	1313	1167	1050	955	876	700	584
6000	1910	1637	1432	1273	1146	1042	955	764	637
6500	2069	1773	1552	1379	1241	1129	1035	828	690
7000	2228	1910	1671	1485	1337	1215	1114	891	743
7500	2387	2046	1790	1592	1432	1302	1194	955	796
8000	2546	2183	1910	1698	1528	1389	1273	1019	849
8500	2706	2319	2029	1804	1623	1476	1353	1082	902
9000	2865	2456	2149	1910	1719	1563	1432	1174	955
9500	3024	2592	2268	2016	1814	1649	1512	1210	1008
10,000	3183	2728	2387	2122	1910	1736	1592	1273	1061
10,500	3342	2865	2507	2228	2005	1823	1671	1337	114
11,000	3501	3001	2626	2334	2101	1910	1751	1401	1164
11,500	3661	3138	2745	2440	2196	1997	1830	1461	1220
12,000	3820	3274	2865	2546	2292	2083	1910	1582	1273
12,500	3979	3410	2984	2653	2387	2170	1989	1592	1326
13,000	4138	3547	3104	2759	2483	2257	2069	1655	1379
13,500	4297	3683	3223	2865	2578	2344	2149	1719	1432
14,000	4456	3820	3342	2971	2674	2431	2228	1783	1485
14,500	4615	3956	3462	3077	2769	2518	2308	1846	1538
15,000	4775	4093	3581	3183	2865	2604	2604	1910	1592

Diamond blades are tensioned to run between 9,000 and 13,000 surface feet per minute (SFPM). Nominal tensioning in a blade is for 9500 SFPM. However, blade speed should be increased for soft abrasive materials, and should be decreased for dense materials.

Caution... Reduced performance is frequently incurred when blades are run outside of these limits. The above table shows the optimum blade speeds (RPM) for different blade diameters and peripheral speeds (SFPM).

DIAMOND BLADE SPEED GUIDELINES

Diameter		Recommended RPM*	Never Exceed RPM
4"	(102mm)	9,000	15,200
4-1/2"	(114mm)	8,000	13,500
5"	(127mm)	7,200	12,200
5-1/2"	(140mm)	6,500	11,090
6"	(152mm)	6,000	10,185
7"	(178mm)	5,100	8,730
8"	(203mm)	4,500	7,640
9"	(229mm)	4,000	6,700
10"	(254mm)	3,600	6,115
12"	(305mm)	3,000	5,095
12" (High Speed Blades)			6,300
14"	(356mm)	2,500	4,365
14" (High Speed Blades)			5,460
16"	(406mm)	2,200	3,800
18"	(457mm)	2,000	3,300
20"	(508mm)	1,800	3,000
22"	(559mm)	1,600	2,780
24"	(610mm)	1,500	2,550
26"	(660mm)	1,300	2,350
28"	(711mm)	1,200	2,185
30"	(762mm)	1,200	2,040
32"	(813mm)	1,100	1,910
36"	(914mm)	1,000	1,700
42"	(1067mm)	800	1,455
48"	(1219mm)	700	1,275

* Recommended RPM based on 9,500 SFPM

CONSULTATION CAL OSHA SERVICE

Silica Hazard Alert

Exposures to respirable crystalline silica dust during construction activities can cause serious respiratory disease. Each year more than 300 U.S. workers die from silicosis and thousands more are diagnosed with the lung disease. It is frequently misdiagnosed, so actual numbers may be higher.

The Source:

Silica is a natural mineral that comes in several forms, some more hazardous than others. Typically, it's the crystalline forms that are of greatest concern.

Silica can be present in large quantities in certain types of rocks and sand. Construction materials made from these natural ingredients then become the source of exposure associated with several of the construction trades, such as tile roofs, masonry and concrete finishing or re-finishing.

The Types of Operations:

The following are some examples of work-operations where the Cal/OSHA 8-hour average PEL of 0.1 mg/m3 for crystalline silica can be exceeded. There may very well be other operations you do, not listed here, that can also produce excessive exposure levels, such as dry grinding on granite counter tops.

- ☐ Tuck point grinding
- ☐ Surface grinder
- ☐ Rock drill
- ☐ Broom or shovel
- ☐ Jackhammer / chipping gun
- ☐ Hand-held masonry saw
- ☐ Road mill
- ☐ Backhoe, excavator, bulldozer
- ☐ Walk-behind concrete saw
- ☐ Mixing concrete, grout, etc
- ☐ Bobcat

Where to go for more info on the types of exposures you might expect, along with some control measures:

* *http://depts.washington.edu/silica/index.html*

* *http://www.cdc.gov/niosh/topics/construction/*

The Hazard:

Breathing too much dust containing the crystalline forms of silica particles small enough to enter the deep parts of the lung can cause "silicosis", which is a scarring of the lung tissues, cancer and other forms of lung disease, including an increased risk of getting tuberculosis. It usually takes several years before you know that you have a problem. Higher exposures can produce health problems much sooner. At first, there can be no symptoms of disease, and then shortness of breath, fatigue, severe cough and chest pain can develop later on. Short of a lung transplant, silicosis can not be reversed, so best to minimize exposures now to prevent disability later in life.

Best Ways For Employees To Protect Themselves:

Knowledge, equipment and work practices:

- Ask your employer if your work can produce excessive silica dust exposure, and what control measures are to be used.
- Where possible, work with products that don't contain silica.
    - ◊ For example, there are a variety of materials such as glass beads, pumice, sawdust, steel grit, shot, and walnut shells that are available as substitutes for sandblasting operations.
- Understand the hazards and take the appropriate preventative measures.
- Minimize dust getting into the air you breath:
    - ◊ Use equipment designed to cut, saw and grind wet or use ventilation that captures the dust as it is created.
        - * Proper use and preventive maintenance is critical.

For more information call 1-800-963-9424 or go to www.dir.ca.gov/dosh 08-019V3

Silica Hazard Alert

- ◊ Don't smoke tobacco products.
- ◊ Never use compressed air to clean dust off equipment, surfaces or your clothes. Where safely feasible, use water or a HEPA vacuum. Consider using disposable or re-usable clothing that stays at the work site.

- ◊ Minimize dust generation when working with or around silica-containing materials.
- ◊ Handle and dispose of waste materials without generating airborne dust.
  - * Use a HEPA vacuum, squeegee instead of broom, or sweeping compound, in that order

You may still have excessive exposure despite using controls, which means you may still need to use an appropriate respirator, along with a good respirator protection program. Establish defined areas beyond which protection is required. [Reference T8CCR, Section 5144 for details on respirator requirements]

Training Requirements Checklist for Employees Exposed to Dust Generated from Concrete and Masonry Materials.

Who?

- All employees and their supervision required to work with or around powered tools and equipment used to cut, grind, core, or drill concrete or masonry materials.
  - ◊ Supervisors are required to go through additional training.

When?

- Before their initial assignment in which these operations will be conducted, and
- Repeated at least annually.

What?

- Potential health effects, including silicosis, lung cancer, chronic obstructive lung disease and loss of lung function. Refer to the MSDS and the NIOSH Website.
- Methods to be used to control airborne dust exposures, such as wet-cutting, local exhaust systems, and isolation of the process.
  - ◊ These procedures will likely be new to the company, therefore ensure that the company's Code of Safe Practice(s) are updated to reflect the new operations.
- Proper use and maintenance of dust control equipment, including safe handling of collected waste.
- Good personal hygiene and housekeeping, including,
  - ◊ Not smoking tobacco products
  - ◊ Avoiding activities that can contribute to generation of airborne dust
  - ◊ Cleaning up without generating airborne dust.
- <u>For supervisors, also include</u>:
  - ◊ Identification of tasks that may result in employee exposures.
  - ◊ Implementation procedures for the control methods employees are to use.
    - * Outlining the pre-operational steps the supervisors need to go through to identify hazards is critical to preventing exposures to begin with. If the hazard can be eliminated through some sort of control, the likelihood an employee is overexposed to airborne silica dust is greatly diminished.

NOTE: Reference T8CCR Section 1530.1 for details, along with other applicable Cal/OSHA standards. 1530.1 is applicable to most concrete and masonry activities; there can be a number of other sources of silica at a construction site that can be a significant health hazard.

DIAMOND BLADE DO'S AND DON'T

- Blades should be generally run between 9,000 to 13,000 surface feet per minute. This means that larger blades should be run at a lower RPM than smaller blades. If a blade is not cutting, run it at a reduced RPM; this should open the blade up, expose the diamonds. If the blade is wearing too rapidly, increase the RPM. Remember always to consult the Manufacturer for the proper RPM.

- A good water flow equally on both sides of the blade (2-4 gallons/min) is best for wet cutting blades.

- When a blade is snugged up evenly to the flanges it will run straight and provide maximum efficiency. Blades that run lopsided and show signs of heat buildup become egg shaped, and are the result of bad seating by the flange.

- Certain specifications have been developed to provide the best cutting for each application. Making sure that the blade is suited for your cutting job will result in faster, easier cutting and better blade life.

- The more horsepower (torque-not pressure on the blade) supplied to the spindle, the more efficient the cutting action will be. Lower horsepower may require a softer blade bond or less diamond concentration.

- Check your equipment. Bad bearings or worn shafts are the cause for blade run out which causes excessive stress and wear. Maintaining your equipment will give diamond blades longer life and better cutting performance.

- Excessive pressure on the blade will dull the diamond, create stress in the steel core, and cause the blade to become out of round. To much pressure on lightweight saws will cause the blade to ride up out of the cut. Listen to sound of the engine and the smooth cutting sound of the blade to determine the best operating conditions for the blade.

- Always put the blade on the spindle so that the blade is always running in the same direction. Look for the arrow.

- If you have to cut through sub base of either asphalt or concrete, water loss can result and the abrasive sand will put extreme wear on both the steel core and the diamond segment.

- Each blade is tensioned to run true at a specific RPM. Blades that run at a higher or lower speed than they are tensioned for will wobble or flutter, creating excessive side wear or core cracking.

- The cuttings, if not properly flushed from the cut, will abrade both the diamond matrix and/or the steel core. Be sure to maintain sufficient water flow to the cut.

- The loss of tension in a blade is only evident when the blade does not run true (wobbles) and the cut widens. Most blades can be retensioned.

DIAMOND BLADE TROUBLESHOOTING

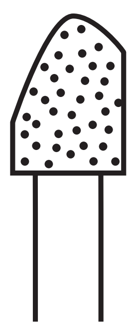
Here are some suggested solutions to the problems we are most commonly approached about.

Blade Worn Out of Round

Cause	Shaft bearings are worn (masonry and concrete).
Remedy	Install new blade shaft bearings or blade shaft, as required.
Cause	Engine is not properly turned on concrete saws, causing surges in blade rotation.
Remedy	tune engine according to manufacturers' Manual.
Cause	Blade arbor hole is damaged from previous mismounting.
Remedy	Replace worn shaft or mounting arbor bushing. Bond is too hard for material, causing a "rounding" and wearing one half of the blade more than the other. Make certain that drive pin is functioning. Use proper blade specification.

Blade Will Not Cut

Cause	Blade is too hard for material being cut.
Remedy	Use a softer bonded blade. Select proper blade specification for material being cut.
Cause	Blade has become dull as a result of being used on too hard a material.
Remedy	Improper blade specification; blade is too hard for the material being cut. Use a softer bonded blade to reduce operating stresses.
Cause	"Dull" Blade
Remedy	"Open" blade by dressing segment on abrasive block.



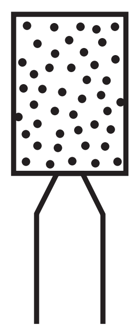
Uneven Segment Wear

Cause	Insufficient water (usually on one side of blade).
Remedy	Flush out water system and check flow and distribution to both sides of blade.
Cause	Equipment defects cause the segments to wear unevenly.
Remedy	Replace bad bearings, worn arbor shaft, or align spindle. With concrete saws, engine must run smoothly to prevent harmonic vibration.
Cause	Saw is misaligned.
Remedy	Check saw head alignment for squareness both vertically and horizontally.

DIAMOND BLADE TROUBLESHOOTING

Arbor Hole Out-of-Round

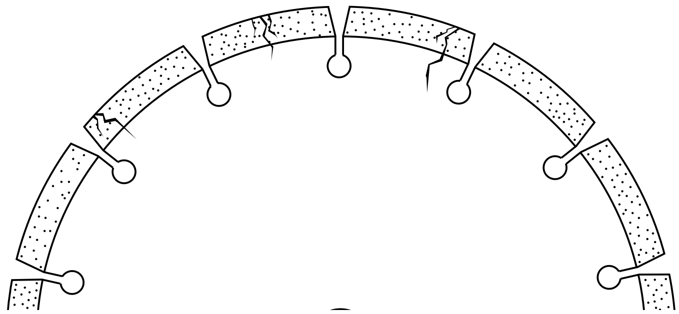
Cause	Blade collar is not properly tightened, permitting blade rotation or vibration on the shaft.
Remedy	Tighten the shaft nut with a wrench to make certain that the blade is adequately secured.
Cause	Blade collars are worn or dirty, not allowing proper blade clamping.
Remedy	Clean blade collars, making sure they are not worn.
Cause	Blade is not properly mounted.
Remedy	Make certain the blade is mounted on the proper shaft diameter before tightening shaft nut. Ensure the pin hole slides over dive pin. Make sure that drive pin is in pin hole.
Cause	Loose belt on saw.
Remedy	Tighten belts. Check to see if arbor on saw is running true.



Undercutting the Steel Center

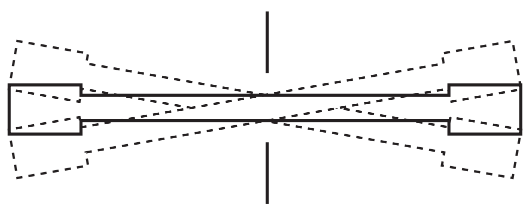
Cause	Abrasion of steel center due to highly abrasive fines generated during cutting.
Remedy	Use as much water as possible to flush out fines generated during cutting, or use wear-retardant cores.
Cause	Cutting through material into sub-base.
Remedy	Wear-retardant cores are not always the ultimate solution to eliminating undercutting. Your best defense is to always provide an adequate water flow to the steel center area immediately adjacent to the segment. This is especially important when making deep cuts.

DIAMOND BLADE TROUBLESHOOTING



Segment Cracks

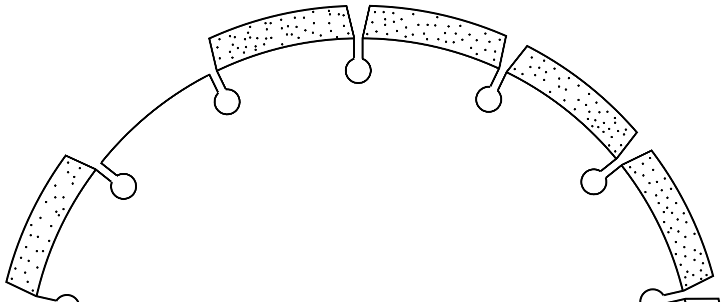
Cause	Blade is too hard for material being cut.
Remedy	Use a blade with a softer bond.
Cause	Blade being"forced" through the cut, causing chattering.
Remedy	Run saw at normal speed. "Open" blade by resharpening in abrasive material.



Blade Wobbles

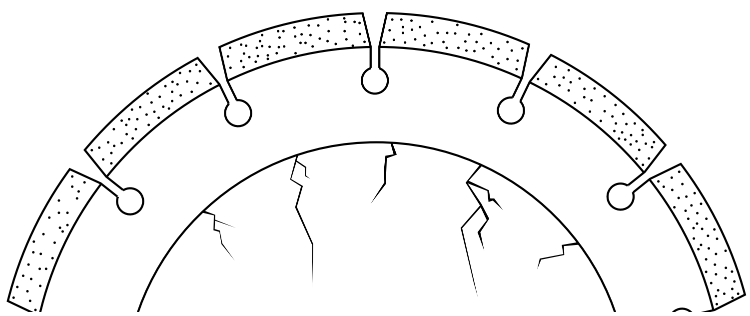
Cause	Blade runs at improper speed.
Remedy	Check for bad bearings, bent shaft, or worn mounting arbor. Speed of the saw is either too fast or too slow for the size of the blade. RPM of the should be verified to the specific speeds established by the NASI Standards for minimum and maximum blade speeds; make certain that blade shaft is running at recommended RPM to match tensioned speed of blade. Should the blade continue to wobble after verification of the saw RPM, then the blade should be returned to the manufacturer to be retensioned and flattened.
Cause	Blade collar diameters are not identical.
Remedy	Check blade collar discs to make sure they are clean, flat and of correct diameter.
Cause	Blade is bent as a result of dropping or being twisted in the cut during operation.
Remedy	Balde should be returned to the manufacturer to be retensioned and flattened.
Cause	Loss of blade tension.
Remedy	See Loss of Tension page 40.

DIAMOND BLADE TROUBLESHOOTING



Segment Loss

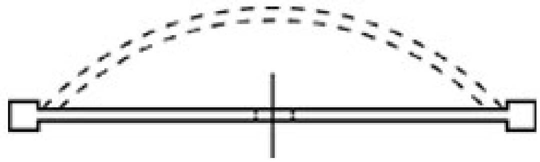
Cause	Overheating due to lack of water.
Remedy	Check water feed lines and make sure flow is adequate on both sides of blades.
Cause	Steel center is worn from undercutting.
Remedy	Use sufficient water to flush out the cut.
Cause	Defective blade collars are causing blade misalignment.
Remedy	Clean blade collars or replace if collars are under recommended diameter.
Cause	Blade is too hard for material being cut.
Remedy	Use proper blade specification for material being cut.
Cause	Blade is cutting out of round, causing a pounding motion.
Remedy	Replace worn bearings: realign blade shaft or replace worn blade mounting arbor.
Cause	improper blade tension.
Remedy	ensure blade is running at correct RPM. Blade is tensioned for correct RPM. Tune engine according to manufacturer's manual.



Cracks in Steel Center

Cause	Blade flutters in cut as a result of blade losing tension.
Remedy	Tighten the blade shaft nut. Make sure blade is running at proper tensioned speed and that drive pin is functioning properly.
Cause	Blade specification is too hard for the material being cut.
Remedy	Use a softer blade bond to eliminate stresses that create cracks.
Cause	Bad blade shaft bearing.
Remedy	Replace blade shaft bearing.
Cause	Overheating due to lack of water.
Remedy	Check water feed lines and make sure flow is adequate on both sides of blade.

DIAMOND BLADE TROUBLESHOOTING



Loss of Tension

Cause	Steel center has been overheating as a result of blade spinning on arbor.
Remedy	Check water flow, distribution and lines. Tighten the blade shaft nut. Make certain the dirve pin is functioning (on concrete saws).
Cause	Steel center has been overheating from rubbing the side of material being cut.
Remedy	Make certain blade RPM is correct so the blade operates at its tensioned speed. Tune engine according to manufacturer's manual.
Cause	Unequal pressure at blade clamping collars.
Remedy	Blade clamping collars must be identical in diameter and the recommended size.

Short Blade Life

Cause	Blade bond or matrix too soft.
Remedy	Use a harder matrix blade.
Cause	Overheating due to lack of water.
Remedy	Check water feed lines and make sure flow is adequate on both sides of blade.