Diamond Bits

CME Diamond Bits

Central Mine Equipment Company
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MOH'S SCALE OF HARDNESS

This scale characterizes the scratch resistance of various minerals through the ability of a harder material to scratch a softer material.

Moh's Hardness Scale

Note: On the Moh's scale, a pencil "lead" (graphite) has a hardness of 1; a fingernail, 2.5; copper penny, about 3.5; a knife blade, 5.5; window glass, 5.5; and a steel file, 6.5. Using these ordinary materials of known hardness can be a simple way to approximate the position of the mineral scale.

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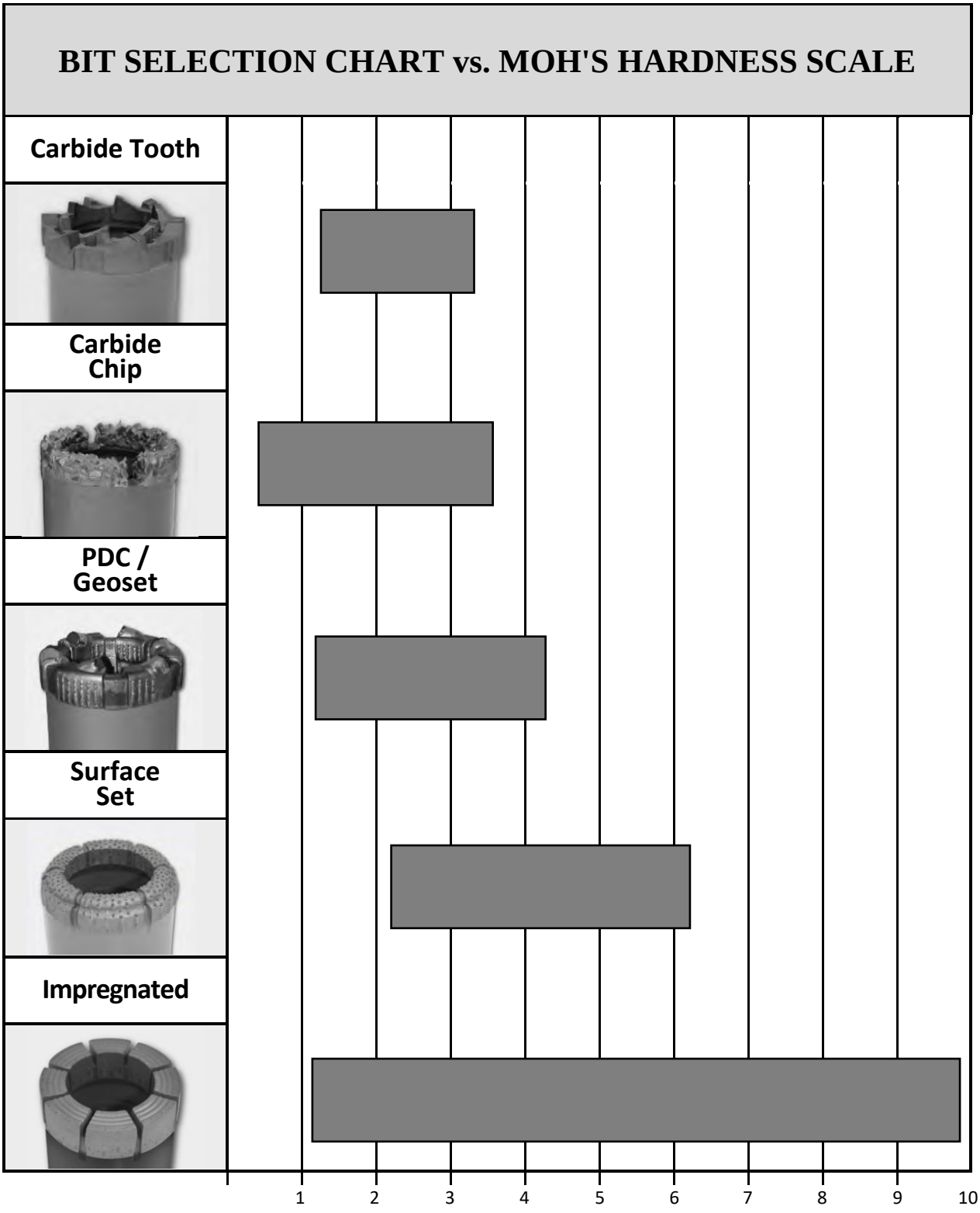
BIT SELECTION CHART vs. MOH'S HARDNESS SCALE



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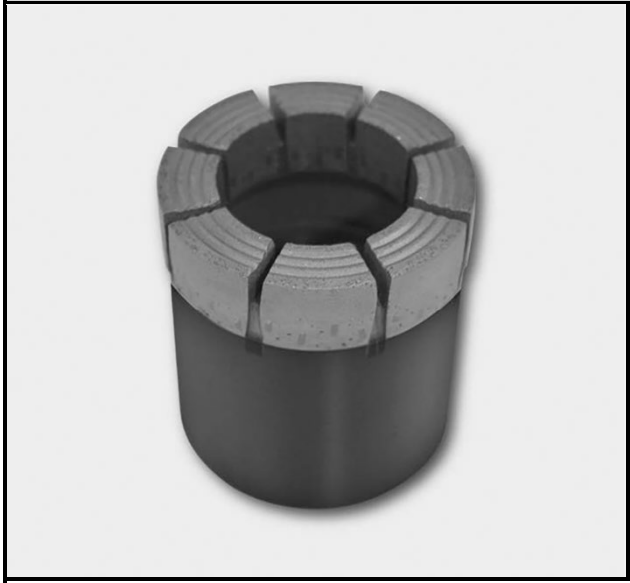
BITS – IMPREGNATED



The impregnated diamond bit is for cutting medium to ultra-hard formations. They utilize various powdered metals mixed with synthetic diamond grits and are reinforced with carbide and diamond. This allows the bit to drill all types of formations. The impregnated diamond bit can be matched to the job ranging from broken and highly abrasive to fine-grained, consolidated and ultra-hard rock. The bit resharpens as it drills, renewing the cutting edges. New diamond layers are exposed as the matrix wears away. Several waterway designs are available for different type of formations and conditions. The impregnated bit is not designed to drill through overburden.

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BITS – IMPREGNATED

Selecting an impregnated diamond bit.

Where to get started.

What is the competency of the formation?

If it is fractured or broken, a lower series # bit is recommended due to the abrasiveness of the rock. For a competent formation, a higher series # bit is suggested where a softer matrix is utilized for proper diamond exposure and matrix erosion.

What is the torque output of the drill rig?

If a machine has low torque output, then a higher series # bit ought to be used because of the higher RPM output. A lower series # bit may perform better with a high torque machine that optimizes the available RPMs.

What is the hardness of the rock?

(see Moh's Scale of Hardness)

When drilling in soft rock, a lower series # bit is more resistant to the abrasive conditions which extends bit life and increases penetration rates. A higher series # bit is more productive in hard rock conditions where the softer matrix wears exposing new diamonds to the rock formation.

Once these criteria have been evaluated and the bit has been selected and used, record the footage, wear pattern and penetration rates.

Continue to use bit if successful or re-evaluate your selection for a different bit.

Adjustments?

If penetration rate is slow, try a higher series # bit.
If the bit life is short, try a lower series # bit.

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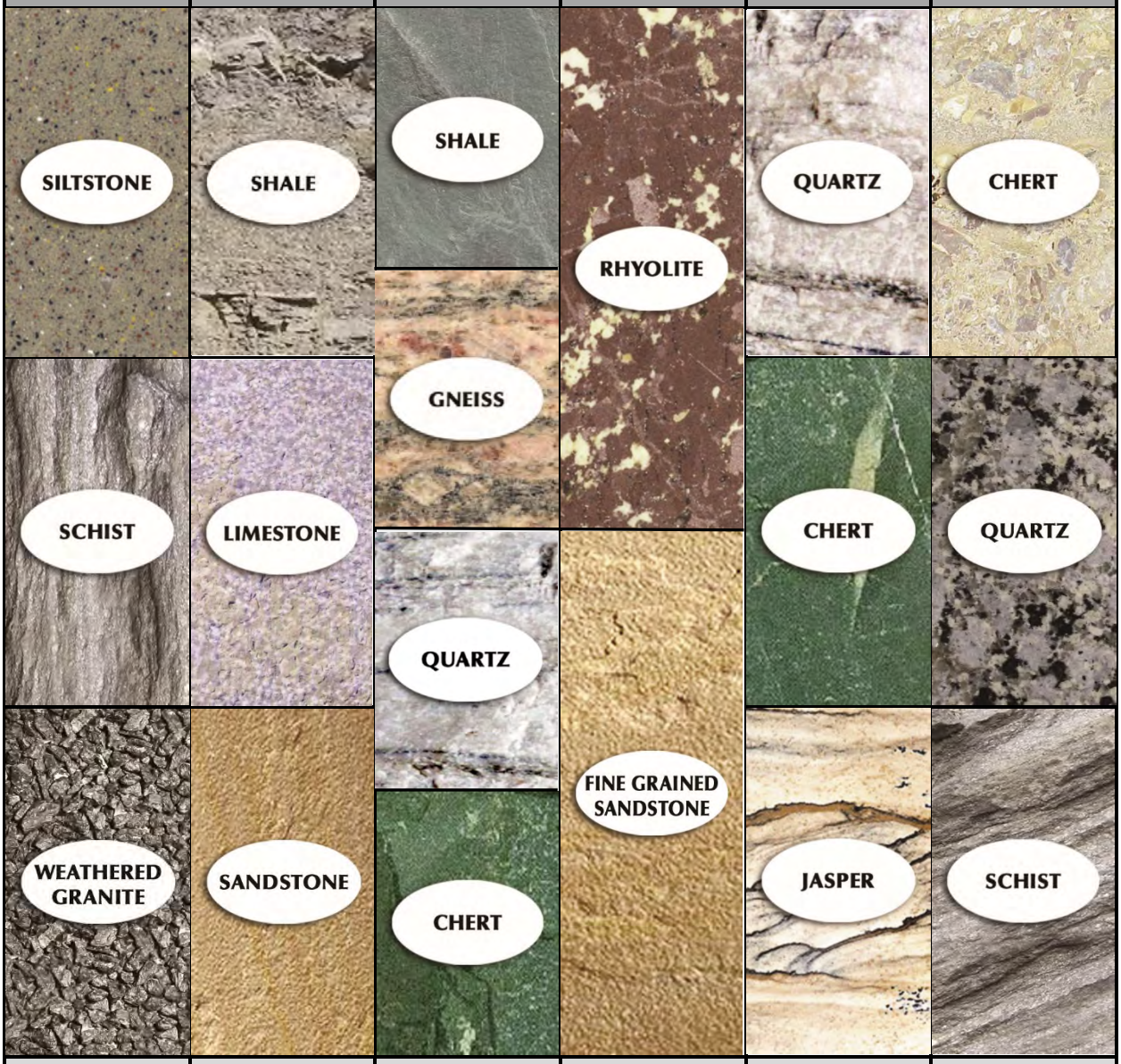
BITS – IMPREGNATED SELECTION GUIDE



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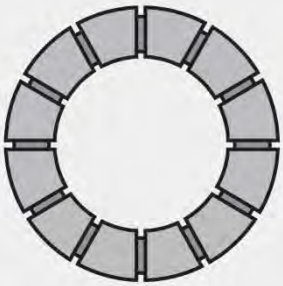
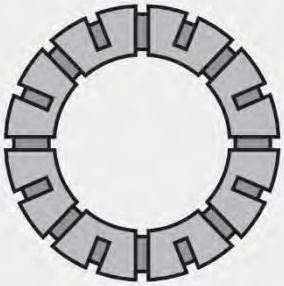
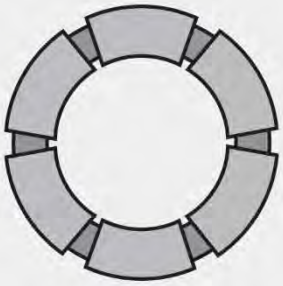
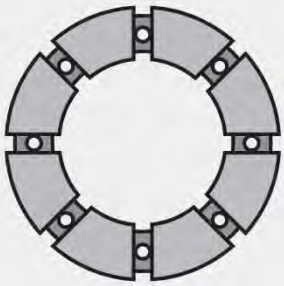
BITS – IMPREGNATED	
Waterway Configuration	
	**Standard Waterways, longest life**
	**Hydra Waterways, faster penetration, reduced down pressure required**
	**Tapered Waterways, helps push cuttings to the OD and reduces pressure across bit face**
	**Face Discharge Waterways, has the benefit of reducing fluid pressure to the ID and redirects it to the face of the bit (reduce core wash)**

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BITS – IMPREGNATED

Operating Recommendations

We recommend flexible guidelines for running impregnated diamond bits that take into account the many operating variables such as fluid flow, rpm and weight-on-bit. This approach, in combination with formation characteristics, maximizes bit life and penetration rate.

Drilling Fluid

Formation characteristics and penetration rate will dictate proper fluid make-up and flow. With an increase in penetration rate, fluid flow should be increased to properly clean the bit. The cuttings generated by an impregnated bit abrade the metal matrix around the diamonds, which plays an important role in keeping the bit sharp. Conversely, if the cuttings are washed away too quickly, the metal matrix will not wear away fast enough to properly expose new diamond surfaces, and the bit will polish, reducing performance.

Rotation Speed

In general, impregnated diamond bits should be run at higher rotational speeds (rpm) than similar size surface set diamond bits. Maximum bit performance is achieved by running the impregnated bit as fast as conditions allow, without vibration caused by high rotation speed.

Weight-On-Bit

Optimum weight-on-bit, combined with proper rotation speed, fluid flow and penetration rate provides for a balanced system. The least possible weight-on-bit that maintains efficient penetration rates should be used. Applying insufficient weight results in polishing the diamonds, while too much weight, over a prolonged period, may damage the bit. When the bit fails to penetrate after adjusting weight-on-bit, rpm, or fluid flow, a different bit should be selected which is designed for drilling harder rock.

Operating Observations

- Stable, smooth, vibration free rotation optimizes bit cutting efficiency. Reaming shells and stabilized core barrel outer tubes should provide improved bit performance.
- Experience indicates that optimum rotation speeds for impregnated bits in wireline applications should be 400 rpms or greater for N sized bits.
- While bit lubrication with a polymer or water soluble oil mixture is helpful, high fluid viscosity can create a cushion between the bit and formation, resulting in poor performance.

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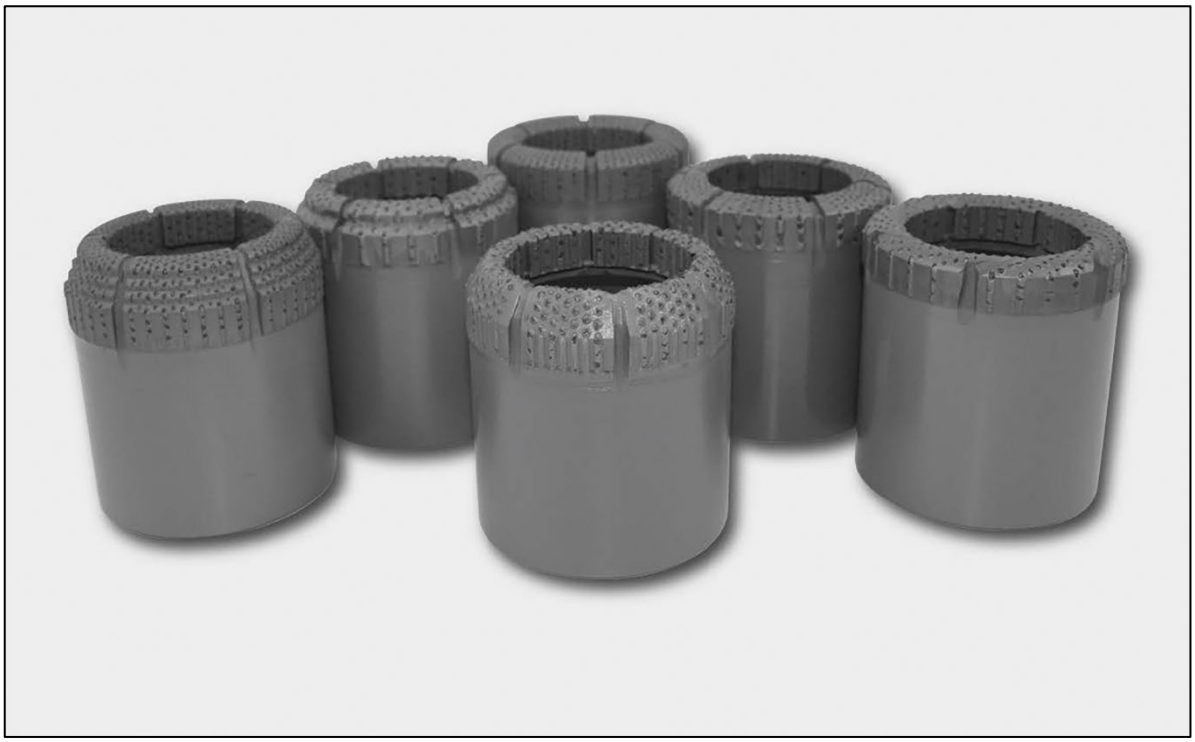

CME Surface Set Diamond Bits

The surface set diamond bit is for coring soft to medium hard formations where impregnated diamond bits are less effective. They are set with a single layer of natural diamonds in a tungsten carbide matrix with diamond and carbide reinforcements. They are recommended for relatively soft, unconsolidated formations and harder formations where the RPMs and bit loads required for impregnated bits are not available. The surface set bit is not ideal for ultra-hard formations and are not recommended.

The choice of a Surface Set Bit will be dictated by the rock type. The diamond size, crown design and matrix hardness used will be determined by the hardness of the formation. The friability of the core will determine the type of fluid passages. The surface set bit provides a greater exposure of diamonds than the impregnated bit and, therefore, faster penetration in soft formations.

Surface Set Bits are available in 8spc, 15spc, 25spc, 40spc, and 40/60spc-step diamond sizes (SPC=stones per carat). Other diamond sizes are available upon request.

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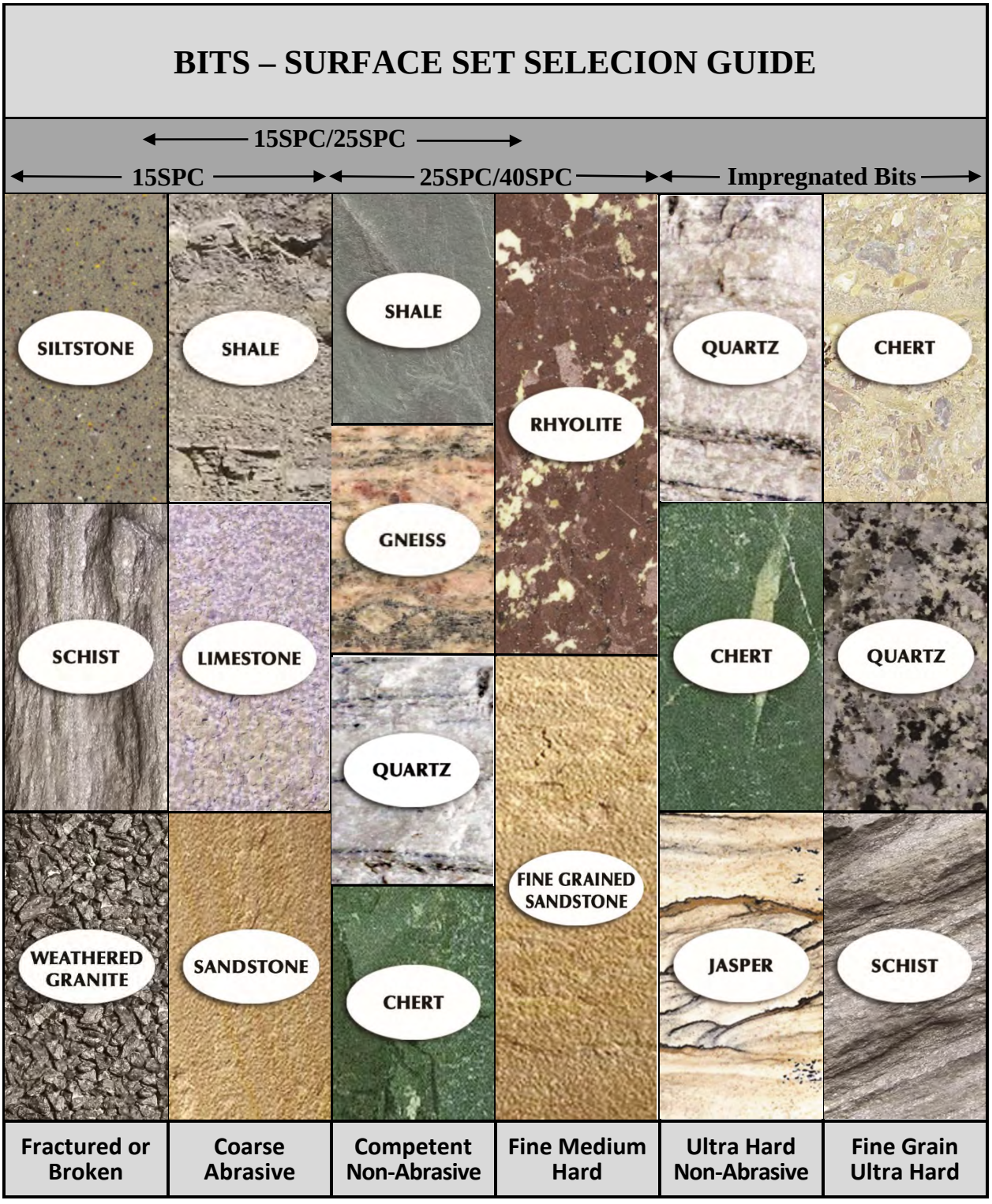
BITS – SURFACE SET SELECION GUIDE



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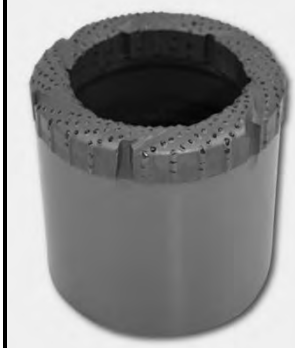
BITS – SURFACE SET



CME SR 8

The 8 stone per carat bit applies the advantage of diamond cutting power to drilling in exceptionally soft, friable formations.

Using natural diamonds and extra hard matrix, extended bit life is achieved in formations that tend to abraid the matrix.

CME MR 15

Designed for coring in badly fractured, soft to moderately hard formations, this bit utilizes a hard matrix and a pilot crown design which stabilizes the cutting face and minimizes hole deviation and vibration. The 15 stone per carat bit with natural diamonds uses a controlled diamond exposure for increased drilling efficiency.

CME MR 25

This bit configuration is designed for coring fractured, medium to hard formations. A hard matrix and natural diamonds, extend bit life and resists abrasion. The modified pilot crown is designed for stability and permits diamonds to be set over a comparatively regular surface to increase load per stone. This coupled with controlled diamond exposure optimizes cutting efficiency.

Reinforced waterways contribute OD and ID strength, minimizing matrix and waterway erosion while providing flushing and cooling of a predetermines diamond pad area.

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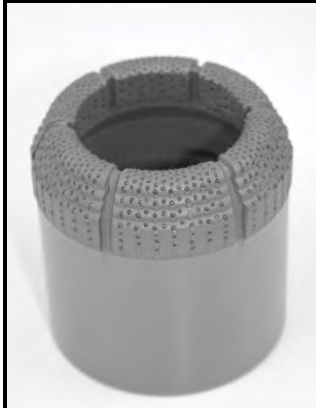
BITS – SURFACE SET

CME HR 40

This bit provides excellent performance in coring medium-hard to hard broken formations. The diamonds are set in a hard matrix, balancing the need for cutting power with abrasive resistance and ductility.

The semi-round crown provides a reduced area over which diamonds can be set. The resulting smaller crown area in contact with the formation improves cutting efficiency and increases penetration. Optimum unit loading of the diamonds keeps them cutting in hard rock.



CME HR 40-60 STEP

Hard solid formations are drilling territory for this design which is set with a size blend of natural diamonds. By using a medium concentration of diamonds, cutting efficiency and penetration are optimized allowing maximum loading of the diamonds to keep them cutting. The tapered step crown design of this bit provides good stability and fast penetration. Free cutting is enhanced by this design, facilitating constant mechanical fracturing and chipping of the formation.

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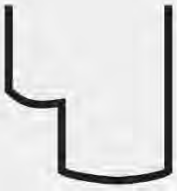
BITS – SURFACE SET

Bit Profiles

 **#2 A CROWN**	 **#4 W CROWN**	 **#5 FLAT W CROWN**
 **#8 MODIFIED PILOT**	 **#9 WIDE PILOT**	 **#10 NARROW PILOT**
 **#11 WIDE STEP** **# OF STEPS OPTIONAL**	 **#12 NARROW STEP**	 **#13 TAPERED CROWN**

NOTE: Other crown types for special applications are available upon request.

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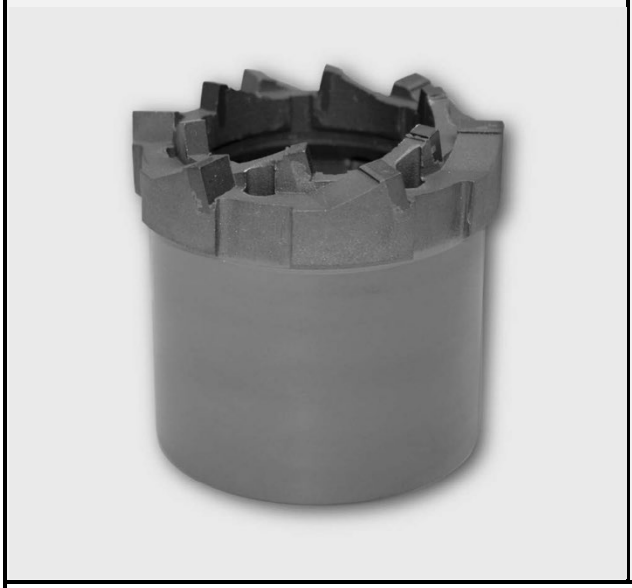
BITS – TUNGSTEN CARBIDE

Carbide Tooth	Tuff-Kut Carbide Chip
	

The Carbide Tooth core bit is designed to cut soft formations with very small gravel, sticky shales or clay. The tooth bit is provided in 2 styles, Full Sawtooth or Staggered Tooth. Tungsten carbide inserts are selectively placed in the carbide matrix. Waterways are designed for optimum discharge of fluid and aid in controlling matrix abrasion to maximize cutting efficiency and penetration. The carbide bits will not drill hard formations and are constructed with single layer cutting elements. The bit is also available with face discharge ports to reduce washing of the core.

The Tuff-Kut core bit is for general drilling in soft formations such as clay, sand, gypsum or soft shale. The matrix is comprised of tungsten carbide chips suspended in the metal alloy. This bit is similar to an impregnated diamond bit in that the crown is composed of several layers of cutting media. As the bit wears new layers of randomly set carbide chips are exposed. The Tuff-Kut bit is also used to clean steel fragments from existing drill holes.

An oversized bit gage is highly recommended (but not mandatory) for these bits. Oversized bits will not permit passage thru the corresponding casing (i.e. N size bit thru NW casing).

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BITS – PDC (Polycrystalline Diamond Compact)

PDC	GeoSet
	

PDC bits are for coring formations too soft and/or sticky for large stone diamond bits such as clay, shale, or sandstone to abrasive, broken siltstone or limestone. Disc shaped cutters consist of a layer of polycrystalline diamonds on a tungsten carbide base. The bit is set with 9 mm or 13 mm diameter cutters. Gage is maintained by natural diamond and hard facing. Waterways are designed for efficient cuttings removal. Oversized gage is highly recommended for these bits. PDC bits are primarily run on drills with high torque and low RPM output.

GeoSet bits are triangular shaped polycrystalline diamond cutters. These bits are designed for high performance in soft abrasive to medium hard formation. The crown design with its intermediate waterways allows for high volume cuttings removal and fast penetration.

Footnote: Attributes of these bits are fast penetration and long life.

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N W/L 1-7/8" CORE SIZE

Part No.	Bit Type	Matrix	Waterways		Bit OD"
C36500	Impregnated	#2	Standard		RSG-2.980
C36752	Impregnated	#2	Tapered-Air		3.125
220787	Impregnated	#4	Standard		RSG-2.980
C36501	Impregnated	#6	Standard		RSG-2.980
C36571	Impregnated	#6	Hydra		RSG-2.980
C36691	Impregnated	#6	Tapered-Air		3.125
C36587	Impregnated	#6-Ultra	Hydra		RSG-2.980
220599	Impregnated	#7	Face Discharge		RSG-2.980
220600	Impregnated	#7	Tapered-Air		3.125
C36502	Impregnated	#8	Standard		RSG-2.980
C36572	Impregnated	#8	Hydra		RSG-2.980
C36692	Impregnated	#8	Tapered-Air		3.125
C36588	Impregnated	#8-Ultra	Hydra		RSG-2.980
220778	Impregnated	#8-Ultra	Tapered-Air		3.125
220811	Impregnated	#9	Standard		RSG-2.980
C36689	Impregnated	#9	Hydra		RSG-2.980
C36730	Impregnated	#10	Standard		RSG-2.980
C36699	Impregnated	#10	Hydra		RSG-2.980
C36760	Impregnated	#10	Tapered-Air		3.125
C36639	Impregnated	#10-Ultra	Hydra		RSG-2.980
Part No.	**Bit Type**	**Stone Size**	**Waterways**	**Crown**	**Bit OD"**
C36504	Surface Set	8SPC	Spiral	#4 Semi Round	RSG-2.980
P36505	Surface Set	15SPC	Standard	#9 Wide Step	RSG-2.980
P36750	Surface Set	15SPC	Deep ID-Expand	#13 Tapered	RSG-2.980
C36749	Surface Set	15SPC	Face Discharge	#9 Wide Step	RSG-2.980
P36669	Surface Set	15SPC	Deep ID-Expand	#13 Tapered	3.125
P36506	Surface Set	25SPC	Standard	#8 Mod-Step	RSG-2.980
P36733	Surface Set	25SPC	Deep ID-Expand	#13 Tapered	RSG-2.980
P36680	Surface Set	25SPC	Deep ID-Expand	#13 Tapered	3.125
P36507	Surface Set	40SPC	Standard	#4 Semi Round	RSG-2.980
C36547	Surface Set	60/40	Standard	#11 3-Step	RSG-2.980
Part No.	**Bit Type**	**Crown**	**Waterways**		**Bit OD"**
C36568	Tungsten Carbide	Chip	Standard		RSG-2.980
C36560	Tungsten Carbide	Staggered	Standard		RSG-2.980
C36564	Tungsten Carbide	Staggered	Standard		3.125
C36577	Tungsten Carbide	Staggered	Face Discharge		RSG-2.980
C36581	Tungsten Carbide	Staggered	Face Discharge		3.125
Part No.	**Bit Type**	**Cutters**	**Waterways**		**Bit OD"**
220631	PDC	6	Deep ID		3.125
220580	PDC	6	Deep ID		3.25
220827	GeoSet	80	Deep ID		RSG-2.980

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N W/L2 2" CORE SIZE					
Part No.	**Bit Type**	**Matrix**	**Waterways**		**Bit OD"**
C36508	Impregnated	#2	Standard		RSG-2.980
220577	Impregnated	#4	Standard		RSG-2.980
C36509	Impregnated	#6	Standard		RSG-2.980
C36555	Impregnated	#6	Hydra		RSG-2.980
C36589	Impregnated	#6 Ultra	Hydra		RSG-2.980
C36745	Impregnated	#6	Spiral		RSG-2.980
220800	Impregnated	#6	Tapered-Air		RSG-2.980
220676	Impregnated	#6	Internal Discharge		RSG-2.980
C36747	Impregnated	#6	Tapered-Air		3.125
C36667	Impregnated	#7	Standard		RSG-2.980
C36672	Impregnated	#7-Spec	Standard		RSG-2.980
C36510	Impregnated	#8	Standard		RSG-2.980
C36556	Impregnated	#8	Hydra		RSG-2.980
C36590	Impregnated	#8 Ultra	Hydra		RSG-2.980
C36746	Impregnated	#8	Spiral		RSG-2.980
C36761	Impregnated	#8	Tapered-Air		3.125
220694	Impregnated	#8	Hydra		3.125
C36670	Impregnated	#10	Standard		RSG-2.980
C36640	Impregnated	#10 Ultra	Hydra		RSG-2.980
220699	Impregnated	#10	Tapered-Air		3.125
Part No.	**Bit Type**	**Stone Size**	**Waterways**	**Crown**	**Bit OD"**
C36655	Surface Set	8SPC	Spiral	#4 Semi Round	RSG-2.980
P36513	Surface Set	15SPC	Standard	#9 Wide Step	RSG-2.980
P36666	Surface Set	15SPC	Spiral	#4 Semi Round	RSG-2.980
P36690	Surface Set	15SPC	Standard	#13 Tapered	RSG-2.980
220824	Surface Set	15SPC	Face Discharge	#9 Wide Step	RSG-2.980
P36694	Surface Set	15SPC	Deep ID-Expand	#13 Tapered	3.125
P36514	Surface Set	25SPC	Standard	#8 Mod-Step	RSG-2.980
220712	Surface Set	25SPC	Deep ID-Expand	#13 Tapered	RSG-2.980
P36515	Surface Set	40SPC	Standard	#4 Semi Round	RSG-2.980
P36546	Surface Set	60/40	Standard	#11 3-Step	RSG-2.980
Part No.	**Bit Type**	**Crown**	**Waterways**		**Bit OD"**
C36557	Tungsten Carbide	Chip	Standard		RSG-2.980
C36561	Tungsten Carbide	Staggered	Standard		RSG-2.980
C36565	Tungsten Carbide	Staggered	Standard		3.125
C36578	Tungsten Carbide	Staggered	Face Discharge		RSG-2.980
C36582	Tungsten Carbide	Staggered	Face Discharge		3.125
Part No.	**Bit Type**	**Cutters**	**Waterways**		**Bit OD"**
220810	PDC	6	Deep ID		RSG-2.980
220830	PDC	6	Deep ID		3.125
220506	GeoSet	80	Deep ID		RSG-2.980
220826	GeoSet	80	Deep ID		3.125

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N W/L3 1-3/4" CORE SIZE

Part No.	Bit Type	Matrix	Waterways		Bit OD"
C36624	Impregnated	#2	Standard		RSG-2.980
220613	Impregnated	#2	Face Discharge		RSG-2.980
C36625	Impregnated	#6	Standard		RSG-2.980
C36748	Impregnated	#6	Hydra		RSG-2.980
220614	Impregnated	#6	Face Discharge		RSG-2.980
C36626	Impregnated	#8	Standard		RSG-2.980
220704	Impregnated	#8	Hydra		RSG-2.980
C36671	Impregnated	#10	Standard		RSG-2.980
220705	Impregnated	#10	Hydra		RSG-2.980
Part No.	**Bit Type**	**Stone Size**	**Waterways**	**Crown**	**Bit OD"**
C36631	Surface Set	8SPC	Spiral	#4 Semi Round	RSG-2.980
C36627	Surface Set	15SPC	Standard	#9 Wide Step	RSG-2.980
C36738	Surface Set	15SPC	Deep ID-Expand	#13 Tapered	3.125
C36649	Surface Set	25SPC	Spiral	#4 Semi Round	RSG-2.980
P36628	Surface Set	25SPC	Standard	#8 Mod-Step	RSG-2.980
P36629	Surface Set	40SPC	Standard	#4 Semi Round	RSG-2.980
P36630	Surface Set	60/40SPC	Standard	#11 3-Step	RSG-2.980
Part No.	**Bit Type**	**Crown**	**Waterways**		**Bit OD"**
C36636	Tungsten Carbide	Chip	Standard		RSG-2.980
C36637	Tungsten Carbide	Chip	Standard		3.125
C36632	Tungsten Carbide	Staggered	Standard		RSG-2.980
C36633	Tungsten Carbide	Staggered	Standard		3.125
C36634	Tungsten Carbide	Staggered	Face Discharge		RSG-2.980
C36635	Tungsten Carbide	Staggered	Face Discharge		3.125
Part No.	**Bit Type**	**Cutters**	**Waterways**		**Bit OD"**
220822	PDC	9	Deep ID		3.25
220507	GeoSet	90	Deep ID		RSG-2.980
220785	GeoSet	90	Deep ID		3.125
220798	GeoSet	90	Deep ID		3.25

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NWD4 2.06" CORE SIZE					
Part No.	**Bit Type**	**Matrix**	**Waterways**		**Bit OD"**
C36516	Impregnated	#2	Standard		RSG-2.980
C36753	Impregnated	#2	Tapered-Air		3.125
C36517	Impregnated	#6	Standard		RSG-2.980
C36573	Impregnated	#6	Hydra		RSG-2.980
C36591	Impregnated	#6 Ultra	Hydra		RSG-2.980
C36687	Impregnated	#6	Tapered-Air		3.125
C36518	Impregnated	#8	Standard		RSG-2.980
C36574	Impregnated	#8	Hydra		RSG-2.980
C36592	Impregnated	#8 Ultra	Hydra		RSG-2.980
C36685	Impregnated	#8	Tapered-Air		3.125
220665	Impregnated	#8 Ultra	Hydra		3.125
C36623	Impregnated	#10	Standard		RSG-2.980
C36641	Impregnated	#10 Ultra	Hydra		RSG-2.980
C36698	Impregnated	#10	Tapered-Air		3.125
Part No.	**Bit Type**	**Stone Size**	**Waterways**	**Crown**	**Bit OD"**
C36520	Surface Set	8SPC	Spiral	#4 Semi Round	RSG-2.980
P36521	Surface Set	15SPC	Standard	#9 Wide Step	RSG-2.980
P36736	Surface Set	15SPC	Deep ID-Expand	#13 Tapered	3.125
220768	Surface Set	15SPC	Face Discharge	#9 Wide Step	RSG-2.980
P36758	Surface Set	25SPC	Deep ID-Expand	#13 Tapered	3.125
P36522	Surface Set	25SPC	Standard	#8 Mod-Step	RSG-2.980
P36523	Surface Set	40SPC	Standard	#4 Semi Round	RSG-2.980
P36548	Surface Set	60/40SPC	Standard	#11 3-Step	RSG-2.980
Part No.	**Bit Type**	**Crown**	**Waterways**		**Bit OD"**
C36569	Tungsten Carbide	Chip	Standard		RSG-2.980
C36562	Tungsten Carbide	Staggered	Standard		RSG-2.980
C36566	Tungsten Carbide	Staggered	Standard		3.125
C36579	Tungsten Carbide	Staggered	Face Discharge		RSG-2.980
C36583	Tungsten Carbide	Staggered	Face Discharge		3.125
Part No.	**Bit Type**	**Cutters**	**Waterways**		**Bit OD"**
220821	PDC	6	Face Discharge		RSG-2.980
220836	PDC	6	Deep ID		3.125
220816	PDC	6	Deep ID	Pilot	3.125
220843	GeoSet	90	Deep ID		3.125

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NXB 1.875" CORE SIZE

Part No.	Bit Type	Matrix	Waterways		Bit OD"
C36524	Impregnated	#2	Standard		RSG-2.980
C36525	Impregnated	#6	Standard		RSG-2.980
C36575	Impregnated	#6	Hydra		RSG-2.980
C36593	Impregnated	#6 Ultra	Hydra		RSG-2.980
C36526	Impregnated	#8	Standard		RSG-2.980
C36576	Impregnated	#8	Hydra		RSG-2.980
C36594	Impregnated	#8 Ultra	Hydra		RSG-2.980
C36642	Impregnated	#10 Ultra	Hydra		RSG-2.980
Part No.	**Bit Type**	**Stone Size**	**Waterways**	**Crown**	**Bit OD"**
C36528	Surface Set	8SPC	Spiral	#4 Semi Round	RSG-2.980
C36529	Surface Set	15SPC	Standard	#9 Wide Step	RSG-2.980
220581	Surface Set	15SPC	Deep ID-Expand	#13 Tapered	3.125
C36530	Surface Set	25SPC	Standard	#8 Mod-Step	RSG-2.980
C36531	Surface Set	40SPC	Standard	#4 Semi Round	RSG-2.980
C36549	Surface Set	60/40SPC	Standard	#11 3-Step	RSG-2.980
Part No.	**Bit Type**	**Crown**	**Waterways**		**Bit OD"**
C36570	Tungsten Carbide	Chip	Standard		RSG-2.980
C36563	Tungsten Carbide	Staggered	Standard		RSG-2.980
C36567	Tungsten Carbide	Staggered	Standard		3.125
C36580	Tungsten Carbide	Staggered	Face Discharge		RSG-2.980
C36584	Tungsten Carbide	Staggered	Face Discharge		3.125

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H W/L 2.50" CORE SIZE

Part No.	Bit Type	Matrix	Waterways		Bit OD"
C36595	Impregnated	#2	Standard		RSG-3.782
220565	Impregnated	#2	Tapered-Air		3.900
C36596	Impregnated	#6	Standard		RSG-3.782
220547	Impregnated	#6	Standard		4.000
C36602	Impregnated	#6	Hydra		RSG-3.782
C36643	Impregnated	#6 Ultra	Hydra		RSG-3.782
220589	Impregnated	#6	Face Discharge		RSG-3.782
220566	Impregnated	#6	Tapered-Air		3.900
220567	Impregnated	#7	Standard		RSG-3.782
220818	Impregnated	#7-SPEC	Standard		RSG-3.782
220573	Impregnated	#7	Tapered-Air		3.900
C36597	Impregnated	#8	Standard		RSG-3.782
C36603	Impregnated	#8	Hydra		RSG-3.782
C36644	Impregnated	#8 Ultra	Hydra		RSG-3.782
220551	Impregnated	#8	Standard		3.900
C36743	Impregnated	#10	Standard		RSG-3.782
C36645	Impregnated	#10 Ultra	Hydra		RSG-3.782
Part No.	**Bit Type**	**Stone Size**	**Waterways**	**Crown**	**Bit OD"**
C36608	Surface Set	8SPC	Spiral	#4 Semi Round	RSG-3.782
220556	Surface Set	8SPC	Deep ID-Expand	#13 Tapered	3.900
P36598	Surface Set	15SPC	Standard	#9 Wide Step	RSG-3.782
220549	Surface Set	15SPC	Standard	#9 Wide Step	3.900
220525	Surface Set	15SPC	Face Discharge	#4 Semi Round	RSG-3.782
220530	Surface Set	15SPC	Face Discharge	#9 Wide Step	3.937
220723	Surface Set	15SPC	Face Discharge	#9 Wide Step	RSG-3.782
C36599	Surface Set	25SPC	Standard	#8 Mod-Step	RSG-3.782
220550	Surface Set	25SPC	Standard	#8 Mod-Step	3.900
C36600	Surface Set	40SPC	Standard	#4 Semi Round	RSG-3.782
C36601	Surface Set	60/40SPC	Standard	#11 3-Step	RSG-3.782
Part No.	**Bit Type**	**Crown**	**Waterways**		**Bit OD"**
C36606	Tungsten Carbide	Chip	Standard		3.900
C36604	Tungsten Carbide	Staggered	Standard		3.900
220037	Tungsten Carbide	Sawtooth	Standard		3.900
C36605	Tungsten Carbide	Staggered	Face Discharge		3.900
220593	Tungsten Carbide	Chip	Face Discharge		3.900
Part No.	**Bit Type**	**Cutters**	**Waterways**		**Bit OD"**
220562	PDC	9	Deep ID		4.500
220819	PDC	9	Deep ID		3.930
220629	GeoSet	84	Deep ID		RSG-3.782

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H W/L3 2.40" CORE SIZE

Part No.	Bit Type	Matrix	Waterways		Bit OD"
C36545	Impregnated	#2	Standard		RSG-3.782
220594	Impregnated	#2	Face Discharge		RSG-3.782
C36610	Impregnated	#6	Standard		RSG-3.782
220686	Impregnated	#6	Internal Discharge		RSG-3.782
C36616	Impregnated	#6	Hydra		RSG-3.782
220534	Impregnated	#6	Face Discharge		RSG-3.782
220805	Impregnated	#6	Standard		3.900
C36611	Impregnated	#8	Standard		RSG-3.782
C36617	Impregnated	#8	Hydra		RSG-3.782
C36744	Impregnated	#8 Ultra	Spiral		RSG-3.782
C36656	Impregnated	#10	Standard		RSG-3.782
C36737	Impregnated	#10 Ultra	Hydra		RSG-3.782
Part No.	**Bit Type**	**Stone Size**	**Waterways**	**Crown**	**Bit OD"**
C36621	Surface Set	8SPC	Spiral	#4 Semi Round	RSG-3.782
P36754	Surface Set	15SPC	Deep ID-Expand	#13 Tapered	RSG-3.782
P36612	Surface Set	15SPC	Standard	#9 Wide Step	RSG-3.782
220540	Surface Set	15SPC	Face Discharge	#9 Wide Step	RSG-3.782
220763	Surface Set	15SPC	Deep ID-Expand	#13 Tapered	4.000
220806	Surface Set	15SPC	Deep ID-Expand	#13 Tapered	3.900
220775	Surface Set	15SPC	Face Discharge	#9 Wide Step	3.900
220659	Surface Set	15SPC	Deep ID-Expand	#9 Wide Step	3.900
P36613	Surface Set	25SPC	Standard	#8 Mod-Step	RSG-3.782
P36757	Surface Set	25SPC	Deep ID-Expand	#13 Tapered	RSG-3.782
C36614	Surface Set	40SPC	Standard	#4 Semi Round	RSG-3.782
P36615	Surface Set	60/40SPC	Standard	#11 3-Step	RSG-3.782
Part No.	**Bit Type**	**Crown**	**Waterways**		**Bit OD"**
C36620	Tungsten Carbide	Chip	Standard		3.900
C36618	Tungsten Carbide	Staggered	Standard		3.900
C36619	Tungsten Carbide	Staggered	Face Discharge		3.900
Part No.	**Bit Type**	**Cutters**	**Waterways**		**Bit OD"**
220833	PDC	6	Deep ID		3.895
220528	PDC	6	Deep ID		3.900
220709	PDC	9	Deep ID		3.930
220764	PDC	9	Deep ID		4.000
220799	PDC	9	Deep ID		4.125
220616	PDC	9	Deep ID		4.500

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P W/L 3.345" CORE SIZE

Part No.	Bit Type	Matrix	Waterways		Bit OD"
C36700	Impregnated	#2	Standard		RSG-4.827
C36701	Impregnated	#6	Standard		RSG-4.827
C36708	Impregnated	#6	Hydra		RSG-4.827
220795	Impregnated	#6	Face Discharge		RSG-4.827
220797	Impregnated	#6	Standard		6.000
C36702	Impregnated	#8	Standard		RSG-4.827
C36709	Impregnated	#8	Hydra		RSG-4.827
C36732	Impregnated	#8 Ultra	Hydra		RSG-4.827
220667	Impregnated	#8	Standard		4.950
220668	Impregnated	#10	Standard		4.950
Part No.	**Bit Type**	**Stone Size**	**Waterways**	**Crown**	**Bit OD"**
C36713	Surface Set	8SPC	Spiral	#4 Semi Round	RSG-4.827
220672	Surface Set	8SPC	Spiral	#4 Semi Round	5.000
P36703	Surface Set	15SPC	Standard	#9 Wide Step	RSG-4.827
220641	Surface Set	15SPC	Face Discharge	#9 Wide Step	RSG-4.827
C36740	Surface Set	15SPC	Standard	#9 Wide Step	4.950
C36704	Surface Set	25SPC	Standard	#8 Mod-Step	RSG-4.827
220563	Surface Set	25SPC	Face Discharge	#8 Mod-Step	RSG-4.827
220724	Surface Set	25SPC	Standard	#4 Semi Round	5.500
220669	Surface Set	25SPC	Standard	#8 Mod-Step	4.950
C36705	Surface Set	40SPC	Standard	#4 Semi Round	RSG-4.827
P36706	Surface Set	40SPC	Standard	#9 Wide Step	RSG-4.827
P36707	Surface Set	60/40SPC	Standard	#11 3-Step	RSG-4.827
Part No.	**Bit Type**	**Crown**	**Waterways**		**Bit OD"**
C36712	Tungsten Carbide	Chip	Standard		5.250
C36710	Tungsten Carbide	Staggered	Standard		5.250
C36711	Tungsten Carbide	Staggered	Face Discharge		5.250
220671	Tungsten Carbide	Sawtooth	Standard		5.250

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P W/L3 3.270" CORE SIZE

Part No.	Bit Type	Matrix	Waterways		Bit OD"
C36717	Impregnated	#2	Standard		RSG-4.827
220729	Impregnated	#2	Face Discharge		RSG-4.827
C36718	Impregnated	#6	Standard		RSG-4.827
C36724	Impregnated	#6	Hydra		RSG-4.827
220693	Impregnated	#6	Face Discharge		RSG-4.827
220802	Impregnated	#6	Standard		5.125
C36719	Impregnated	#8	Standard		RSG-4.827
C36725	Impregnated	#8	Hydra		RSG-4.827
220620	Impregnated	#8 Ultra	Hydra		RSG-4.827
220670	Impregnated	#10	Hydra		RSG-4.827
220688	Impregnated	#10 Ultra	Hydra		RSG-4.827
Part No.	**Bit Type**	**Stone Size**	**Waterways**	**Crown**	**Bit OD"**
C36729	Surface Set	8SPC	Spiral	#4 Semi Round	RSG-4.827
220663	Surface Set	8SPC	Face Discharge	#4 Semi Round	RSG-4.827
220662	Surface Set	15SPC	Face Discharge	#4 Semi Round	RSG-4.827
C36720	Surface Set	15SPC	Standard	#9 Wide Step	RSG-4.827
220591	Surface Set	15SPC	Face Discharge	#9 Wide Step	RSG-4.827
220750	Surface Set	15SPC	Standard	#9 Wide Step	4.950
C36721	Surface Set	25SPC	Standard	#8 Mod-Step	RSG-4.827
P36722	Surface Set	40SPC	Standard	#4 Semi Round	RSG-4.827
P36723	Surface Set	60/40SPC	Standard	#11 3-Step	RSG-4.827
Part No.	**Bit Type**	**Crown**	**Waterways**		**Bit OD"**
220777	Tungsten Carbide	Chip	Standard		RSG-4.827
C36728	Tungsten Carbide	Chip	Standard		5.250
220643	Tungsten Carbide	Staggered	Standard		RSG-4.827
C36726	Tungsten Carbide	Staggered	Standard		5.250
C36727	Tungsten Carbide	Staggered	Face Discharge		5.250
Part No.	**Bit Type**	**Cutters**	**Waterways**		**Bit OD"**
220701	PDC	9	Deep ID		5.000

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CASING & ROD SHOES

Impregnated	Carbide Tooth	Tuff-Kut
		

Casing or wireline rod shoes are used to seat casing or wireline rod into the rock to maintain fluid control during core or rotary drilling applications.

Shoes are designed in several configurations which include: Diamond Impregnated (Standard or Heavy Duty), Surface Set, Carbide Tooth and Tuff-Kut.

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FLUSH JOINT CASING SHOES

Size	Part No.	Type	Matrix	O.D.
NW	C36542	Impregnated	Standard	3.615"
NW	C36552	Impregnated	Series 2	3.615"
NW	220719	Impregnated	Series 6	3.615"
NW	220555	Impregnated	Series 8	3.900"
NW	C36646	Impregnated-Advancer	Series 2	3.750"
NW	220715	Impregnated-Advancer	Series 2	4.000"
NW	C36765	Impregnated-Advancer-Geo	Series 2	3.750"
NW	220615	Surface Set	MR35	3.615"
NW	220569	Surface Set-Advancer	MR35	3.750"
NW	C36682	TC-Chip-Advancer		3.750"
NW	C36731	TC-Sawtooth		3.750"
HW	C36543	Impregnated	Standard	4.625"
HW	C36553	Impregnated	Series 2	4.625"
HW	220780	Impregnated	Series 2	5.250"
HW	C36647	Impregnated-Advancer	Series 2	4.750"
HW	220745	Impregnated-Advancer	Series 2	5.000"
HW	220731	Impregnated-Advancer-Geo	Series 2	4.750"
HW	220685	TC-Chip-Advancer		4.750"
HW	220578	TC-Sawtooth		4.750"
HWT	C36551	Impregnated	Standard	4.625"
HWT	C36554	Impregnated	Series 2	4.625"
HWT	C36648	Impregnated-Advancer	Series 2	4.750"
HWT	220732	Impregnated-Advancer-Geo	Series 2	4.750"
HWT	C36659	TC-Chip-Advancer		4.750"
HWT	220535	TC-Sawtooth-Advancer		4.750"
PW	C36674	Impregnated	Standard	5.650"
PW	C36734	Impregnated-Advancer	Series 2	5.750"
PW	C36675	TC-Chip-Advancer		5.750"
PWT	C36751	Impregnated	Standard	5.650"
PWT	C36735	Impregnated-Advancer	Series 2	5.750"
PWT	220760	TC-Chip-Advancer		5.750"
SW	C36693	Impregnated	Standard	6.790"
SW	220779	Impregnated	Series 2	6.790"
SW	220517	TC-Chip-Advancer		6.875"

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WIRELINE ROD SHOES

Size	Part No.	Type	Matrix	O.D.
N W/L	C36677	Impregnated	Standard	2.980"
N W/L	220664	TC-Sawtooth		2.980"
H W/L	C36651	Impregnated	Standard	3.615"
H W/L	C36652	Impregnated	Series 2	3.615"
H W/L	C36653	Surface Set	MR35	3.615"
H W/L	C36660	TC-Chip-Advancer		3.750"
H W/L	C36676	Impregnated-Advancer	Series 2	3.750"
H W/L	220612	TC-Insert		3.615"

NOTE: Other sizes available upon request.
The shoes listed above are normally kept in stock for immediate shipment.
Advancer Impregnated HD is required for the casing advancer system.

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REAMER SHELLS

Standard	Heavy Duty
	

Reamer shells connect the core bit to a core barrel. The outside surface of the reamer shell can be inset with diamonds or hard facing to maintain the gage of the hole as the O.D. of the core bit wears. The proper hole gage is critical. If the hole gage is reduced, the cuttings may not be flushed from the face of the bit. This can result in core grinding. In extreme cases, the core barrel may become difficult or even impossible to remove from the hole. Reamer shells are available in a standard or a heavy duty design.

Note: Oversized, blank, and hardfaced reamer shells are also available.

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REAMER SHELLS

Size	Part No.	Type	O.D.
N W/L	C36532	Diamond-Standard	2.980"
N W/L	C36539	Hardfaced	2.980"
N W/L	C36650	Diamond-HD-Spiral	2.980"
N W/L	C36681	Blank	2.910"
N W/L	C36755	Diamond-Standard	3.125"
NWD4	C36533	Diamond-Standard	2.980"
NWD4	C36540	Hardfaced	2.980"
NWD4	C36742	Blank	2.910"
NWD4	C36763	Diamond-Standard	3.125"
NXB	C36534	Diamond-Standard	2.980"
NXB	C36541	Hardfaced	2.980"
H W/L	C36544	Diamond-Standard	3.782"
H W/L	C36607	Hardfaced	3.782"
H W/L	C36697	Diamond-HD-Spiral	3.782"
H W/L	220010	Blank	3.683"
H W/L	220552	Diamond-HD-Spiral	3.900"
P W/L	C36716	Diamond-Standard	4.827"
P W/L	C36715	Hardfaced	4.827"
P W/L	C36714	Blank	4.745"
P W/L	C36741	Diamond-Standard	4.950"

Note: Oversized shells are available upon request.
The Reamer Shells listed above are normally kept in stock for immediate shipment.

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BIT SET DIMENSIONS

CORE BARREL	BIT DIMENSIONS		CORE BARREL	BIT DIMENSIONS	
Size	O.D. RSG	I.D.	Size	O.D. RSG	I.D.
EWG, EWM*	1.485	.845	HWD-4	3.650	2.400
AWG, AWM*	1.890	1.185	HXB, HWC-3	3.650	2.400
A W/L, AV	1.890	1.062	H W/L	3.782	2.500
BWG, BWM*	2.360	1.655	H W/L3	3.782	2.406
BWD-4	2.360	1.615	P W/L	4.827	3.345
BXB, BWC-3	2.360	1.432	P W/L3	4.827	3.270
B W/L, BV	2.360	1.432	2.75 X 3.875*	3.875	2.690
NWG, NWM*	2.980	2.155	3 X 4.625	-	3.000
NWD-3, NWD-4	2.980	2.060	4 X 5.125	5.125	3.922
NXB, NWC-3	2.980	1.875	4 X 5.5*	5.495	3.970
N W/L, NV	2.980	1.875	4 X 5.75	-	3.970
N W/L2	2.980	1.995	6 X 7.125	7.125	5.922
NXE	2.980	1.995	6 X 7.75*	7.750	5.970
N W/L3	2.980	1.775	6.5 X 7.875	7.875	6.547
HWG*	3.907	3.000			

SHOE SET DIMENSIONS

CASING	SHOE DIMENSIONS		CASING	SHOE DIMENSIONS	
Size	O.D.	I.D.	Size	O.D.	I.D.
RW*	1.485	1.185	HW/HWT*	4.625	3.975
EW*	1.875	1.495	PW*	5.650	4.852
AW*	2.345	1.900	SW*	6.790	5.937
BW*	2.965	2.370	UW*	7.800	6.905
NW*	3.615	2.992	ZW*	8.815	7.977

NOTE: * Conforms to DCDMA standards. All dimensions are in inches.

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USE & CARE OF DIAMOND BITS

WHAT TO DO	WHY IT IS DONE
1. Be sure wrenches never contact the diamonds in bits and shells.	1. Broken stones will result. Diamonds will not stand this kind of abuse.
2. Use full circle grip inner & outer tube wrenches.	2. Avoid damaging or egg-shaping the tubular connections of the core barrel assembly.
3. Start a hole with a used bit whenever possible in slow feed at moderate RPMs.	3. The sharp points on a new bit may be broken on a rough rock surface.
4. Start water circulating before putting a bit on bottom.	4. To remove the cuttings which have settled in the bottom of the hole.
5. Start a new bit in an existing core hole 4-6 inches from bottom and drill it down.	5. The used bit it replaced may have been slightly under gage.
6. Run a new bit in slow feed and at moderate RPM for the first few inches.	6. To give the diamonds time to seat themselves in the rock.
7. Tighten all drill rod joints and wick when necessary, before lowering into the hole.	7. Wash water may escape through joints and the bit will burn in the sludge at bottom.
8. Grease core barrels and rods.	8. To prevent vibration and its hammering effect, which results in broken diamonds.
9. Avoid grinding core.	9. Grinding core rapidly destroys both bit and shell.
10. Remove lost core.	10. Running over loose core is very destructive to the bit.
11. Avoid dry blocking.	11. The heat generated in dry blocking can render a bit useless.
12. Never drop a bit on bottom.	12. Diamonds may shatter.
13. Never start bits turning under pressure.	13. This will damage the cutting points on the diamonds.
14. Make sure that fluid is circulating through the bit, before starting to drill.	14. Remember that time is required, particularly on deeper holes, for circulation to reach the bit.
15. When necessary to improve circulation in sticky ground, never raise the bit more than half an inch off bottom.	15. Short lengths of core may fall in the hole and damage the bit.
16. Maintain safe storage for bits and shells. They should be removed from the barrel, well oiled, and packed in a separate box.	16. Protects bits and shells from damage.

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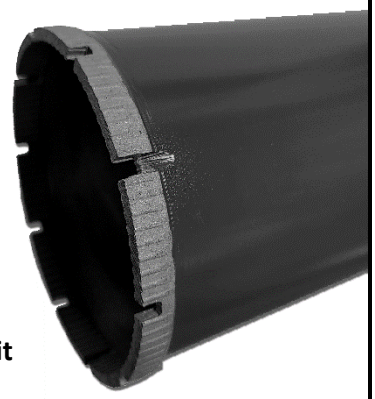
THIN WALL DIAMOND BITS
"MASONRY BITS"

Part No.	Description
220011	Maroon bit 4-1/4" OD
220021	Maroon bit 6-1/4" OD
220638	Segmented bit 4-1/4", Black 30
220644	Segmented bit 6-1/4", Black 30
220717	Segmented bit 8", Black 30
30725	Sub AWJ box 1.25-7 UNC pin
30755	Sub AW box 1.25-7 UNC pin
30797	Sub NWJ box 1.25-7 UNC pin

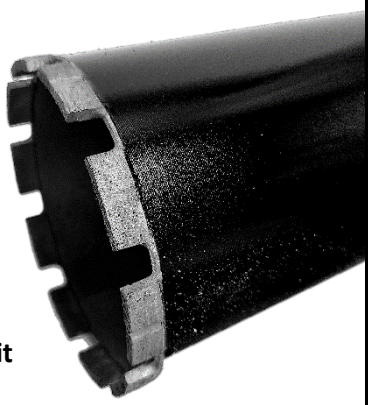
NOTE: These bits are stocked items. Other diameters available upon request.
Standard drill depth is 14", other drill depths are available on request.
Standard construction with closed head, open head with adaptor available on request.

Maroon Bit



- Highway-all purpose
- Asphalt/concrete
- Continuous crown
- 1"to 6-1/2" diameter

Segmented Bit



- Reinforced concrete where hardness is known
- Segmented crown
- 1/2" to 24" diameter

Options

- Orange - Pro 800 shortest crown height/life
- Black - Pro 1000 medium crown height/life
- Blue - Pro 1200 high crown height/life – Premium
- 10 - softest matrix, hard rock, B10 bond
- 30 - medium matrix, medium to hard rock, B30 bond
- 50 - hard matrix,asphalt or abrasive rock, B50 bond

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THIN WALL DIAMOND BITS
CORE DRILLING INFORMATION

TIPS FOR CORE DRILLING

Never rotate or spin the bit in the hole without applying drilling pressure. Spinning the bit in the hole can overheat the bit and glaze the segments.

When drilling through reinforcement steel (rebar), reduce the drilling pressure to approximately 1/3 and allow the bit to drill at its own rate. **DO NOT OVER PRESSURE THE BIT WHEN DRILLING THROUGH STEEL.**

When drilling in high PSI concrete or concrete with hard aggregate (i.e. flint, river rock, hard granite) the bit can glaze over. To reopen the bit, do one of the following:

- Decrease the water flow to 1/2 for a few minutes. As the bits penetration rate increases, slowly increase the water flow back to its original level.
- Slowly pour sand or sandblast media such as "Black Beauty" into the slurry. Then decrease the water flow to 1/2 for a few minutes. As the bits penetration rate increases, slowly increase the water flow back to its original level.
- Remove the bit from the hole and drill into a cement block or cinder block with sufficient water flow to form a wet paste-like slurry. Repeat this procedure until the bit is open.

CORING PROBLEMS & SOLUTIONS

SEGMENT CRACKING
Cause: Bond is too hard for material being drilled
Remedy: Use softer bond
Cause: Drill rig is not firmly secured
Remedy: Secure drill rig

GLAZING
Cause: Too much feed pressure
Remedy: Open bit, reduce feed pressure
Cause: Aggregate is too hard
Remedy: Use a softer bond
Cause: Too much water, flushing slurry away
Remedy: Open bit, reduce water flow

CORE HANGS UP
Cause: Insufficient water flow causing slurry to bind core in bit
Remedy: Increase water flow
Cause: Dented core barrel
Remedy: Repair core barrel and increase water flow

LOSS OF SEGMENTS
Cause: Snagging on steel reinforcement (rebar)
Remedy: Reduce drilling pressure, use higher grade bit
Cause: Insufficient water flow
Remedy: Increase water flow
Cause: Drill rig is not firmly secured
Remedy: Secure drill rig

BENT SEGMENTS
Cause: Too much feed pressure and insufficient water
Remedy: Reduce feed pressure and increase water flow
Cause: Aggregate is too hard
Remedy: Use a softer bond

BARREL CRACKING
Cause: Too much feed pressure
Remedy: Reduce feed pressure
Cause: Aggregate is too hard
Remedy: Use a softer bond

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