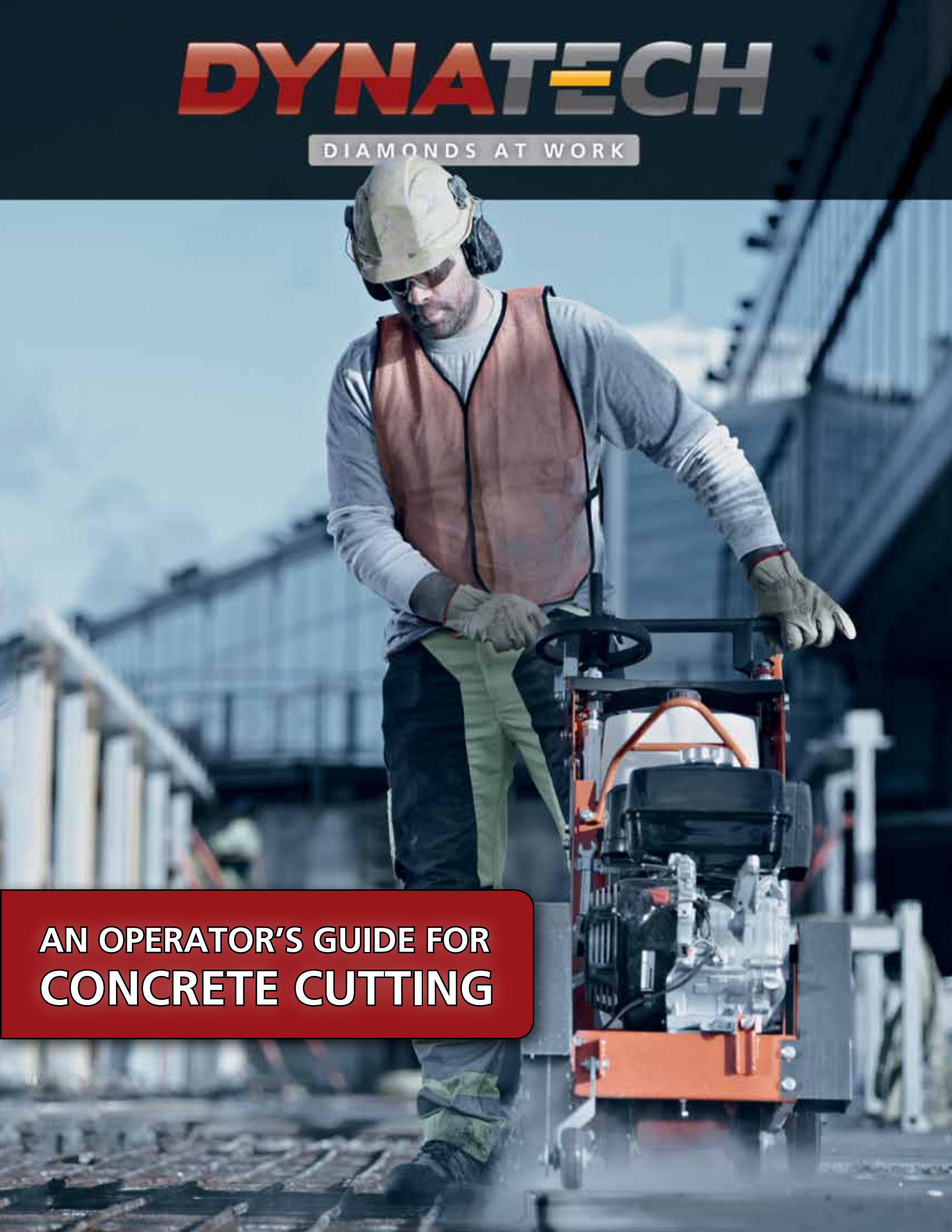
DYNATECH

DIAMONDS AT WORK



AN OPERATOR'S GUIDE FOR CONCRETE CUTTING

The purpose of this publication is to let you know how important you are to this company, what is expected of you and to give you basic information on the tasks you may be performing .

The major difference between the successful professional cutter and the one destined to go out of business is the skill and abilities of its' field operators- You. You are the most important part of this business and as an operator you affect two thirds of the costs of running it. Mistakes made in cutting operations, accidents and attitude can put profit on the bottom line or the company out of business.

We know that you want to learn, improve and make yourself more valuable to the company, your family and yourself. To be a better cutter you should know the traits of a good field operator. Think about these traits, how you compare, and how you can improve on those which you are weak.

For more information on sawing and drilling
check out our "How To" videos available free
on our website: dynatech-diamond.com

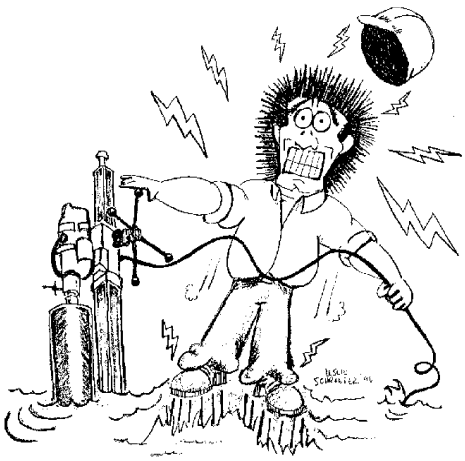
DYNATECH

DIAMONDS AT WORK

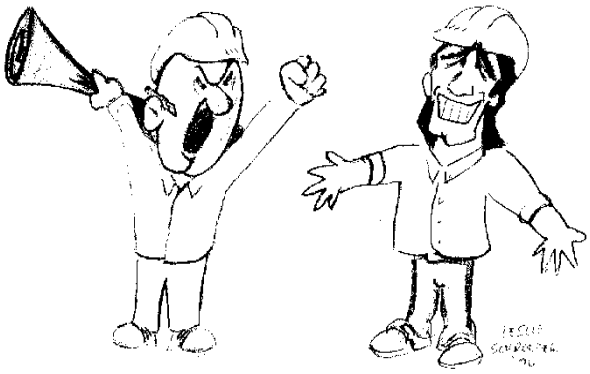
CONTENTS:

THE TRAITS OF A GOOD OPERATOR

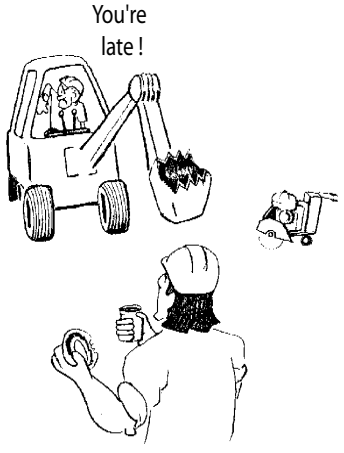
1. GOOD COMMUNICATOR - is able to quickly and clearly have the customer understand what he can and cannot do. A good communicator must be able to describe situations and problems found in the field to an office supervisor or to others at the office.



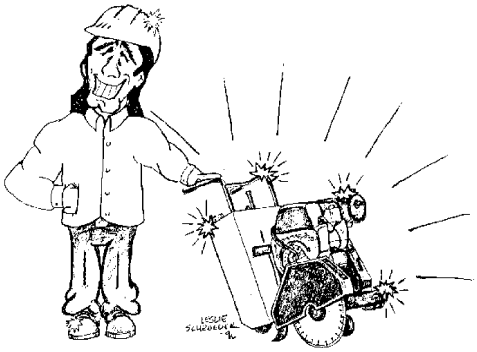
2. HIGH DEGREE OF COMMON SENSE - This is the ability to know what to do and most importantly what not to do in a situation. A good example of common sense is not to run an electric core rig while standing in 10 inches of water.



3. POSITIVE ATTITUDE - Maintaining a "Can Do" positive attitude is not only a reflection of the operators ability to get the job done but tells the customer that it will be done right. A positive attitude means keeping your problems, be they personal or business, to yourself. It is the foundation of being a true professional.

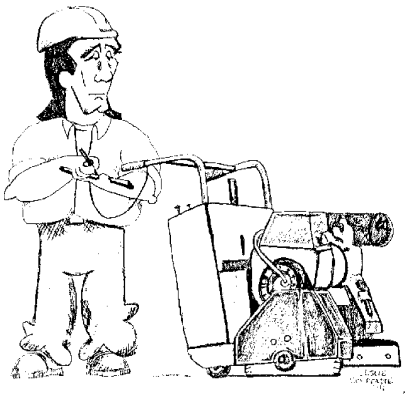


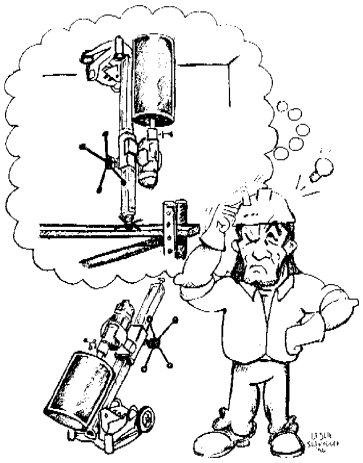
4. DISCIPLINED - Being on time, sticking to the schedule and doing what has to be done to complete the job requires discipline. Discipline and a positive attitude go hand in hand.



5. NEAT - You are not just a cutter. You are a representative of your company. If you have holes in your pants, a dirty shirt, are operating dirty equipment or leave a dirty job site after cutting, it tells the customer that this is the way your company runs it's business. We all know that this is not true !

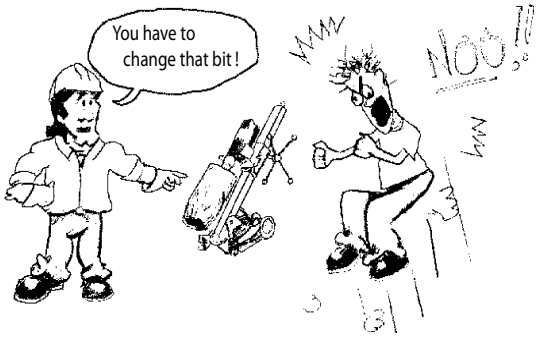
6. DETAIL ORIENTED - Keeping accurate records of the footage cut and the time on the job is as important as your paycheck. Guessing at what you have done can mean a loss of profit, the overcharging of the customer and eventually the loss of your job. Being detail oriented applies to all record keeping - footage cut , holes drilled, time on the job, maintenance of equipment and what spec diamond tool was used on the job.





7. ABILITY to ADAPT, IMPROVISE AND OVERCOME - is the mark of a true professional. It means that you are still able to do the job even though it is not what you thought it was supposed to be. It means finding a way to drill that 24" hole vertically when you thought it was on the deck. It means fixing the equipment and getting the job done rather than quitting and going back to the shop.

8. STEADY PERSONALITY - This does not mean that you are always the good guy but that you are not subject to temper tantrums and wild swings in moods and personality. It means that you can be counted on to get the job done under almost any circumstances without losing your cool.

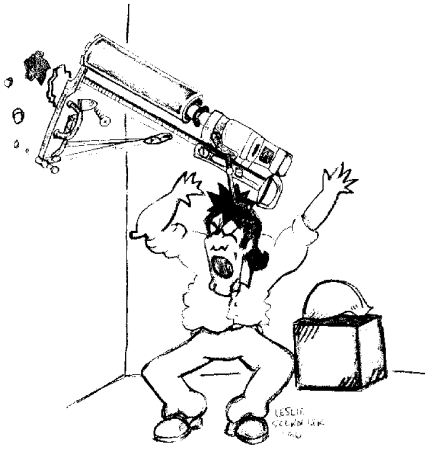


9. DESIRE TO LEARN AND IMPROVE - The more your learn, the more valuable you are to the company, to your family and to yourself. With each new acquired skill comes a higher degree of professionalism which will almost always find it's way into your paycheck.

10. UNDERSTANDS THE NEED FOR PROFIT - This is the most important trait. As an operator, you are delivering a service for a profit. Without profit there would be no company. Profit is what allows your company to buy more equipment and to pay you on a regular basis even though business may be slow. Profit allows your company to advertise it's services, to experiment with new equipment and techniques and to grow it's business. Profit is the reason you are working. You as an operator have a great effect on it.

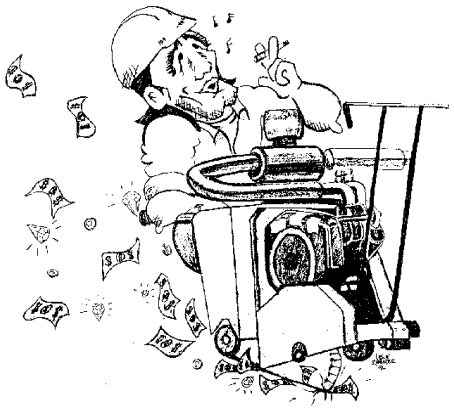
HOW DO YOU EFFECT PROFIT ?

Unless you are a socialist, profit is not a dirty word. Profit is the reason you are here and profit is directly controlled by costs. You effect two thirds of the costs of running this company. Here are four areas where you can have a positive or negative effect on costs:

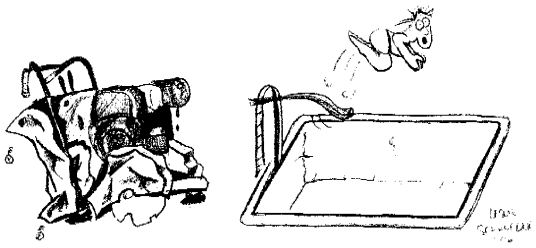


SAFETY - We can never over emphasize the need for safety, not because accidents and injuries cut profits and raise costs, but because they effect our most valuable asset - You. Hard hats, steel toed shoes, eye protection and back braces only work if they are used.

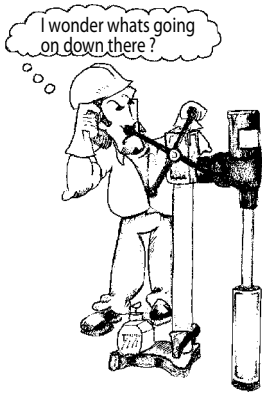
TIME - 1/3 of all costs are for your time. Taking too long or goofing off on the job cuts profit and irritates the customer.



TOOLS - Diamond bits and blades can be very expensive. Using a bit or blade with the wrong specification wastes money. Abusing a bit or blade such as hitting it with a hammer to remove it will not be tolerated. Remember a 1% decrease in diamond cutting tool costs can put 10% profit on the bottom line jst as a 1% increase can take off 10% and jeopardize your job.



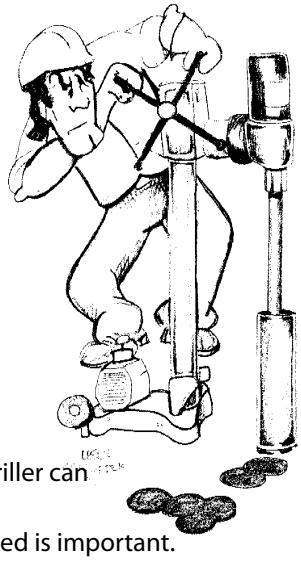
EQUIPMENT- Not repairing or failing to bring needed repairs to attention wastes both time and money. Using equipment that is not up to snuff is like diving into a swimming pool without knowing if there is any water in it.



EDUCATION - You are by nature equipment oriented, NOT process oriented. This means that you know how to operate the machinery but not what the diamond cutting tool is doing. Understandingthe process increases your performance and makes you more valuable.

CORE DRILLING

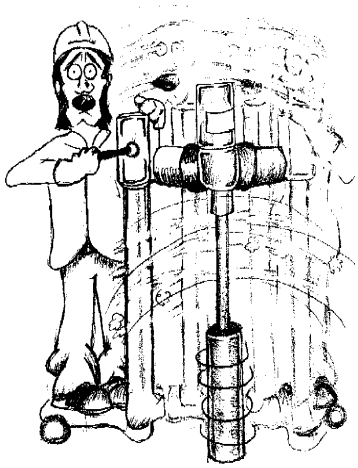
As there are more variables in core drilling than in any other type of cutting, being competent in core drilling is the foundation of a good cutter.



Factors that affect bit performance and company profit:

Speed (RPM) -If the speed is too high the bit will polish. If the speed is too low the job will take too long.

Power is necessary to maintain the proper cutting speed. Efficient cutting means keeping the bit at the right speed.



Water - Not too little and not too much-The right amount removes slurry and keeps the cut clean.

Aggregate - You can't see it until you're done, but a good driller can feel the right speed and pressure to cut varying types.

Steel - slows the cutting process. Maintaining drill motor speed is important. DON'T PUSH THE BIT TOO HARD !- MAINTAIN SPEED !

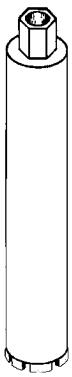
Bond Specs - Too hard and it takes too long. Too soft and it costs too much.

Proper Alignment - is necessary for good bit life. This means the rig must be properly anchored. A rig can be anchored with concrete anchors, vacuum or a post jack.

STANDING ON THE RIG IS DANGEROUS AND NOT ACCEPTABLE !

Core Rig Maintenance -performance, speed and bit life will mean little if your rig has bad shims, bearings and hold down devices.

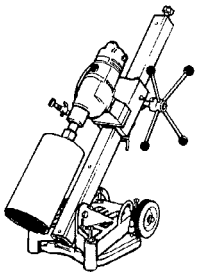
RECOMMENDED HORSE POWER BY BIT DIAMETER



Bit Diameter	Min. AMPS	Min. HP	GPM
1"-4"	13	1-2	-
5"	15	2	-
6"	15	2	-
7"	15	2-3	-
8"	15	2-3	-
10"	18	2-3	-
12"	18	3	-
14"	20	3	-
16"	*		-
18"	*		8-10 @ 1500 PSI
20"	*		8-10 @ 1500 PSI
24"	-		8-10 @ 1500 PSI
26"	-		8-10 @ 1500 PSI
30"	-		12-15 @ 2000 PSI
32"	-		12-15 @ 2000 PSI
34"	-		12-15 @ 2000 PSI
36"	-		15-20 @ 2500 PSI
40"	-		15-20 @ 2500 PSI
42"	-		15-20 @ 2500 PSI

* Not recommended for 120 Volt Use 220V 0r Hi-Cycle machine

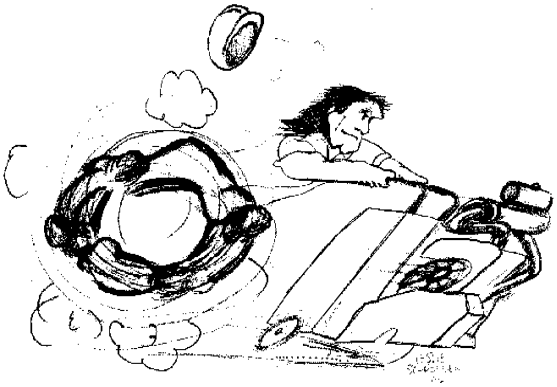
RECOMMENDED CORE DRILLING SPEEDS



Bit Diameter	Minimum RPM	IDEAL RPM	Maximum RPM
1"	2400	3200	4000
2"	1200	1600	2000
3"	800	1050	1300
4"	600	800	1000
5"	475	640	800
6"	400	530	665
7"	340	450	600
8"	300	400	500
10"	240	320	400
12"	200	265	330
14"	170	225	285
16"	150	200	250
18"	130	175	220
20"	120	160	200
24"	100	130	165
26"	90	125	150
30"	80	105	130
32"	75	100	125
34"	70	95	120
36"	65	85	110
40"	60	80	100
42"	55	75	95

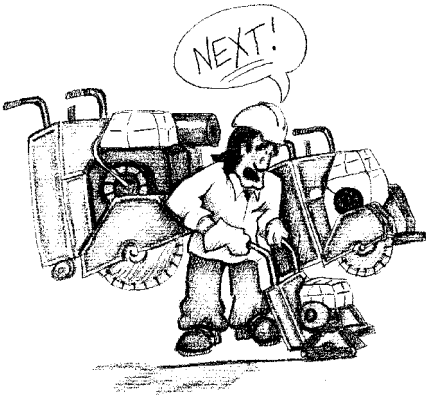
FLAT SAWING

Successful flat sawing is a combination of blade selection, blade speed and common sense.



Pay Attention ! -The saw does not follow the cut itself- you have to guide it ! - Stay with the controls.

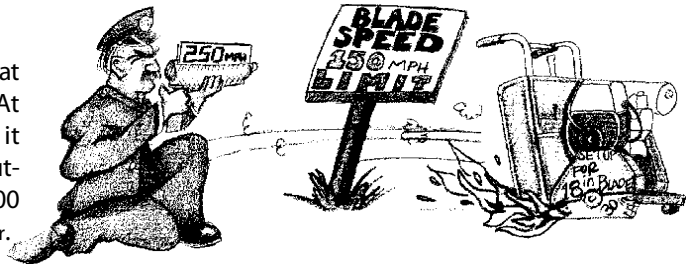
Water -is the blade's life and death. Don't be sparing with it . When road sawing keep the hose out of the traffic lane. Never gravity feed the water to the cut.



Always step cut - Make a 1" cut as your guide cut- Never cut full depth on the first pass.

Blade Speed -Always match the RPM of the saw to the diameter of the blade . Running a bladeat higher than recommended speed is dangerous. At worst the blade could fly apart and at best it reduces cutting effi- ciency.The maximum cut- ting efficiency of a blade is at approximately 12,000 SFPM (surface feet per minuite) or 150 Miles Per Hour.

PRODUCTIVITY IS NEVER INCREASED BY INCREASING BLADE SPEED !



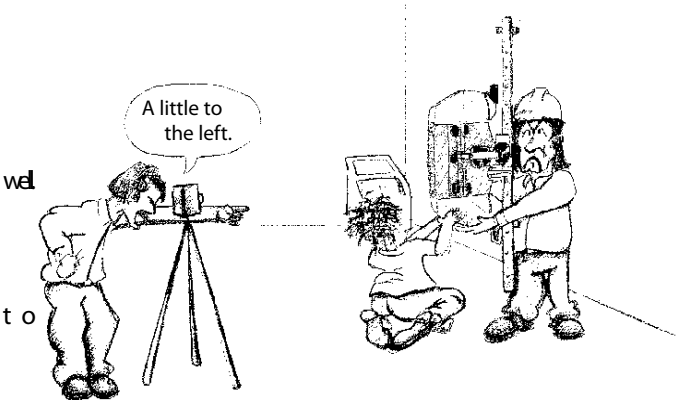
Listen to the engine- You'll be able to tell when a blade is bouncing, the belts are slapping (loose) and when the blade is lifting itself out of the cut.

RECOMMENDED BLADE RPM & MAXIMUM DEPTH OF CUT

Blade Diameter	Operating RPM	Blade Collar	Maximum Depth of Cut
14"	2900	4-1/2"	4-3/4"
16"	2600	4-1/2"	5-3/4"
18"	2600	4-1/2"	6-3/4"
20"	2450	4-1/2"	7-3/4"
24"	1950	4-1/2"	9-3/4"
26"	1950	4-1/2"	10-3/4"
30"	1650	6"	12"
36"	1400	6"	15"
42"	1050	6"	18"
48"	850	8"	20"
54"	775	8"	23"

WALL SAWING

Accuracy is the key to profitable wall sawing.

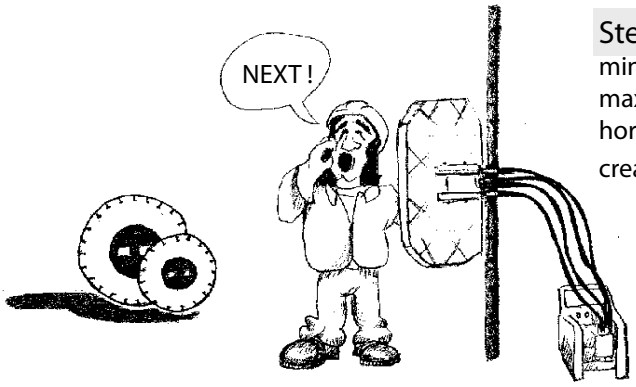


Track Setting- Accurate track setting is critical.

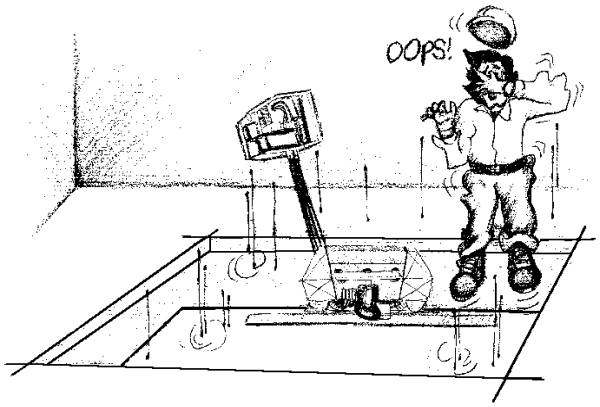
Right Blade - The bonds used in wall saw blades are made not only for specific materials but different types of saws as Make sure you have the right blade for the job.

Speed - Wall saws in general have less horsepower than other types of saws. Maintaining the right speed means paying close attention to the saw- you'll be able tell when cutting concrete or rebar. Make sure the blade is running at the correct RPM. Don't over speed the blade.

Water - is always important, especially when you are on a wall. Keep the pressure up !



Step cut- Don't over cut ! - Proper step cutting minimizes the cost per inch foot of cut and maximizes blade life. Step cutting increases the horsepower available to the blade and allows increased water flushing.



Don't cut the branch you are standing on and make sure it is properly secured !

* Plan your cuts so you and your equipment are not on a piece when it breaks loose.
* Insure that the blade is running in the proper direction.
* Make sure the blade is in good condition with no cracks, nicks or flaws.
* Use only steel centered wet cutting diamond blades.
* Do not use high speed steel blades, carbide tipped blades or abrasive blades.
* Always keep the blade guard in place and in good condition.
* Always keep all parts of your body away from the blade.
* Avoid getting in a direct line with the blade.
* Make sure the track is securely anchored and track stops are installed.
* Insure there are no electric, water or gas lines in the area you are cutting.
* Do not operate the saw near combustible materials or fumes.

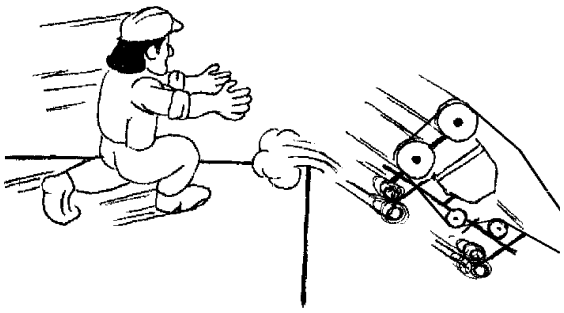
RECOMMENDED BLADE RPM & MAXIMUM DEPTH OF CUT

Blade Diameter	Operating RPM	Blade Collar	Maximum Depth of Cut
14"	1500	5"	4-1/2"
16"	1500	5"	5-1/2"
18"	1500	5"	6-1/2"
20"	1500	5"	7-1/2"
24"	1450	5"	9-1/2"
26"	1450	5"	10-1/2"
30"	1400	5"	12-1/2"
36"	1300	5"	15-1/2"
42"	950	5"	18-1/2"
48"	850	5"	21-1/2"
54"	700	5"	24-1/2"
60"	625	5"	27-1/2"

WIRE SAWING

Safety- is the key to profitable wire sawing.

* Rope off the area in front of and behind and even below the job.
* Secure the saw. It must be anchored and not weighted down.
* Always keep the wire guard in place and in good condition.
* Inspect the wire frequently for damage, frayed sections, missing beads, flat spots or weak connection points.
* Always keep all parts of your body away from the wire
* Avoid getting in a direct line with the wire.

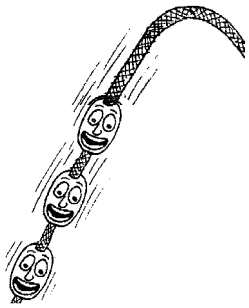


Wire Twist- The number of twists in the wire is critical for maximum bead life. Start with one twist for every three feet of wire. Increase the number of twists per the chart below. These additional twists will assure that the beads wear round and give maximum life . While twisting this is a good time to look for flaws in the cable such as broken strands.

RECOMMENDED WIRE TWIST

Wire Length	Wire Diameter .440"	Wire Diameter .425"	Wire Diameter .410"	Wire Diameter .395"	Wire Diameter .380"
25'	8	9	10	11	12
50'	17	19	21	23	25
75'	25	28	31	34	37
100'	33	36	40	44	48

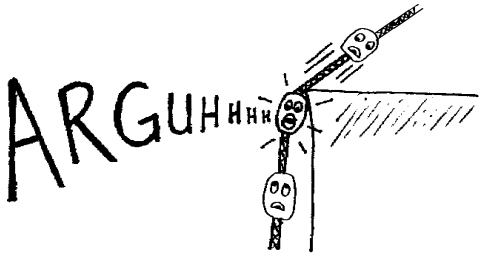
Wire Speed - is critical to good wire life. This table notes the correct wire speed for varoius flywheel diameters.

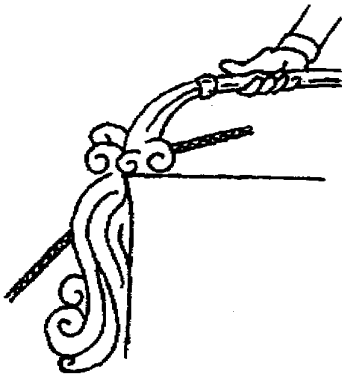


WIRE SPEED vs FLYWHEEL DIAMETER

Flywheel Diameter	RPM
24"	600-750
30"	475-600
36"	400-500

Beginning and Ending -Starting and finishing a cut produces the most strain on the wire. Give the wire a radius to start on. Don't start on a sharp edge.





Water- should be introduced at the beginning of the cut and contained throughout the cut. Vertical cuts should be directed as to allow the water to flow with gravity.

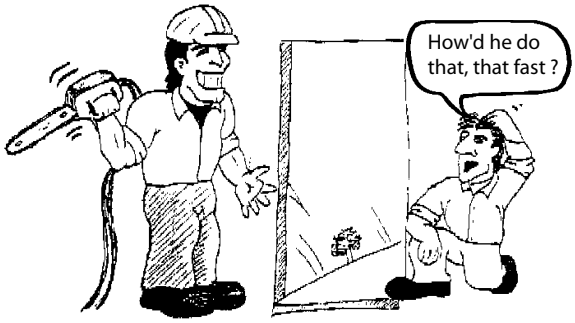
CHAIN SAWING

Safety- A concrete chain saw can be just as dangerous as a wood cutting chain saw.

* Never chain saw where you do not have sure footing and cannot face the cut without over extending your reach.
* Always run the chain in a forward direction. Running the chain backwards reduces chain life and can cause serious injury.
* Make sure hydraulic hoses are connected properly between the saw and power pack.
* Avoid pinching the bar and chain in the cut.
* Check for electrical wiring, gas or water lines near the cuttting area.
* Inspect the chain frequently for damage and proper tension.
* Make sure the drop out section is properly secured before making your final cut.
* Rope off the work area.
* Wear proper safety equipment including: Eye protection, boots, gloves, hard hat, hearing protection and rain suit.

Plan Your Cuts- Outline each cut with a marker for a visual cutting guide.

Water Pressure- must be maintained at a minimum of 80 PSI.

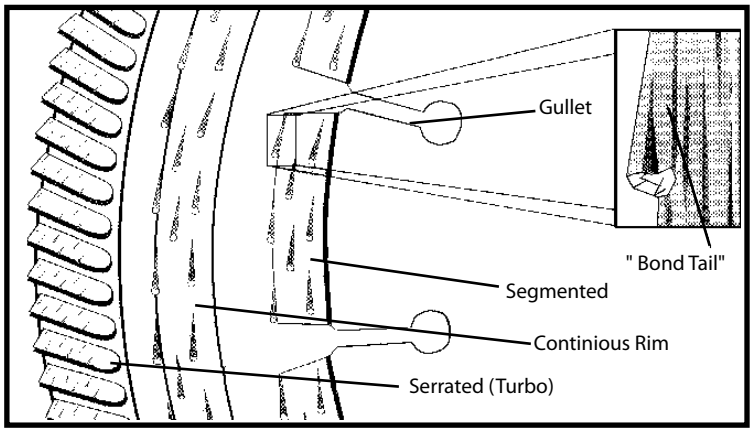


Cutting Tips-

* Use Wall Walker for constant chain feeding.
* Minimize the number of plunge cuts.
* Never exceed 8 gpm @ 2500 psi
* Expect less chain life in steel reinforcing.
* Select the correct chain type for the job and material.
* Check and maintain proper chain tension
* For long vertical/horizontal cuts, score line first for guides.

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 rim configuration.

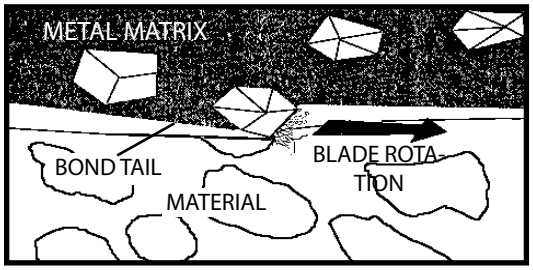
The blade core is a precision- made steel disc which may have slots called "gullets". These provide faster cooling by allowing water or air to flow between the segments. These slots also allow the blade to flex.

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 with a powder consisting of metals such as cobalt, iron, tungsten, carbide, 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.

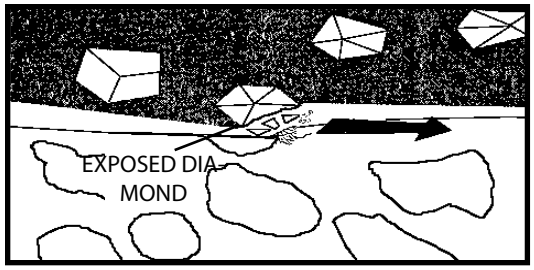
There are several methods of attaching the segments to the steel core. Brazing - Silver solder is placed between the segment and the core and then heated until the solder melts and bonds the two together. This method is used for wet cutting blades only. Laser welding - The diamond segment and steel core are welded together by a laser beam . 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.

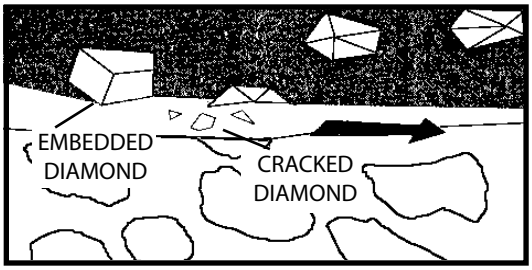
HOW DO DIAMOND CUTTING TOOLS WORK ?



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

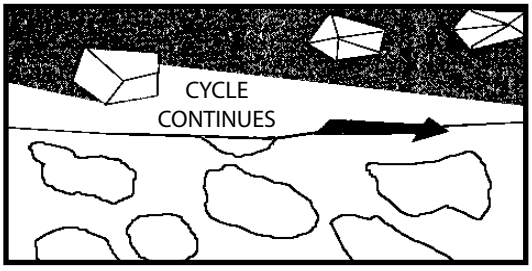
After several thousand passes through the material being cut the exposed diamonds begin to crack and fracture. The matrix holding the diamond also begins to wear away.





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.



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 4-6,000 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	4-6,000	Highways
Soft		3,000 or less Side-

SIZE OF AGGREGATE

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

Size	
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 bank 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

Mohs' Range	Description	Aggregates
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,

REINFORCING STEEL

Steel reinforcing tends to make a blade cut slower. Less reinforcing allows a 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 eights of an inch. #4 is 1/2" diameter, #5 is 5/8" diameter etc.

Size	Examples
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

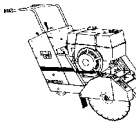
The drying or curing of concrete greatly affects how the concrete will interact with a diamond blade. Green concrete is freshly poured concrete that has not yet cured. It is softer and more abrasive than cured concrete. A harder bond with undercut protection should be used in this application until it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

VARIABLES

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
		Thicker	Slower	Longer
		Thinner	Faster	Shorter
The Saw	Segment Width	Lower	Slower	Longer
		Higher	Faster	Shorter
	Horsepower	Higher	Slower	Longer
		Lower	Faster	Shorter
The Job	Blade Speed	Higher	Slower	Longer
		Lower	Faster	Shorter
	Water Volume	Deep	Slower	Longer
		Shallow	Faster	Shorter
	Cutting Depth	Lower	Slower	Longer
		Higher	Faster	Shorter
The Material	Cutting Pressure	Harder	Slower	Longer
		Softer	Faster	Shorter
	Material Hardness	Less	Slower	Longer
		More	Faster	Shorter
	Material Abrasiveness	Larger	Slower	Longer
		Smaller	Faster	Shorter
	Aggregate Size	More	Slower	Longer
		Less	Faster	Shorter

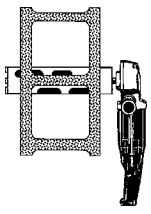
DIAMOND CUTTING TOOL FACTS

MAXIMUM BLADE CUTTING DEPTHS and OPERATING SPEEDS



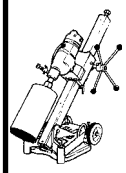
Blade Diameter	Cutting Depth	Recommended Operating Speed (RPM)	Maximum Safe Speed (RPM)
Concrete Saw Blades			
12"	3-3/4"	4500	
14"	4-3/4"	2900	3900
16"	5-3/4"	2900	3400
18"	6-3/4"	2600	3000
20"	7-3/4"	2600	2700
24"	9-3/4"	2450	2250
26"	10-3/4"	1950	2100
30"	12"	1950	1800
36"	15"	1680	1500
42"	18"	1400	1300
48"	20"	850	1100
Quickie Saw Blades		775	
12"	4"		6300
14"	5"	4300	5400
Wall Saw Blades		4300	
18"	6-1/2"		3000
24"	9-1/2"	1500	2250
30"	12-1/2"	1450	1800
36"	15-1/2"	1400	1500
42"	18-1/2"	1300	1300
48"	21-1/2"	950	1100
Masonry Saw Blades		850	
14"	5"		3900
18"	7"	2550	3000
20"	8"	2300	2900
Tile saw Blades		2300	
6"	1-3/4"		10175
7"	2-1/4"	6050	8725
8"	2-3/4"	5175	7650
9"	3-1/4"	4500	6800
10"	3-3/4"	4025	6125
Power Hand Saw Blades		3625	
1"			15000
4"	1-1/4"	9075	13300
4-1/2"	1-1/2"	8065	12000
5"	2-1/2"	7250	8725
7"	3"	5175	7650
8"		4500	

RECOMMENDED DRY HOLE SAW OPERATING SPEEDS



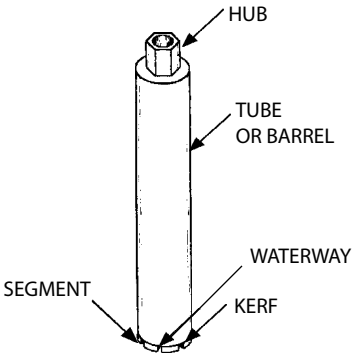
Blt Diameter	Min. AMPS	Max RPM/Min RPM
1"	6	6000/2300
1-1/4"	6	6000/2300
1-1/2"	7	5000/1600
1-3/4"	7	5000/1600
2"	7	5000/1200
2-1/4"	7	5000/1200
2-1/2"	7	5000/1200
3"	7	5000/800
3-1/2"	10	5000/800
4"	10	5000/700
5"	10	2500/700

RECOMMENDED CORE DRILLING SPEEDS



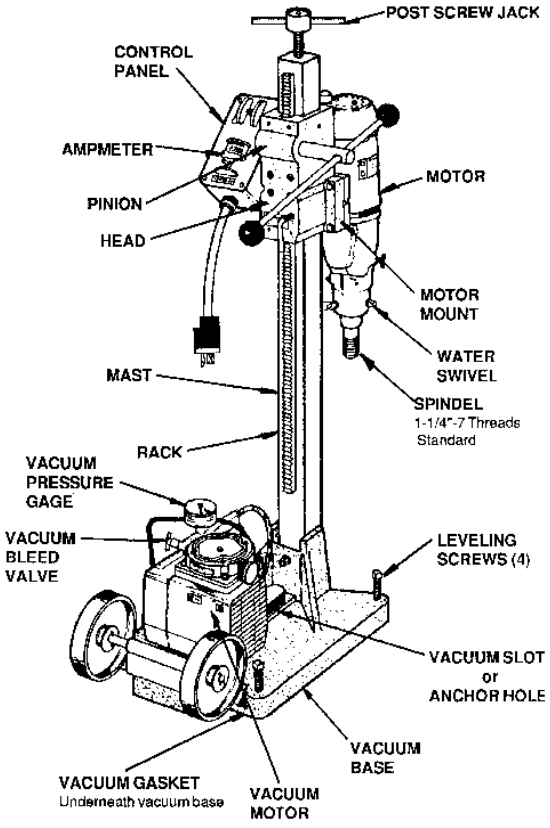
Bit Diameter	10 Amp Motor (RPM)	15 Amp Motor (RPM)	18 Amp Motor (RPM)	20 Amp Motor (RPM)
Up to 3"	1200	1200	1200	1200
4"	-	900	900	1200
5"	-	375	900	450
6"	-	375	375	450
7"	-	375	375	450
8"	-	-	375	450
10"	-	-	375	450
12"	-	-	375	450

CORE BIT NOMENCLATURE

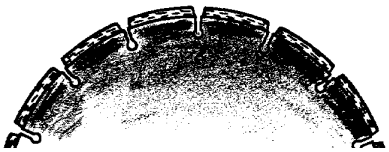


SEGMENT - Metal matrix containing diamonds which are brazed or welded to the tube.
WATERWAY - Allows cooling water to reach the cutting surface.
TUBE OR BARREL - Nominally 14" in length with a 13" core depth.
HUB - 1/2" to 1-1/2" threaded 5/8-11 1-5/8 and up threaded 1-1/4-7

CORE RIG NOMENCLATURE

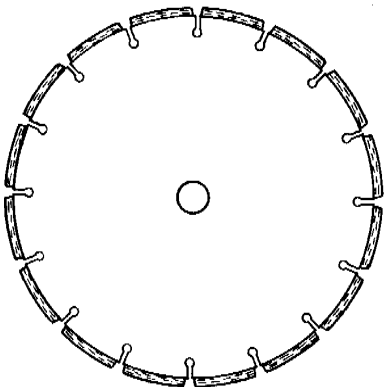


TROUBLE SHOOTING DIAMOND BLADES



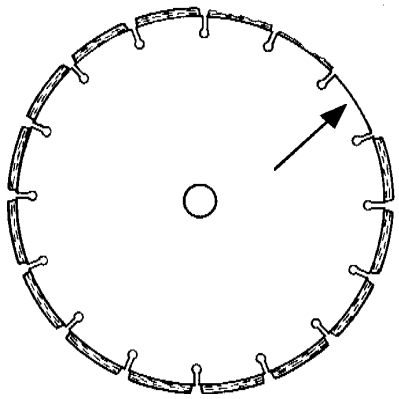
BURNING

CAUSE: Insufficient coolant (water) at the cutting surface of a wet cut
core bit or blade.
REMEDY: Increase the flow of water and check for proper direction of the
water to the cutting surface.
CAUSE: Insufficient cooling (air)



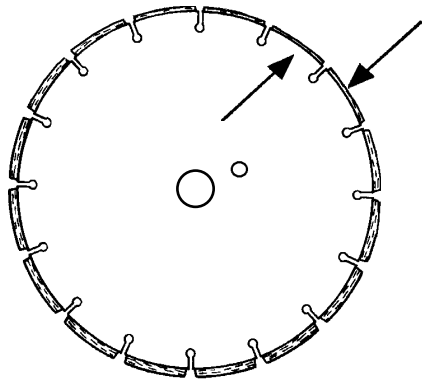
BLADE WILL NOT CUT (GLAZING)

CAUSE: Blade is too hard for material being cut. (Wrong spec.)
Bond will not wear away to expose new diamonds.
REMEDY: Choose a softer bond.
CAUSE: Material being cut is too hard.
REMEDY: Dress or sharpen the blade with a soft concrete block or old
abrasive wheel to expose new diamonds. If continual dressing
is needed change to a softer bond.
CAUSE: Insufficient power to permit blade to cut properly.
REMEDY: Check and tighten belts and make sure adequate



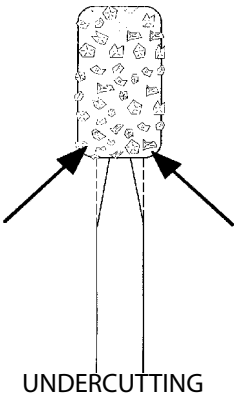
SEGMENT LOSS

CAUSE: On stone or masonry blades the material may not have been
held firmly which allowed the blade to twist or jam.
REMEDY: Material must be held firmly.
CAUSE: Overheating due to an inadequate supply of water.
Look for burning or discoloration near missing segments.
REMEDY: Provide adequate supply of water.
CAUSE: Undercutting which wears away blade core and weakens the
weld between segment and core.
REMEDY: Increase water supply and if material being cut is very abrasive
switch to wear-resistant cores.



WORN OUT-OF AROUND

CAUSE: Worn shaft bearings on saw which allows blade to run eccentric.
REMEDY: Install new bearings.
CAUSE: Engine not properly tuned which causes "hunting".
REMEDY: Tune the engine.
CAUSE: Blade arbor hole is damaged.
REMEDY: If blade is in good condition the core may be re-bored.
CAUSE: Blade mounting arbor is worn or is the wrong size.
REMEDY: Replace worn arbor busing or arbor shaft.
CAUSE: Bond is too hard for material causing machine to "pound" at

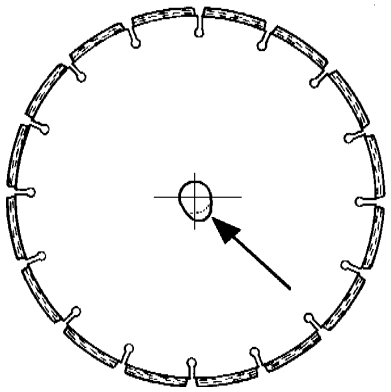


UNDERCUTTING

CAUSE: A condition in which the steel core wears at a faster rate than
the diamond segments. It is caused by highly abrasive material grinding against the core.
REMEDY: The blade core should be equipped with undercut

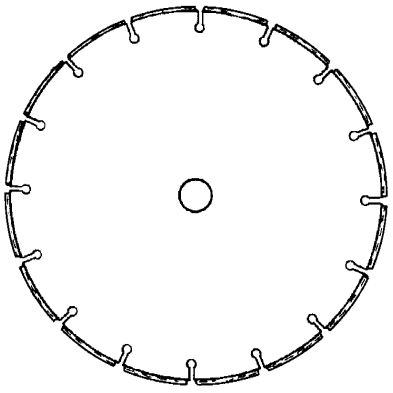
LOSS OF TENSION

CAUSE: Blade is used on a misaligned saw.
REMEDY: Check for proper saw alignment.
CAUSE: Blade is excessively hard for the material being cut.
REMEDY: Correct bond spec.
CAUSE: Material slippage causing blade to twist.
REMEDY: Maintain a firm qrip on material while cutting.
CAUSE: Undersize or mis-matched blade collars.
REMEDY: Minimum 3-7/8" - 4-1/2" on concrete saws, 6" Minimum on
blades over 30", 8" Miniumum over 48".
CAUSE: Blade used at improper RPM.
REMEDY: Check shaft RPM.
CAUSE: Improper mounting on arbor shaft allows collars to bend blade
when tightened.



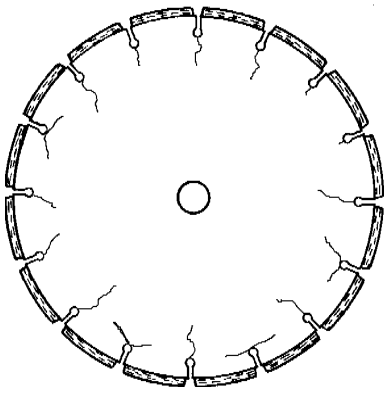
ARBOR OUT OF AROUND

CAUSE: Blade collar is not properly tightened allowing it to turn or rotate on shaft.
REMEDY: Tighten collars.
CAUSE: Worn or dirty collars which do not allow proper blade clamping.
REMEDY: Clean and replace if necessary.



EXCESSIVE WEARUNDERCUTTING

CAUSE: Using the wrong blade spec. on highly abrasive materials.
REMEDY: Change to a more abrasive resistant bond.
CAUSE: Lack of sufficent coolant to the blade often detected by excessive wear in the center of the segment.
REMEDY: Make sure water supply system is functioning properly.
CAUSE: Wearing out-of-round accelerates wear. Usually caused



CORE CRACKS

CAUSE: Blade is too hard for material being cut.
REMEDY: Change to softer bond.
CAUSE: Excessive cutting pressure, or jamming or twisting of the blade
REMEDY: The saw operator should use a steady even pressure without
twisting the blade in the cut.
CAUSE: Overheating through inadequate water supply or not allowing a dry

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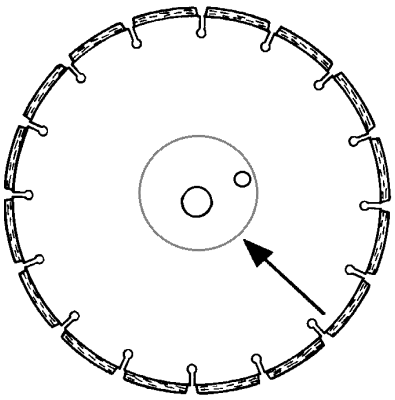
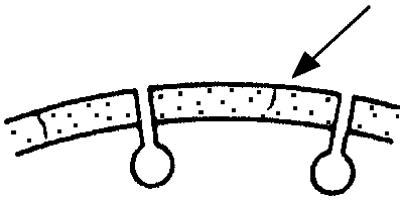


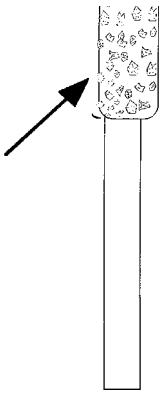
MISMOUNTING

CAUSE: Blade collars are not properly tightened or are worn out.



SEGMENT CRACKS

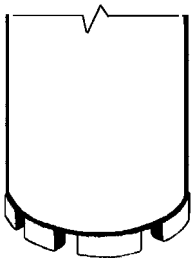
CAUSE: Blade is too hard for the material being cut.
REMEDY: Use correct blade with a softer bond.



UNEVEN SIDE WEAR

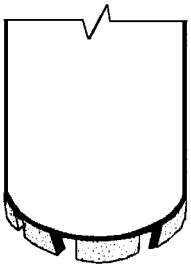
CAUSE: Insuffient water, generally on one side of blade.
REMEDY: Make sure water is being distributed evenly on both sides of
blade.
CAUSE: Equipment problem which causes blade to wear out-of round.
REMEDY: Relpace bearings, worn arbor shaft or misaligned spindle.

TROUBLE SHOOTING CORE BITS



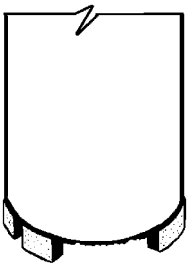
GLAZING
(Bit stops drilling or is very slow)

CAUSE: Too much feed pressure.
REMEDY: Open bit with abrasive material (Sand pot, concrete block, chop saw blade). Reduce feed pressure. Using an ammeter will help to control speed and pressure.
CAUSE: Aggregate is too hard.
REMEDY : Change to a softer bond.



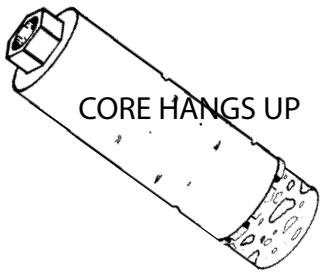
BENT SEGMENTS

CAUSE: Too much feed pressure and not enough water.
REMEDY: Repair the bit if possible. Ease up on feed pressure and increase water flow.
CAUSE: Aggregate is too hard.



LOST SEGMENTS
(Particularly on bits up to

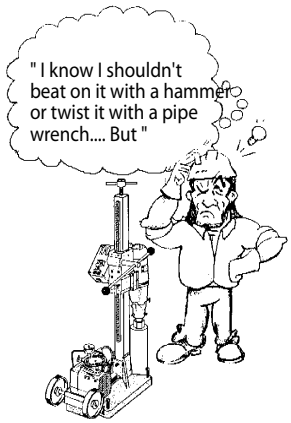
CAUSE: Steel reinforcing rod
REMEDY: Ease up on feed pressure (watch ammeter). Use a higher quality bit and increase the water flow.
CAUSE: Not enough water too properly cool bit.
REMEDY : Increase water flow.
CAUSE: Drill rig is not properly anchored.
REMEDY: There are three ways of anchoring a core rig. STANDING ON IT IS NOT ONE OF THEM !.



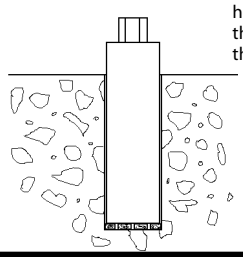
CORE HANGS UP

CAUSE: Not enough water to remove slurry.
REMEDY: Remove bit and drive core out with a spike through the hub. Increase water flow.
CAUSE: Core barrel is dented because of hammering on it to remove previous hung up

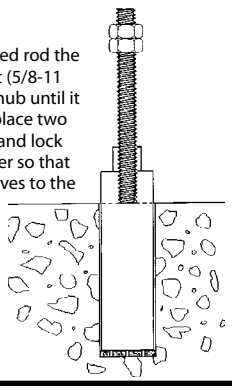
HOW TO REMOVE A STUCK BIT



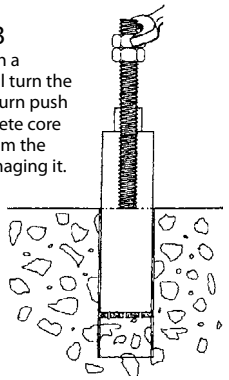
STEP 1
Disconnect the core rig from the



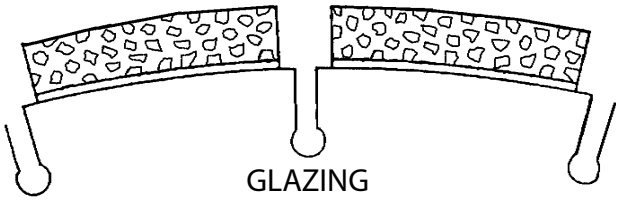
STEP 2
Thread a piece of threaded rod the same diameter as the bit (5/8-11 or 1-1/4-7) through the hub until it hits the concrete. Then place two hex nuts on the the rod and lock them against one another so that they inturn lock themselves to the



STEP 3
Turn the nuts with a wrench which will turn the rod which will inturn push against the concrete core pulling the bit from the hole without damaging it.

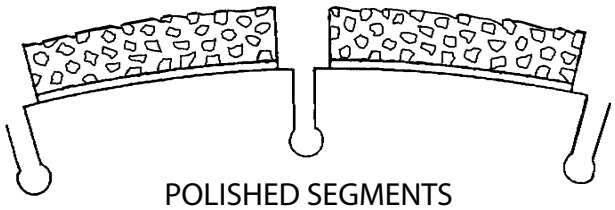


TROUBLE SHOOTING - DIAMOND PROBLEMS



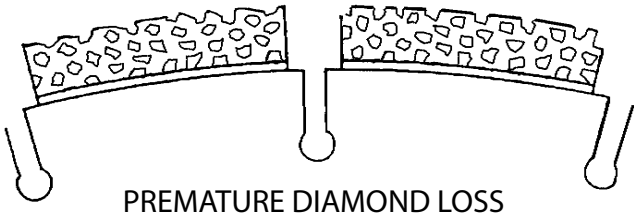
GLAZING

CAUSE: Diamonds are too friable (too hard).
REMEDY: Change to a softer diamond.
CAUSE: Bond is too hard.
REMEDY : Change to a softer bond.
CAUSE: Blade speed is too high.



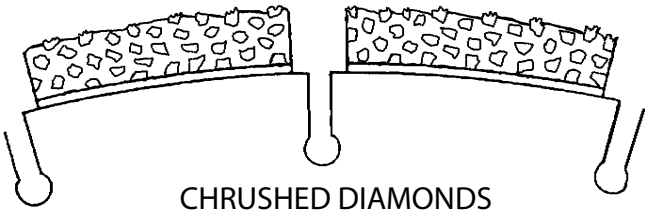
POLISHED SEGMENTS

CAUSE: Diamonds are too hard.
REMEDY: Change to a softer diamond.
CAUSE: Diamond size is too large.
REMEDY : Change to a smaller diamond.
CAUSE: Diamond concentration is too high.
REMEDY: Change spec to a lower concentration.



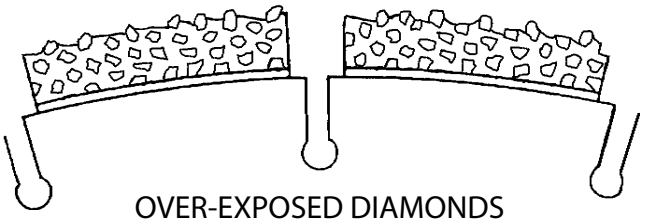
PREMATURE DIAMOND LOSS

CAUSE: Diamonds are too soft (poor quality).
REMEDY: Change spec to a harder diamond.
CAUSE: Bond is too soft for diamond quality.



CHRUSHED DIAMONDS

CAUSE: Diamonds are too hard.
REMEDY: Change to a softer diamond.
CAUSE: Diamond size is too large.
REMEDY : Change to a smaller diamond.
CAUSE: Too much pounding or vibration
REMEDY: Check machine bearing,



OVER-EXPOSED DIAMONDS

CAUSE: Bond is too soft for material.
REMEDY: Change to a harder diamond.
CAUSE: Diamond concentration and bond is unsuitable.

CONCRETE ANCHORING - COMMON SENSE AND FACTS

CONCRETE ANCHORING IS A CRAFT. It is not a science. It is a craft because of the tremendous variables found in concrete, the tolerances of the carbide drills and anchors, the tools used to set them and most importantly the skill of the installer. As a craft it is imperative that the "craftsman" learn as much about the material, tools and conditions that he has to work with.

ALLOWABLE WORKING LOADS & MATERIAL STRENGTH. A quick look at the catalogs of various anchor manufacturers will have many scratching their heads. Some print the ultimate load while others state the maximum allowable load. Shown below are the performance charts on Drop-In anchors from three major manufactures which at first glance could be confusing and if not properly understood the cause of a costly anchor failure.

	2000 PSI Concrete		4000 PSI Concrete		6000 PSI Concrete	
Anchor Size	Tension	Shear	Tension	Shear	Tension	Shear
1/4"	480	430	560	450	770	760
3/8"	790	990	1240	1060	1410	1480
1/2"	1000	1470	1690	1560	2550	2340
5/8"	1390	2220	2420	3050	2600	3400
3/4"	2210	3800	4010	4400	4100	5300

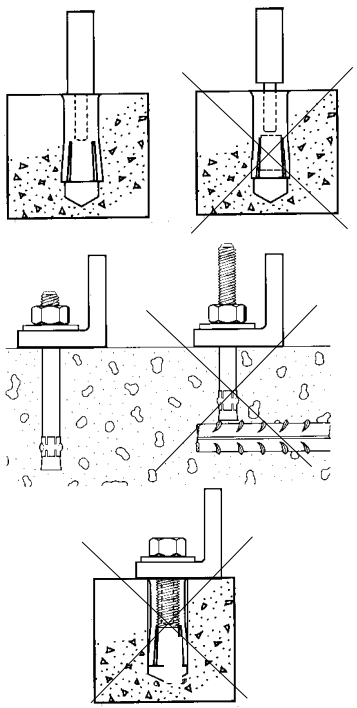
BOLT SIZE	NOMINAL DRILL BIT SIZE	COMPRESSIVE STRENGTH OF CONCRETE			
		2000 PSI		5000 PSI	
		LBS. TENSILE	LBS. SHEAR	LBS. TENSILE	LBS. SHEAR
1/4	3/8	1560	1600	2,400	2,177
3/8	1/2	3024	3640	4,200	3,950
1/2	5/8	3634	6500	6,990	6,422
5/8	7/8	--	--	9,750	12,500
3/4	1	--	--	11,500	16,590

Bolt Size/ Threads Per Inch	Drill Bit Size	A Thread Depth	B Min. Hole Depth	Ultimate Pullout* [1] Lbs.	Ultimate Shear* [1] Lbs.
1/4"/20	3/8"	3/8"	1"	3,204	1,986
3/8"/16	1/2"	1/2"	1-5/8"	6,350	3,968
1/2"/13	5/8"	3/4"	2"	8,544	6,502
5/8"/11	7/8"	1"	2-1/2"	15,218	10,380
3/4"/10	1"	1-1/4"	3-3/16"	17,255	13,962

It is imperative that the Allowable Working Load be determined with regard to the strength of the concrete and the particular cutting or drilling operation before hand. If the ultimate load is published the safe working load is 25% of the ultimate load (4:1) and this value must be matched with the strength of the concrete which can affect the performance of the anchor by another a factor of almost 3:1

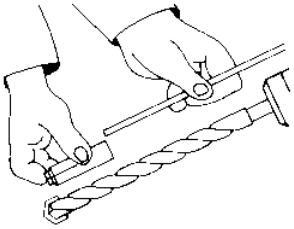
ANCHOR FAILURE - With rare exception almost every anchor failure is caused by the operator. Not the anchor. Among the most prevalent mistakes in the sawing and drilling industry are:

1. Not fully expanding a drop-in anchor because the wrong setting tool was used or the operator simply "felt" that the anchor was set.
2. Setting a stud anchor at too shallow a depth because it was on top of a rebar.
3. Setting a capsule anchor by simply driving the threaded stud into the capsule and not spinning it. As the adhesive has not been mixed with the catalyst it will not set fully or not set at all.
4. Leaving an inordinate amount of dust in the hole when using an adhesive anchoring system.The adhesive bonds to the dust and the dust is bonded to nothing.
5. Using an anchor which does not have the capacity for the job. A particular anchor may be adequate on a horizontal surface but totally inadequate when used on a vertical one with the exaggerated component loads on equipment in this position.
6. Using the wrong size carbide bit to drill the hole. The best example of this is using an old worn 5/8" bit for 1/2" anchors. The anchor is quick to install and just as quick to fail.

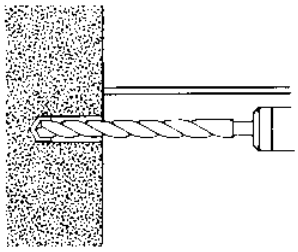


MECHANICAL ANCHOR GUIDE

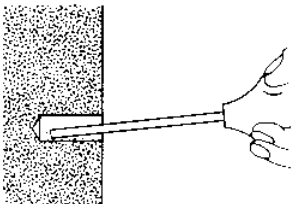
DROP-IN ANCHOR



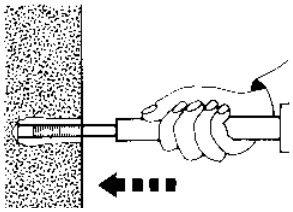
Adjust depth gauge so that anchor will be flush with surface when placed in hole.



Drill Hole the same diameter as the anchor.

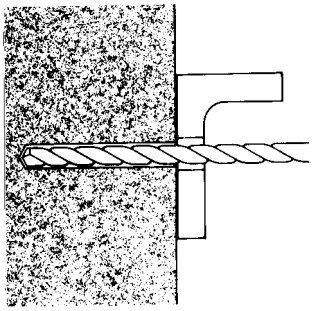


Clean the hole with a blow out bulb, compressed air or wet swab.
Dust left in the hole acts as a lubricant and will reduce it's holding power.

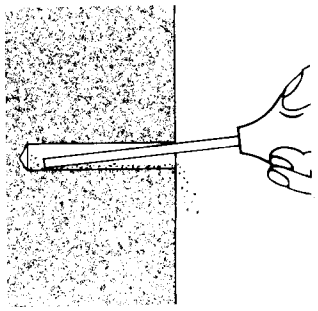


Install with the proper setting tool.
The shoulder of the tool should be flush with the anchor when it is

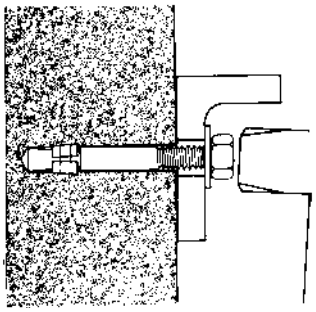
STUD (WEDGE) ANCHOR



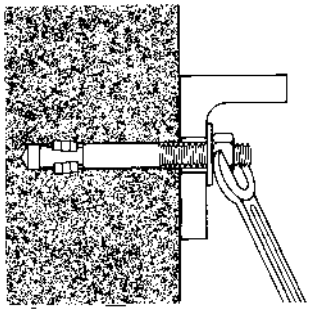
Drill Hole the same diameter as the anchor to a depth of at least the length of the anchor. This will allow the anchor to be pounded flush after it has been used.



Clean the hole with a blow out bulb, compressed air or wet swab.
Dust left in the hole acts as a lubricant and will reduce it's holding power.

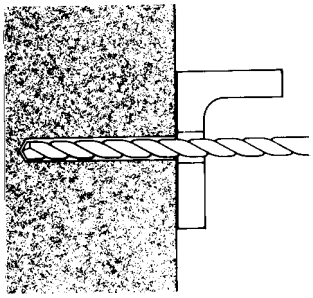


Place the nut on the stud so that all threads are covered by the nut. This will protect them from a missed hammer blow. Drive anchor into hole until it contacts the fixture.

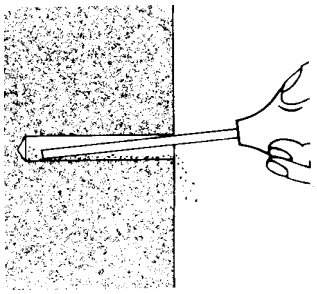


Tighten to the recommended torque value or 3 to 4 turns from the finger tight position. If anchor spins in the hole, force up using a screwdriver until the clip grips the concrete.

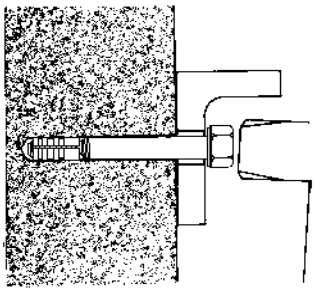
TAPER-BOLT ANCHOR



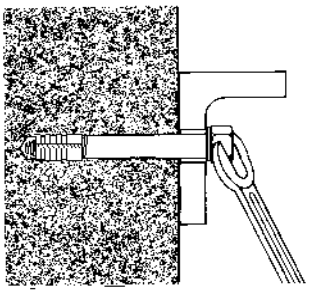
Drill Hole the same diameter as the anchor to a depth of at least the length of the anchor.



Clean the hole with a blow out bulb, compressed air or wet swab.
Dust left in the hole acts as a lubricant and will reduce it's holding power.

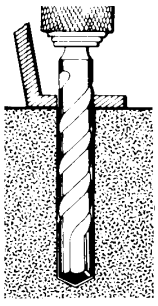


Drive the Taper-Bolt into place leaving the required head clearance.

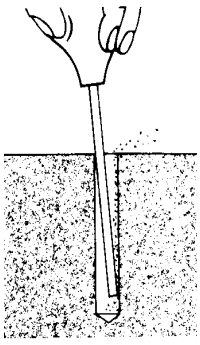


Tighten to the recommended torque or number of turns from the finger tight position. If hole is over sized, simply remove and pre-expand the expander nut. Taper-Bolt can be removed and bolt reused. Can be installed with impact tools.

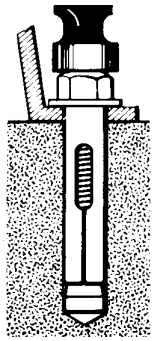
SLEEVE ANCHOR



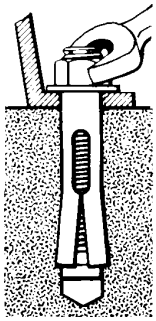
Drill Hole the same diameter as the anchor to a depth of at least the length of the anchor.



Clean the hole with a blow out bulb, compressed air or wet swab. Dust left in the hole acts as a lubricant and will reduce it's holding power.



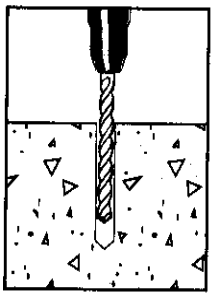
Drill Hole the same diameter as the anchor to a depth of at least the length of the anchor. This will allow the anchor to be pounded flush after it has been used.



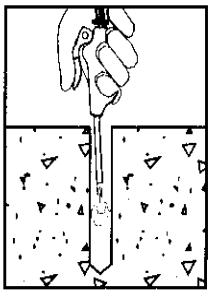
Tighten to the recommended torque value or 3 to 4 turns from the finger tight position. Sleeve anchors may be used in hollow block so long as the correct length is selected.

ADHESIVE BONDED ANCHOR GUIDE

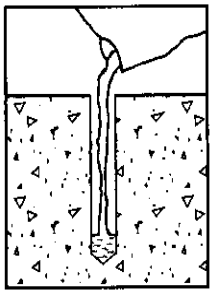
POURABLE ADHESIVE ANCHOR (Horizontal applications only)



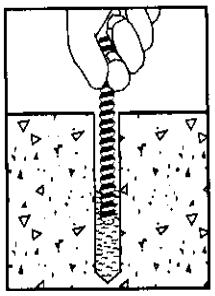
Drill hole to proper depth.



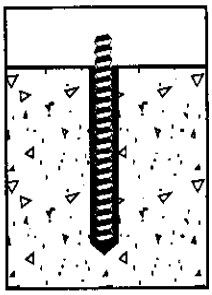
Clean with a blow out bulb, wire brush,water pressure. Dust left in the hole acts as a lubricant and will reduce it's holding power.



Mix adhesive and pour correct amount per manufacturers instructions into the hole.

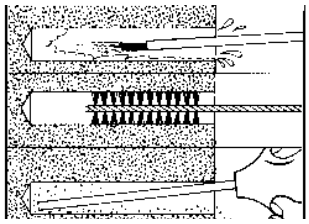


Insert threaded rod slowly into hole using a twisting motion.

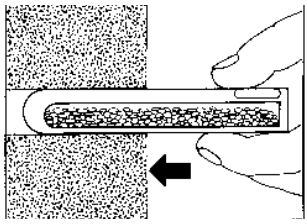


Allow to cure recommended time before applying load.

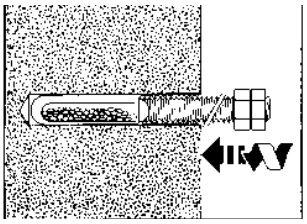
CAPSULE ANCHOR



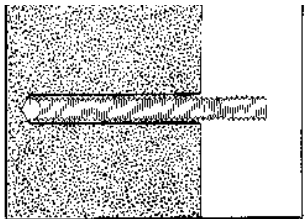
After drilling hole to proper depth clean with a blow out bulb, wire brush,water pressure.Dust left in the hole acts as a lubricant and will reduce it's holding power.



Insert capsule.

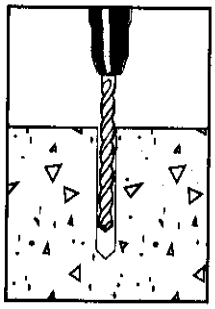


While rotating a chamfered stud with a rotary hammer or hammer drill drive it through the capsule. Remove the drill and setting tool from the stud

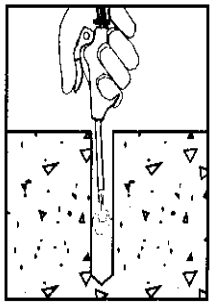


Allow stud to set until adhesive is cured which is dependent upon temperature.(20 minutes to 6 hours)

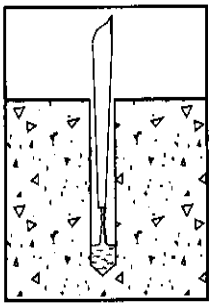
ADHESIVE ANCHOR (Solid application)



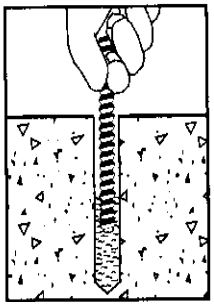
Drill hole to proper depth.



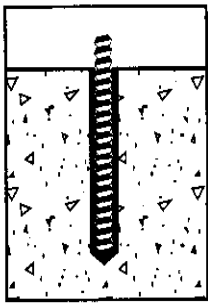
Clean with a blow out bulb, wire brush,water pressure. Dust left in the hole acts as a lubricant and will reduce it's holding power.



Injective adhesive unto the hole unitl it is approximately one-half full (per manufacturers instructions)

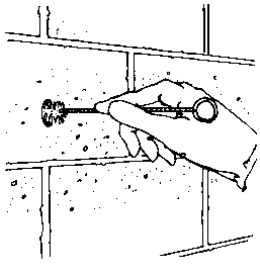


Insert threaded rod slowly into hole using a twisting motion.

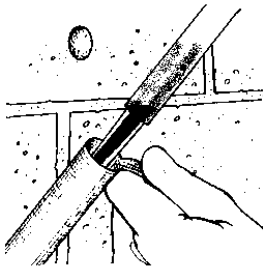


Allow to cure recommended time before applying load.

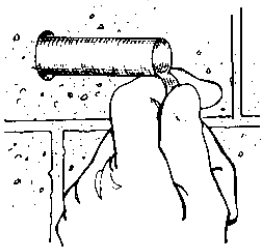
ADHESIVE ANCHOR (Hollow wall application)



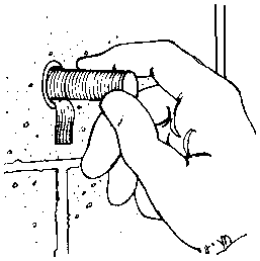
After drilling hole to proper depth clean with a blow out bulb, wire brush,water pressure.



Fill wire screen with adhesive while withdrawing the nozzel.



Insert the filed screen completely into the cleaned hole.

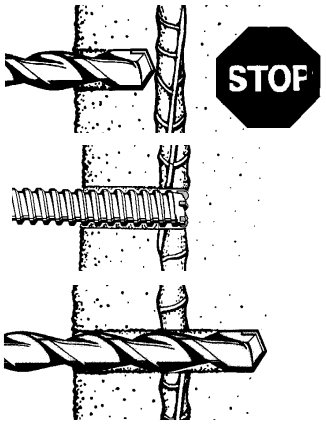


Holding the tab on the screen insert the threaded rod with a slow twisting motion. Allow to set for appropriate cure time which is dependent on temperature.

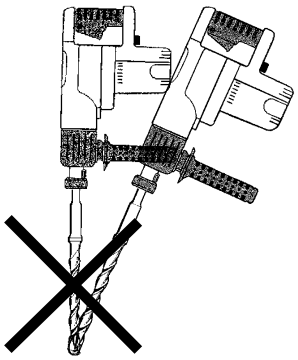
CARBIDE DRILL BITS

HOW TO USE AND EXTEND THE LIFE OF CARBIDE BITS

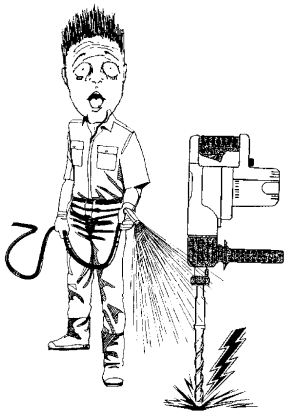
IF POSSIBLE AVOID REBAR
IF NOT USE A REBARE CUTTER



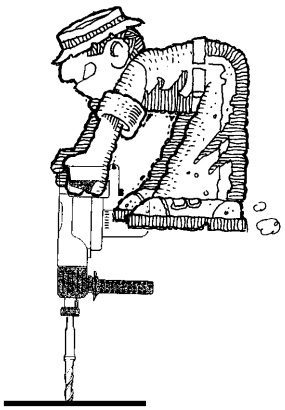
DON'T TRY TO RE-ALIGN THE BIT AFTER YOU
HAVE STARTED DRILLING



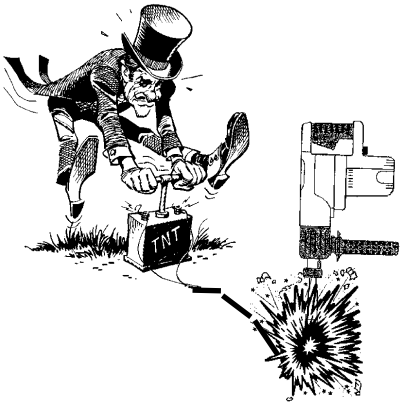
DON'T PUT WATER ON A BIT



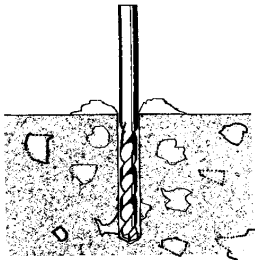
LET THE HAMMER DO THE WORK



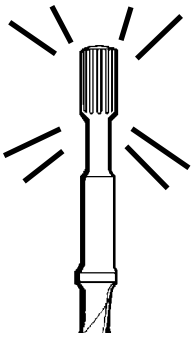
DON'T USE EXCESSIVE FORCE TO
REMOVE A BOUND-UP BIT



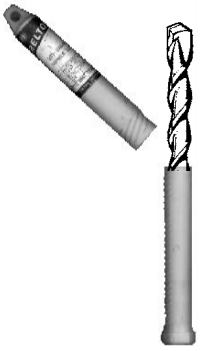
DON'T DRILL DEEPER
THAN THE FLUTES



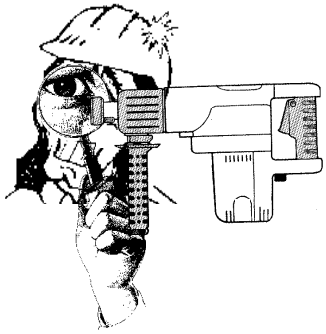
KEEP THE SHANK
CLEAN AND LUBRICATED



STORE THE BIT IN IT'S
OWN CONTAINER



CHECK THE NOSE-PIECE ON YOUR
HAMMER FOR WEAR



LADDERS

LADDER RATINGS

The American National Standards Institute (ANSI) adopted and issued a code of safety requirements for portable ladders. The code, last revised in 1982, sets out the properties and design specifications for wood (A14.1), metal (A14.2) and reinforced plastic (A14.5) ladders. Completed ladders must also be capable of passing a variety of test requirements as set out in the code.

ANSI TYPE *	DUTY RATING **	DESCRIPTION
TYPE 1A	300 lbs.	Extra Heavy Duty Industrial
TYPE I	250 lbs.	Heavy Duty Industrial
TYPE II	225 lbs	Medium Duty Commercial
TYPE III	200 lbs	Light Duty Household

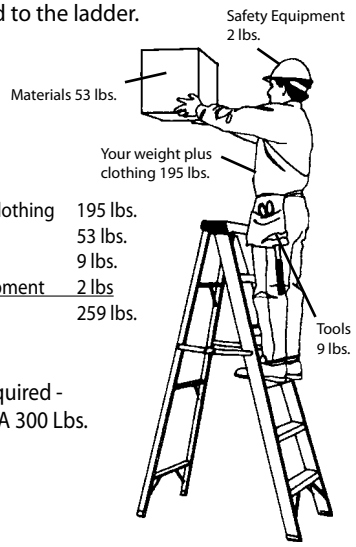
* OSHA essentially follows the guidelines set by ANSI. Therefore, industrial users should purchase and properly use Type 1A and Type 1 ladders to be in compliance with OSHA regulations. Type II and Type III are NOT permitted on the job site.

** The Duty Rating means that the ladder is designed to meet these loads with a safety factor of four (4) when set and used properly at 75-1/2° to the horizontal.

LADDER SELECTION

Select the highest duty rating necessary to cover the total amount of the weight that will be applied to the ladder.

Example:



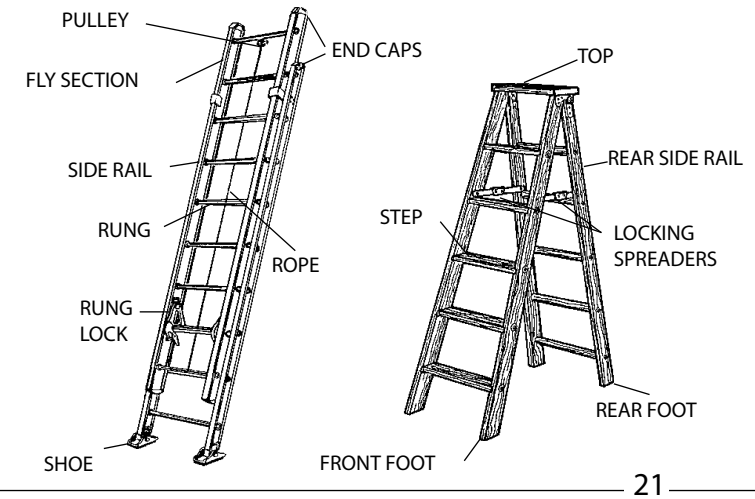
Yourself + Clothing	195 lbs.
Materials	53 lbs.
Tools	9 lbs.
Safety Equipment	2 lbs
Total	259 lbs.

Ladder Required -
Type 1A 300 Lbs.

LADDER MATERIALS

MATERIAL	ADVANTAGES	DISADVANTAGES
WOOD	Low initial cost. Non-conductive. Good strength- to- weight ratio	Heavier and less durable than aluminium or fiberglass.
ALUMINUM	High durability. Weather resistant. Very high strength- to- weight ratio. Light weight.	Highly conductive. Corrodes in some environments.
FIBERGLASS	High durability. Non-conductive. High strength- to -weight ratio. Weather resistant.	Higher initial cost. Can be damaged by heat.

LADDER COMPONENTS



LADDER TYPES

SINGLE STEPLADDER- Has steps on one side and is a self supporting climbing tool for applications at low to medium heights. 3' to 16'.
DOUBLE FRONT STEPLADDER - Has steps on both sides and is a self supporting climbing tool for low to medium heights. 3' to 16'.
PLATFORM STEPLADDER - Provides a large platform to work on and is self supporting.
TRESTLE LADDERS - May be used alone or with a second trestle ladder to support planking systems. Up to 16'.
STRAIGHT LADDERS - A non self supporting single straight ladder section used for mid -range heights. 8' to 20'.
EXTENSION LADDERS - A non self supporting adjustable ladder for mid-range to high work levels. 8' to 40'.

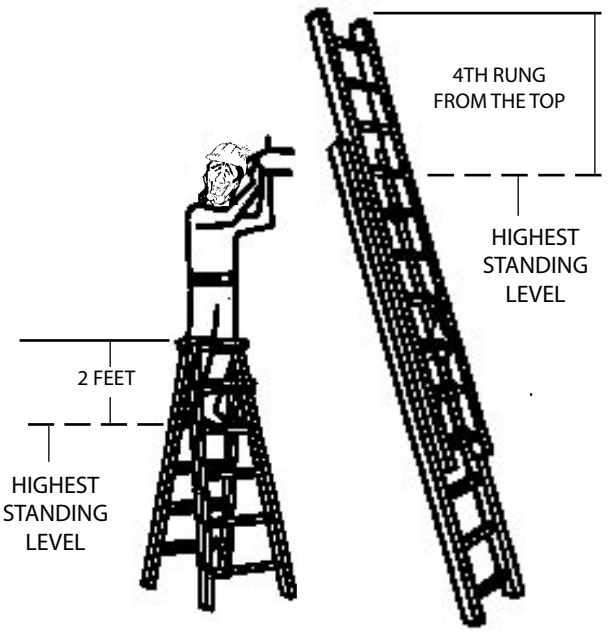
For further Information check with your ladder manufacturer or refer to ANSI A14 for additional guidelines.

LADDER SAFETY

DO inspect your ladder carefully ----when you buy it and before each use. Look for missing, damaged or loose parts.
DO make sure that working parts move freely and that there are no missing nuts, bolts, rivets or locks.
DO follow label instructions. Start by carefully reading all labels. These instructions are gathered from years of experience and they are offered for your benefit.
DO be sure that the ladder feet are on solid ground.
DO wear shoes that have soles that do not slip. Make sure they are free of mud, oil, or anything slippery.
DO check for frayed or damaged cords when using power tools. Use only cords with grounded outlets.
DO climb facing the ladder. Center your body on the steps. Use a firm grip. If possible, have someone hold the ladder for you.
DO keep your body centered on the ladder while working.
DO hold the ladder with one hand while working with the other, whenever possible.
DO keep children away from ladders while working.
DO move materials with extreme caution. Be careful pushing or pulling anything while on a ladder.
DO use a ladder only when you are mentally and physically alert.
DO securley tie down the ladder when transporting it on a vehicle.
DO store ladders out of reach of children.
DO keep ladders protected from excessive heat and the weather.
DO keep your ladder in good condition. Keep it clean.

DON'T use or repair a bent or damaged ladder. Send it back to the factory for repairs or replace it.
DON'T test a ladder by jumping on it. This could damage or weaken the ladder, and you may slip or fall.
DON'T use on slippery surfaces or uneven ground.
DON'T set up a ladder where it could possibly touch electrical devices or wires.
DON'T set up a ladder on a wet or icy surface unless you tie down the legs.
DON'T climb down a ladder with your back to the ladder, or carry a load in your arms.
DON'T over-reach, lean to one side or stand on one foot.
DON'T hurry or skip steps when geting on or off a ladder.
DON'T try to move a ladder while on it by bouncing "walking" the ladder.
DON'T leave a ladder unattended
DON'T position the ladder where it blocks foot traffic or where it could be bumped by a door.
DON'T place a ladder on boxes, chairs, furniture, or other things which are movable to try to climb higher.
DON'T climb from one ladder to another.
DON'T climb a damaged ladder.
DON'T climb a ladder when ill or physically alert.
DON'T drop or throw ladders.
DON'T use a ladder as a pry bar.
DON'T use a ladder as a work bench. Hammering, sawing and grinding can weaken key components.
DON'T use a ladder that has been exposed to fires, acids, caustics or other strong chemicals.
DON'T paint a wood ladder. This can hide damage and can create a slippery surface.

KNOW WHERE THE LAST STEP IS



HOW TO CHOOSE THE RIGHT SIZE

HEIGHT TO SUPPORT POINT	USE THIS LENGTH LADDER	MAX WORKING LENGTH
to 9-1/2' Max.	16'	13'
From 13-1/2" to 17-1/2'	24'	21'
From 21-1/2' to 25'	32'	29'
From 28' to 31'	40'	35'

THE PROPER WAY TO SET UP A LADDER

HEIGHT TO GUTTER OR SUPPORT	HORIZONTAL DISTANCE FROM SUPPORT TO LADDER BASE
9-1/2'	2-1/2'
13-1/2'	3-1/2'
17-1/2'	4-1/2'
21-1/2'	5-1/2'
25'	6-1/2'
28'	7'
31'	8'

CORDS & POWER

DOUBLE INSULATED/GROUNDED TOOLS: A double insulated tool is one that has all the electrical parts of the motor insulated from each other and all gripping surfaces made of non-conductive materials. In essence there are two layers of insulation between the operator and the tool's electrical systems. Tools that are double insulated are not intended to be grounded and therefore are equipped with a two pronged plug. Three-pronged plugs are found on grounded tools and are electrically safe as long as the receptacle is properly grounded.

POWER: In general, the higher the amperage rating of a tool the more powerful the motor. This assumes that tools being compared have motors operating at the same efficiency. Efficiency is defined as a percentage which is obtained when comparing usable output amps (power) to the amps being drawn by the motor. Different motors and/or different manufacturers will not have the same efficiency. One tool manufacturer says 6 amps, another says 750 Watts and still another says 1 horsepower all for the same tool.....How does one make a logical comparison?

*WATTS = AMPS X VOLTS X 62%
(AC apparent power)

$$\text{AMPS} = \frac{\text{WATTS}}{\text{VOLTS}}$$

1 HORSEPOWER = 746 WATTS

*This is the power consumed by the tool and not its power output. Output Watts is the true measure of a tool's power.

GROUND FAULT INTERRUPTER: A device which protects both the worker and the tool against line ground faults (short circuits). It does this by detecting any imbalance in the current flow to and from the tool. If a ground fault should occur, the current imbalance will trip the G. F. I. before the operator is shocked.

RECOMMENDED GENERATOR SIZES

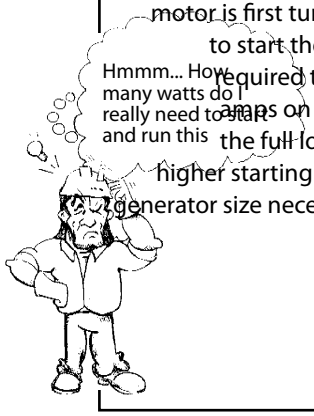
H.P.	AMPS.	PHASE	GENERATOR SIZE IN KILOWATTS
1/2-1	14	1ph	4
1	15	1ph	5
1-1/2	18	1ph	5
2		1ph	6.5
5		1ph	12
7.5		1ph	20
5		3ph	12
7.5		3ph	25
10		3ph	25
15		3ph	30
20		3ph	40
25		3ph	50
30		3ph	60
40		3ph	80

RECOMMENDED POWER CORD GAUGE

RATING OF TOOL				REQUIRED CORD GAUGE SIZE			
H.P.	AMPS	PHASE	VOLTAGE	UP TO 50'	50-100'	100-150'	150-200'
1/3-1/4	7	1ph	125v	#18	#18	#16	#14
1/2	10	1ph	125v	#18	#16	#14	#12
3/4	13	1ph	125v	#16	#14	#12	#10
1	15	1ph	125v	#14	#12	#10	#8
1-1/2	20	1ph	125v	#12	#10	#8	#6
1-1/2	13	1ph	115v	#12	#10	#8	#6
1-1/2	6	1ph	230v	#14	#14	#12	#10
2	30	1ph	125v	#8	#6	#4	#2
2-1/2	21	1ph	115v	#10	#8	#6	#4
2-1/2	11	1ph	230v	#14	#12	#10	#8
5	23	1ph	230v	#10	#8	#6	#4
5	12	3ph	230v	#14	#12	#10	#8
5	6	3ph	460v	#14	#14	#12	#10
7-1/2	33	1ph	230v	#8	#8	#6	#4
10	24	3ph	230v	#10	#8	#6	#4
10	12	3ph	460v	#14	#12	#10	#8
20	52	3ph	230v	#6	#6	#4	#2
20	26	3ph	460v	#10	#8	#6	#4
25	58	3ph	230v	#6	#6	#4	#2
25	29	3ph	460v	#10	#8	#6	#4
30	37	3ph	460v	#8	#6	#4	#2
40	48	3ph	460v	#8	#6	#4	#2
50	62	3ph	460v	#4	#4	#2	#0

HOW TO SELECT A GENERATOR

When selecting a power generator it is important that it is capable of meeting your energy requirements. Both starting and running !



DETERMINE THE STARTING WATTS REQUIRED - When a motor is first turned on, the power required to start the motor fan exceeds the power required to normally run the motor. The amps on the nameplate of the motor are the full load running amps and not the higher starting amps. To determine the generator size necessary use the following formulas.

For single phase
WATTS = Amps x Volts x 2

For three phase
WATTS = Amps x Volts x 3.5

STARTING WATTS VS RUNNING WATTS -Most generators have an intermittent 25% overload capacity. IE: a 2,000 watt generator will carry a 2,500 watt load for a short period, such as during start up. Motors starting under a heavy load (such as air compressors, refrigeration systems and those which must bring a heavy cutting tool up to speed) will require significantly more wattage to start. This higher demand must be considered when estimating power needs. This is particulary important when more than one motor is used at one time.

EXAMPLE:

Motor	Starting Watts	Running Watts
3/4HP Air Compressor	4300	1250
71/4" Circular Saw	-	1500
11/2" Rotary Hammer	-	800
Light String (10-100 Watt Bulbs)	-	1000
		4550

In the above example, a 5,000 watt unit would be ample, but only when the air compressor was started before the other tools were started. If the other tools were in use and the air compressor started after they were on line the power requirement would jump to 7600 watts which the unit may not be capable of.

POWER OUTPUT VS ALTITUDE

Less oxygen at higher altitudes reduces engine efficiency and power output. Unless otherwise specified by the manufacturer the unit should be derated to the following values:

Alternator Rating	Peak Power	Altitude in feet above sea level 2000'	3000'	4000'	5000'	6000'	7000'	
1250	1375	1275	1220	1155	1100	1048	980	
1750	1925	1750	1690	1615	1540	1465	1385	
2500	2750	2500	2420	2300	2200	2090	1980	
3650	4160	3650	3650	3500	3300	3160	2980	
4000	4400	4000	3870	3700	3520	3340	3170	
5000	5500	5000	4840	4620	4400	4170	3960	
7500	9000	7500	7500	7500	7200	6850	6480	

APPROXIMATE POWER CONSUMPTION of VARIOUS CONSTRUCTION TOOLS & APPLIANCES

Window Fan	
Jigsaw	
Belt Sander	
Screwdriver	
Chain Saw	
Circular Saw (7-1/4"-8-1/4")	
Circular Saw (10")	
Cutoff Saw	
Poratble Band Saw	
2.5 HP Masonry Saw	
Impact Wrench (1/2 & 3/4")	
Impact Wrench (1")	
1/4" Drill	
3/8" Drill	
1/2" Drill	
1" Drill	
15 Amp Core Drill	
18 Amp Core Drill	
20 Amp Core Drill	
1/2" Hammer Drill	
5/8" Hammer Drill	
3/4" Hammer Drill	
7/8" Rotary Hammer	
1" Rotary Hammer	
1-1/2" Rotary Hammer	
2" Rotary Hammer	
1-1/8"/1-1/4" Breaker	
Water Pump 3000 GPH	
Water Pump 5000 GPH	
Water Pump 10000 GPH	
Water Pump 20000 GPH	
Wet Dry Vacuum	
Water Pump (Submersible) 3000 GPH	
Water Pump (Submersible) 5000 GPH	
Water Pump (Submersible) 10000 GPH	
Water Pump (Submersible) 20000 GPH	
Concrete Vibrator (3/4 HP)	
Concrete Vibrator (1HP)	
Concrete Vibrator (3HP)	
Air Compressor -3/4HP	
Air Compressor -1-1/2HP	
Concrete Saw - 5HP	

MOTOR STARTING & RUNNING WATTAGE

Motor Size	Running Watts	Universal* Motors Starting Watts	Induction** Motors Starting Watts	Capacitor Start*** Induction Motors Starting Watts
1/4	400	500	850	1050
1/3	450	600	975	1350
1/2	600	750	1300	1800
3/4	850	1000	1900	2600
1	1000	1250	2300	3000
1-1/2	1600	1750	3200	4200
2	2000	2350	3900	5100
3	3000		5200	6800
5	4800		7500	9800

* Utilizes a commutator and is generally used in power tools and small appliances.
** Brushless motor that has a large starting torque with less starting current. Generally used on pumps, compessors, frezzers.
***An induction motor which uses capacitors to start (and in some cases run) the motor. Used on pumps, compressors and refrigeration equipment.

SAFETY SYMBOLS

Please read the instructions for use prior to operating the machine for the first time.
Antes de la puesta en marcha, lea detenidamente las instrucciones y familiarcese con la maquina.

Prohibited
Prohibicion

Warning
Triangulo de advertencia

Wear Eye Protection
Usar gafas de proteccion

Wear Head Protection
Usar casco de proteccion

Wear Breathing Protection
Usar mascara de proteccion

Ear Protection Use is Mandatory
Es obligatorio el uso de proteccion auditiva

Hard Hat is Mandatory
Es obligatorio el uso de casco duro

Safety shoes are mandatory
Es obligatorio el uso de zapatos de seguridad

Fall protection is mandatory
Es obligatorio el uso de ropa adecuada

Use in Well Ventilated Area
Utilizzare in presenza di un'adeguata ventilazione

Danger, Poison Exhaust Gas
Peligro, gases de escape toxicos

Do Not Use in Flammable Areas
No usar en areas inflamables

No Non-Working Personnel in Area
Prohibido para personas ajenas a la obra

Motor Off
Parar el motor

Keep All Guards in Place
Mantenga siempre las protecciones de la hoja en su sitio

Danger ! Keep Hands Away From Machinery
Maquina peligrosa- Matenga manos y pies alejados de la maqunia

No Smoking
No fumar

CONVERSION CHART

MULTIPLY	BY	TO OBTAIN
Acres	0.404687	Hectares
Acres	1076.39	Square Yards
Board Feet	144 sq. in x 1	Cubic Inches
Board Feet	.0833	Cubic Feet
Centimeters	.3937	Inches
Cubic Feet	28.3170	Liters
Cubic Inches	16.38716	Cubic Centimeters
Cubic Meters	35.3145	Cubic Feet
Cubic Meters	1.30794	Cubic Yards
Cubic Yards	.764559	Cubic Meters
Degrees, Angular	.0174533	Radians
Degrees, Fahrenheit	(°F-32) x .5555	Degrees, Centigrade
Degrees, Centigrade	(°C x1.8) +32	Degrees, Fahrenheit
Foot-Pounds	.13826	Kilogram-Meters
Feet	30.4801	Centimeters
Feet	.304801	Meters
Feet	304.801	Kilometers
Gallons - U.S.	.13368	Cubic Feet
Gallons - U.S.	231.0	Cubic Inches
Gallons - U.S.	3.78513	Liters
Hectares	2.47104	Acres
Horsepower-Metric	.98632	Horsepower-U.S.
Horsepower-U.S.	1.01387	Horsepower-Metric
Inches	2.54001	Centimeters
Inches	25.4001	Millimeters
Kilograms	2.20462	Pounds
Kilograms-Meters	7.233	Foot-Pounds
Kilograms per Sq. Cent.	14.223	Pounds per Sq. Inch
Kilograms per Meter	.671972	Pounds per Foot
Kilometers per Sq. Meter	.204817	Lbs. per Sq. Foot
Kilometers	.62137	Miles
Kilometers	.53959	Miles-Nautical
Liters	.26417	Gallons
Meters	3.28083	Feet
Meters	39.37	Inches
Meters	1.09361	Yards
Miles	1.60935	Kilometers
Miles	.8684	Miles-Nautical
Miles-Nautical	6080.204	Feet
Miles-Nautical	1.1516	Miles
Pounds	453.592	Grams
Pounds	.453592	Kilograms
Pounds per Foot	1.48816	Kilograms per Meter
Pounds per Sq. Foot	4.88241	Kilograms per Sq. Meter
Radians	57.29578	Degrees-Angular
Square Centimeters	.1550	Square Inches
Square Feet	.0929034	Square Meters
Square Inches	6.45163	Square Centimeters
Square Inches	645.163	Square Millimeters
Square Kilometers	247.104	Acres
Square Kilometers	.3861	Square Miles
Square Meters	10.7639	Square Feet
Square Miles	259	Hectares
Square Miles	2.59	Square Kilometers
Tons-Metric	2204.62	Pounds
Tons-Metric	.98421	Tons-Long
Tons-Metric	1.10231	Tons-Short
Tons U.S.	40	Cubic Feet
Yards	.914402	Meters

AVERAGE WEIGHTS OF MATERIALS

CONCRETE	LBS. PER CU. FT.
Stone, reinforced	150
Stone, plain	144
Slag, plain	130
Cinder, reinforced	100-115

LIGHT WEIGHT CONCRETE	LBS. PER CU. FT.
Concrete, Aerocrete	50-80
Concrete, Cinder fill	60
Concrete, Haydite	85-100
Concrete, Nailcode	75
Concrete, Perlite	35-50
Concrete, Pumice	60-90
Concrete, Vermiculite	25-60

MORTAR & PLASTER	LBS. PER CU. FT.
Mortar, masonry	116
Plaster, gypsum, sand	104-120
Plaster, gypsum. perlite	50-55
Plaster, Portland Cement, sand	104-120
Plaster, Portland Cement perlite	50-55
Plaster, Portland Cement, vermiculite	50-55

BRICK & BLOCK (INCL MORTAR)	LBS. PER SQ. FT.
4" Brick work	35
4" Concrete block stone or gravel	34
4" Concrete block lightwt. aggregate (avg.)	22
6" Concrete block stone or gravel	50
6" Concrete block lightwt. aggregate (avg.)	31
8" Concrete block stone or gravel	58
8" Concrete block lightwt. aggregate (avg.)	36
12" Concrete block stone or gravel	90
12" Concrete block lightwt. aggregate (avg.)	58

SOIL, SAND & GRAVEL	LBS. PER CU. FT.
Cinder & ashes	40-45
Clay, damp & plastic	110
Clay, dry	63
Clay & gravel dry	100
Earth, dry & loose	76
Earth, dry & packed	95
Earth, moist & loose	78
Earth, moist & packed	96
Earth, mud, packed	115
Sand or gravel, dry & loose	90-105
Sand or gravel, dry & packed	100-120
Sand or garvel, dry & wet	118-120

STONE	LBS. PER CU. FT.
Granite	175
Limestone	165
Marble	165
Sandstone, bluestone	147
Slate	175

WOOD (12% moisture content)	LBS. PER CU. FT.
Birch, red oak	44
Cedar, northern white	22
Cedar, western red	23
Cypress, southern	32
Douglas Fir	34
Fir, commercial white	27
Hemlock	28-29
Maple, hard	42
Oak, white	47
Pine, northern	25
Pine, southern	29
Pine, ponderosa	28
Pine, short leaf southern	36
Poplar, yellow	28
Redwood	28
Walnut, black	38

METALS	LBS. PER CU. FT.
Aluminum, cast	165
Brass, red	546
Brass, yellow, extruded bronze	528
Bronze, commercial	552
Bronze, statuary	509
Copper, cast or rolled	556
Iron, cast gray	450
Iron, wrought	485
Lead	710
Monel	552
Nickel	555
Stainless steel, rolled	492-510
Steel, rolled	490
Zinc, rolled or cast	440

REBAR	DIAMETER	LBS. PER FT.
No. 3	.375"	.376
No. 4	.500	.668
No. 5	.625	1.043
No. 6	.750	1.502
No. 7	.875	2.044
No. 8	1.000	2.670
No. 9	1.128	3.400
No. 10	1.270	4.303
No. 11	1.410	5.313
No. 14	1.693	7.650
No. 18	2.257	13.600

NOTES

DYNATECH

DIAMONDS AT WORK

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E-Mail: dynatech@windstream.net
www.dynatech-diamond.com