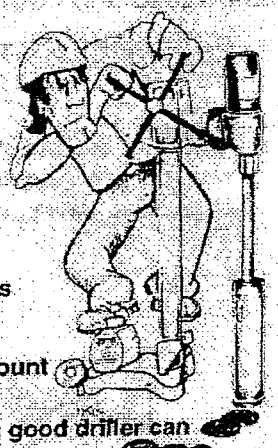
UNDERSTAND NOT ONLY WHAT YOU DO BUT HOW YOU DO IT !

CORE DRILLING

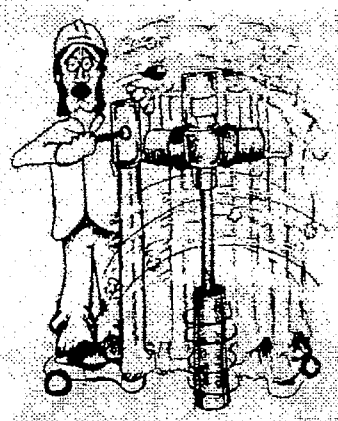
As there are more variables in core drilling than in any other type of cutting, being competent in core drilling is the foundation of a good cutter.



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 !

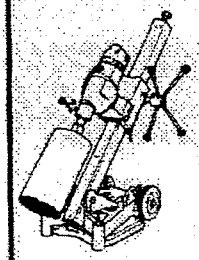
Core Rig Maintenance -performance, speed and bit life will mean little if your rig has bad shims, bearings and hold down devices.

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 or 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	560
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

Core Drilling Safety

- Read all manuals for drills before use
- Clear area if you are going to be drilling overhead
- Never use vacuum base over a 6" diameter hole could potentially be dangerous
- When drilling cinder block use epoxy anchoring system
- Never turn drill on while bit is touching a surface
- Never change gears while drill is running
- Holes over 16" in diameter should have to or more anchors for mounting
- Drilling overhead with electric drill never wrap motor with plastic drill could over heat
- Always check the do's and the don'ts before starting to drill
- To avoid injury always use proper tools required for the job
- Never leave your drill un attended
- Do an inspection daily on you drilling equipment
- Never use bent or cracked equipment

Core Drilling Procedures

- Measure from anchoring slot to spindle to position your drill
- Always flush out your anchor with water before inserting ready rod
- If there is an extension being used turn drill down to a lower gear
- To get a stuck core out of your bit increase water pressure
- Always clean leveling pegs and lubricate carriage and stand on a daily basis
- Ever 200 hours of use check brushes for wear
- Do a daily inspection on or drill to see if there is any bends, cracks, or cord cracks

Core Drilling

Date: March 2006

Used when electrical/pipes are required to go through concrete.

PPE: Safety boots, safety glasses, ear protection, hard hat (if necessary)

Task/Activity:	Potential Hazards	Recommended Procedures
1. Ensure all required equipment/tools are on vehicle before leaving shop		
2. Ensure area to be drilled has been clearly marked by others	a) could cut into piping or electrical	a) ensure communication with job coordinator/customer before sawing
3. Walk around work area to check for any hazards	a) trips, slips, and falls	a) check around work area for any hazards before set-up
4. Begin setting up	a) slips, trips, and falls b) back injury	a) make sure path is clear of hazards b) follow proper lifting procedures
5. Rig power in to work area	a) electrocution b) trip hazards	a) ensure cable is not in traffic area
6. Inspect all equipment/tools before drilling	a) defects in drill bit	a) double-check all equipment before drilling
7. Check other side of wall/floor below for hazards	a) core falling b) injury to other workers	a) mark area off to ensure safety of others while drilling
8. Secure drill stand to wall/floor	a) loose stand could result in fall and severe injury	a) ensure stand is securely tightened and pull back to test for no movement
9. Ensure correct water flow	a) bit could jam	a) ensure water flow is free of obstruction
10. Apply minimal pressure to start a a groove	a) bit could shatter/jam b) broken diamonds	a) tighten up lock on carriage and apply slow, steady pressure
11. Drill with pressure applicable to type of concrete and steel reinforcement	a) bit could jam b) drill motor could bum out	a) drill steadily with correct pressure for type of concret
12. Do not drill through wall/floor	a) core could fall b) bit could jam	a) drill last 1/4"-1/2" without water so that core stays in bit b) apply minimal pressure
13. Removal of core	a) core could fall	a) remove bit slowly from hole
14. Clean up slurry and debris	a) slips, trips, and falls	a) vacuum all slurry, remove debris
15. Removal of equipment	a) slips, trips, and falls b) back injury	a) ensure path is clear and safe b) follow proper lifting procedures
16. Job-site walkthrough, ensure customer has signed jobsheet	a) slip hazards b) forgotten equipment	a) ensure all debris/slurry has been cleaned up b) ensure all tools have been rigged out and returned to vehicle

core drill operators must be trained and certified on proper set-up and operation
pressure applied should depend on concrete type and consistency

DRILLING – CORE DRILLS
JOB PROCEDURES

Installation

The employee must select a drilling machine that has the capacity to drill the required hole sized, and which has a suitable power unit in relation to available power supplies, i.e., air, electric or hydraulic. Most drills are suitable for drilling holes in floors and walls but certain models may not be designed for drilling into ceilings or at an angle upwards into walls, as the motor is not protected from water spray. Where ceiling have to be drilled, consult the drill manufacturers.

The electricity supply on construction sites should normally be 110 volt and equipment should be designed to operate off this supply. If the supply is 220 volt, then suitable transformers should be used. Electrical power leads should be kept as short as possible to avoid voltage drop.

A physical check should be carried out to confirm the nature of the material being drilled and the presence of any services. Never cut through steel reinforcement or structural steelworks without the client's permission. Water, gas, and electricity lines near the work should be turned off.

Where drilling rakes place through walls, the rear side must be checked as thee may be electrical or other hazardous installations against the wall. If it is a locked room, arrangements must be made to have the door opened and the rear of the wall inspected before work commences. When drilling through floors, the cores can drop form the bit. Therefore, protection may need to be provided for people and property below the drilling area.

A check must then be carried out to determine the best method of fixing, in order to hold the rig down securely. This can be by vacuum pad, bracing column, anchor or weights. Anchor fixings provide the safest method as the vacuum and bracing systems have less stability. A smooth surface is essential when using a vacuum pump, and a bracing column must have a strong supporting wall or ceiling opposite.

Drilling can be carried out wet or dry depending on the application, although wet drilling is the most common type of operation. The drill bit must be suitable for whichever method is appropriate. In the case of dry drilling there must be adequate dust extraction facilities and operators must be provided with suitable face protection.

In most cases, the drilling rig will be provided with a constant flow of water for cooling the drill bit and to minimize the creating of dust. The supply should be at main's pressure with a flow of between 4-10 litres per minute. When drilling into hollow components, the means of dispersing the cooling water must be checked in order to avoid water damage. A sealed water chamber can be fitted around the drill hole that allows passage of the drill bit. This chamber contains the water and drains it away.

Having ensured that the drill is securely and squarely fixed to the rig, check that:

1. The slides have free movement.
2. The threads on the motor arbor are clean and free form dirt.
3. The motor unit is mounted square to the column.
4. The core drill runs true to the machine arbor.
5. The motor r.p.m. are set as near as possible to the manufacturer's recommendation.

Operating Procedures

Before turning on the power, ensure that the machine is isolated by an on/off switch so that it does not accidentally start up. Some drills do not have a built-in switch in which case the supply cable should be fitted with an in-line switch.

The water supply should be turned on and adjusted for volume; i.e., the water should flow continually around the core bit circumference without splashing. Do not allow the water supply to stop while drilling.

The motor should then be switched on and the core bit checked for true running. The carriage lock is then released and the core bit brought carefully into contact with the concrete, applying minimum pressure. Once the core bit cuts around is entire circumference, then the pressure can be increased steadily without bouncing the bit. Where an ammeter is fitted, the operator should ensure that the needle is kept within the safe operating ranges. If reinforcement is met, the feed pressure must be reduced.

When dry drilling, the drill hole should be cleaned out regularly, to clear dust and debris.

At the completion of drilling, the core bit should be withdrawn while the motor is running. The motor can then be switched off and the water turned off. Caution must be exercised when removing the core from the bit as it can drop out unexpectedly causing injury.

When working on the machine with the drill at the top of the column, ensure that it is locked in position so that it cannot drop and injure fingers. Before replacing a drill bit, the machine must be unplugged from the power source.

Where a trailer mounted core drill is being used, the manufacturer's instructions must be followed regarding the use of stabilizing jacks and the stability of the machine while drilling. For example, the machine must be level. The drilling plate must not leave the ground during operation, and the operator's feet must be kept well clear of the machine, both while setting up and drilling.

CORE DRILLING SAFETY – January 31, 2003

DRILLING AREA

Before drilling, visually inspect surrounding area for hazards.

Notice electrical, mechanical, gas and plumbing lines or equipment in the area that may be interfered with by core drilling. Trace lines from source area to output areas (electrical boxes to wall plugs or switches, floor drains, wired in equipment). Ask if area has been "scanned".

Check area you are drilling from both sides. If this is not possible, ask questions of customer or maintenance personnel on site. Ensure areas either below or on the other side are protected from dust, water and core damage. Even if you told 'not to worry about it', it is your responsibility if something goes wrong. Take the time to ensure there are no hazards.

Do not drill through reinforced concrete structure without specific approval of customer/engineer. Drilling through reinforcement may weaken structure causing structure failure.

Use appropriate signage, caution/danger tape, lockouts, and communication to ensure your work area is safe. This includes (especially includes) protecting the area on the other side of what you are drilling! A lookout or core catcher is a good way to ensure a wanderer can no enter the area and be hit by falling debris or cores.

POWER SUPPLY

Drill must be grounded to protect from electrical shock.

Before connecting Core Drill to power supply – Check plug for third prong.

Core Drills must always be connected to a supply system, (a building wall plug, a portable generator) equipped with an adequate residual current circuit breaker.

Ensure extension cords are three pronged and heavy gauge appropriate for the distance covered. If extension cord is used outdoors, ensure it is acceptable for outdoor use.
Voltage is labeled on machines rating plate and should match voltage provided by power supply.

WATER CONNECTION

Water is used while drilling to cool diamond segments while drilling. Proper water pressure and flow rate must be maintained. There must be enough water flow for optimal use of the drill bit and to avoid damage but not so much as to create a large sloppy mess.

If the water flow is fluid – it is correct. If it is muddy, it is not correct. Check for a blockage or increase the flow.

If you are enlarging a drilled hole (a 4"dia over top of a 3"dia hole), obstruct the current hole to keep from losing cooling water to the bit.

DRILLING HEAD

CORE BIT TYPES
Ensure the bit is appropriate for the concrete you are drilling.
If the bit is not suitable:

-the drill motor may overload and you may be labelled a slow, low-production driller,
OR diamond segments may severely wear and you may be labelled an expensive slow, low production driller.

SETTING THE CORE BIT
Always use a washer between the driving shaft and core bit.
Wire brush clean screw thread of the bit to avoid oxidation and ease removal of the bit.
Use adapters between the motor connection and core bit if required.
Ensure core bit is tight on motor spindle before starting drill.
Ensure power switch is off and unit is unplugged from power supply before setting or removing bit.
Ensure wrenches are REMOVED from drill and bit before turning it on.

ROTATION SPEED
Measured in RPM – Revolutions per Minute
This is determined by the hole diameter, core bit type, hardness and consistency of material, and reinforcing material.
Always reduce rpms when drilling steel. Normal speed may be resumed once through the steel.
Turn gear change lever when motor is completely stopped. Turn bit spindle by hand to allow gear alignment.

SHIFTING AND DRILLING
Do not shift gears while spindle is rotating!

RPM requirements under specific drilling conditions can vary significantly. This is the "ART" to drilling. It takes time and practice to know the sounds and feel of the drill and bit working optimally to cut through concrete or steel.

When starting a hole, approach the surface with light pressure ensuring correct alignment. Incorrect alignment will cause large power loss due to side friction, core jams and ultimate failure. This may also occur if the drill stand is not securely anchored and moves while drilling.

Once drilling is progressing in correct alignment, open the ball valve on the power unit and increase thrust to correct speed. If thrust is too low, diamonds will friction polish reducing cutting capacity, if it is too heavy, they will wear prematurely.

IF: -the core bit goes ahead very slowly,
-force required on hand wheel increases,
-water out of the hole is clear with metallic splints
You are going through steel!
REDUCE FORCE ON CORE BIT AND RPM'S ON DRILL until you are through steel.

Wood, cork, rubber, and foam will not core easily. Remove this material rather than trying to core through it.

Always drill steady, but be alert. Expect the bit to jam so you are prepared when it happens.

ANCHORING THE DRILL

Ensure that drill base is securely anchored to floor or wall using appropriately sized anchors for equipment. Standing on the drill is not recommended and should never be done out of laziness. If anchoring is not allowed, use of vacuum suction pad should be used.

Ensure the anchor is countersunk ½" deep to stabilize the drill. This also allows for ease of patching.