

REFERENCE TOOLS & CHARTS

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PREMIUM DRILLING TOOLS



Steel & Matrix Bits



Impregnated Bits



Bi-Center Drill Bits



KamiCASE Drill Bits



Coring Drill Bits



SlickWELL Reamers



Total Flow Area : in²

Size, in	1	2	3	4	5	6	7	8	9
⁷ / ₃₂	0.038	0.075	0.113	0.150	0.188	0.225	0.263	0.301	0.338
⁸ / ₃₂	0.049	0.098	0.147	0.196	0.245	0.295	0.344	0.393	0.442
⁹ / ₃₂	0.062	0.124	0.186	0.249	0.311	0.373	0.435	0.497	0.559
¹⁰ / ₃₂	0.077	0.153	0.230	0.307	0.383	0.460	0.537	0.614	0.690
¹¹ / ₃₂	0.093	0.186	0.278	0.371	0.464	0.557	0.650	0.742	0.835
¹² / ₃₂	0.110	0.221	0.331	0.442	0.552	0.663	0.773	0.884	0.994
¹³ / ₃₂	0.130	0.259	0.389	0.518	0.648	0.778	0.907	1.037	1.167
¹⁴ / ₃₂	0.150	0.301	0.451	0.601	0.752	0.902	1.052	1.203	1.353
¹⁵ / ₃₂	0.173	0.345	0.518	0.690	0.863	1.035	1.208	1.381	1.553
¹⁶ / ₃₂	0.196	0.393	0.589	0.785	0.982	1.178	1.374	1.571	1.767
¹⁷ / ₃₂	0.222	0.443	0.665	0.887	1.108	1.330	1.552	1.773	1.995
¹⁸ / ₃₂	0.249	0.497	0.746	0.994	1.243	1.491	1.740	1.988	2.237
¹⁹ / ₃₂	0.277	0.554	0.831	1.108	1.384	1.661	1.938	2.215	2.492
²⁰ / ₃₂	0.307	0.614	0.920	1.227	1.534	1.841	2.148	2.454	2.761
²¹ / ₃₂	0.338	0.676	1.015	1.353	1.691	2.029	2.368	2.706	3.044
²² / ₃₂	0.371	0.742	1.114	1.485	1.856	2.227	2.599	2.970	3.341
²³ / ₃₂	0.406	0.811	1.217	1.623	2.029	2.434	2.840	3.246	3.652
²⁴ / ₃₂	0.442	0.884	1.325	1.767	2.209	2.651	3.093	3.534	3.976
²⁵ / ₃₂	0.479	0.959	1.438	1.917	2.397	2.876	3.356	3.835	
²⁶ / ₃₂	0.518	1.037	1.555	2.074	2.592	3.111	3.629		
²⁷ / ₃₂	0.559	1.118	1.677	2.237	2.796	3.355	3.914		
²⁸ / ₃₂	0.601	1.203	1.804	2.405	3.007	3.608			
²⁹ / ₃₂	0.645	1.290	1.935	2.580	3.225	3.870			
³⁰ / ₃₂	0.690	1.381	2.071	2.761	3.451				
³¹ / ₃₂	0.737	1.474	2.211	2.948	3.685				
³² / ₃₂	0.785	1.571	2.356	3.142	3.927				

Recommended PDC bit makeup torque				
API Reg Connecti on Size, in	Bit Sub OD, in	Minimum, ft.lbf	Normal, ft.lbf	Maximum, ft.lbf
² / ₁	3	2,000	2,300	2,500
	3 1/8	2,600	3,100	3,300
	3 1/4	3,400	4,000	4,200
² / ₁	3 1/2	3,400	4,000	4,200
	3 3/4 and larger	5,000	5,900	6,300
3 1/2	4 1/8	5,700	6,600	7,000
	4 1/4	7,000	8,000	8,500
	4 1/2 and larger	8,500	9,500	10,500
4 1/2	5 1/2	13,700	16,600	17,000
	5 3/4 and larger	18,000	21,000	22,000
6 5/8	7 1/2	40,000	47,000	50,000
	7 3/4 & larger	41,000	47,000	50,000
7 5/8	8 1/2	53,000	61,000	65,000
	8 3/4	63,500	73,000	78,000
	9 and larger	68,600	79,800	84,750

Optimization Software's & Tools

Computational Fluid Dynamics (CFD)

DDS work with two distinctive approach to optimize the Bit Hydraulic. The first is through CFD to strategically place nozzle on the bit and verify if cleaning is optimum & avoid erosion

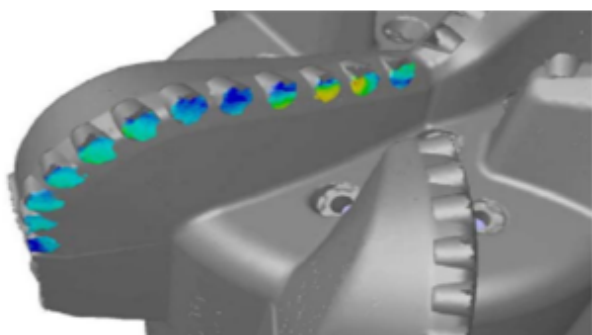
The software used CFD in SOLIDWORKS™ and DDS proprietary module. When design hydraulics are optimized DDS its own proprietary Hydraulic soft to compute the pressure drop along the drilling assembly and recommend the most appropriate TFA et GPM. This type of analysis is used for all types of tools in order to,

- Optimize drill bit nozzle sizes and distribution
- Ensure proper cooling and cleaning of the PDC cutting structure
- Predict and eliminate any erosion potential by mud jets
- Minimize balling potential of the tool
- Calculate pressure drop across the tool
- Ensure smooth streamlined flow through and around the tool
- Predict nozzle jetting effect on the formation to improve ROP

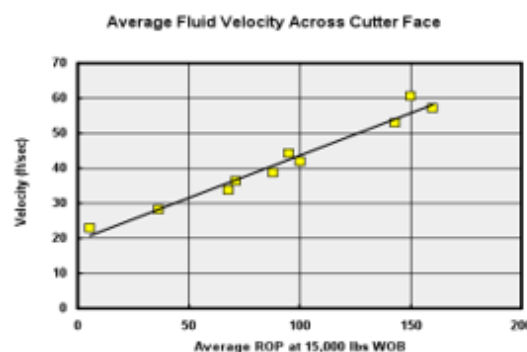
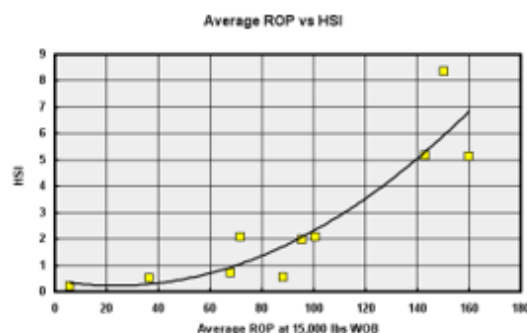


Hydraulics play a crucial role in the bit performances: good cooling of the PDC guarantees the bit longevity, and good cleaning is essential for the whole well quality. DDS checks hydraulics efficiency by running CFD on every design

- CFD analysis shows that the fluid velocity across the PDC cutter face has a much greater correlation with ROP than either H.S.I or flow rate.
- The fit of the trendline for H.S.I vs ROP is weaker (smaller R2 value) than the trendline of cutter fluid velocity vs ROP (which has an R2 value close to 1.0).



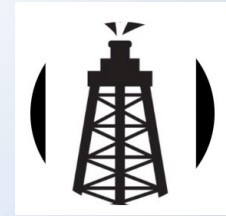
Reference: SPE 114673



PDC bit IADC chart

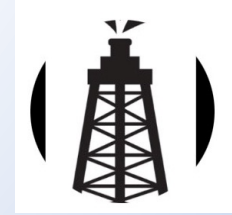
1	2		3				4			
Bit body	Formation type		Size of PDC cutters				Bit profile			
			1	2	3	4	1	2	3	4
S – steel M – matrix D – diamond	Very soft	1	-	19	13	8	Short fishtail	Short profile	Medium profile	Long profile
	Soft	2								
	Soft to medium	3								
	Medium	4								
	no code	5	Diamond cutters type							
	Medium hard	6	Natural diamond	Thermally stable (TSP)	Combination	-				
	Hard	7								
	Extremely hard	8		-	-	Impregnated diamond				

IADC Roller Bit Classification Chart



	FORMATIONS	S E R I E S	T Y P E S	B E A R I N G / G A G E							F E A T U R E S A V A I L A B L E
				STANDARD ROLLER BEARING ①	ROLLER BEARING AIR COOLED ②	ROLLER BEARING GAGE PROTECTED ③	SEALED ROLLER BEARING ④	SEALED ROLLER BRG. - GAGE PROTECTED ⑤	SEALED FRICTION BEARING ⑥	SEALED FRICTION BRG. - GAGE PROTECTED ⑦	
STEEL TOOTH BITS	SOFT FORMATIONS WITH LOW COMPRESSIVE STRENGTH AND HIGH DRILLABILITY	1	1								A - AIR APPLICATION B - SPECIAL BEARING SEAL C - CENTER JET D - DEVIATION CONTROL E - EXTENDED JETS (FULL LENGTH) G - GAGE / BODY PROTECTION (ADDITIONAL) H - HORIZONTAL / STEERING APPLICATION J - JET DEFLECTION L - LUG PADS M - MOTOR APPLICATION S - STANDARD STEEL TOOTH MODEL T - TWO CONE BIT W - ENHANCED CUTTING STRUCTURE X - PREDOMINANTLY CHISEL TOOTH INSERT Y - CONICAL TOOTH INSERT Z - OTHER SHAPE INSERT
			2								
			3								
			4								
	MEDIUM TO MEDIUM HARD FORMATIONS WITH HIGH COMPRESSIVE STRENGTH	2	1								
			2								
			3								
			4								
	HARD SEMI-ABRASIVE AND ABRASIVE FORMATIONS	3	1								
			2								
			3								
			4								
INSERT BITS	SOFT FORMATIONS WITH LOW COMPRESSIVE STRENGTH AND HIGH DRILLABILITY	4	1								
			2								
			3								
			4								
	SOFT TO MEDIUM FORMATIONS WITH LOW COMPRESSIVE STRENGTH	5	1								
			2								
			3								
			4								
	MEDIUM HARD FORMATIONS WITH HIGH COMPRESSIVE STRENGTH	6	1								
			2								
			3								
			4								
	HARD SEMI-ABRASIVE AND ABRASIVE FORMATIONS	7	1								
			2								
			3								
			4								
	EXTREMELY HARD AND ABRASIVE FORMATIONS	8	1								
			2								
			3								
			4								

Sequence



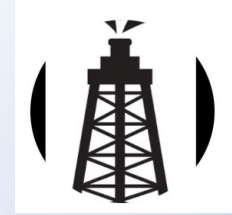
- Numeric Characters are defined:

- Series 1st
- Type 2nd
- Bearing & Gage 3rd

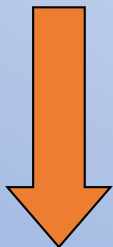
- Alphabetic Character defined:

- Features Available 4th

Type



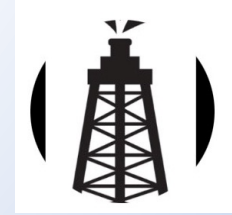
- Second Character
- Degree of Hardness
- Each Series divided into 4 'Types'
- Type 1 Softest Formation in a Series



Increasing Rock Hardness

- Type 4 Hardest Formation in a Series

Hardness Definition



Hardness	UCS (psi)	Examples
Ultra Soft	< 1,000	gumbo, clay
Very Soft	1,000 - 4,000	unconsolidated sands, chalk, salt, claystone
Soft	4,000 - 8,000	coal, siltstone, schist, sands
Medium	8,000 - 17,000	sandstone, slate, shale, limestone, dolomite
Hard	17,000 - 27,000	quartzite, basalt, gabbro, limestone, dolomite
Very Hard	> 27,000	marble, granite, gneiss

UCS = Uniaxial Unconfined Compressive Strength



Total flow area chart

NUMBER OF NOZZLES

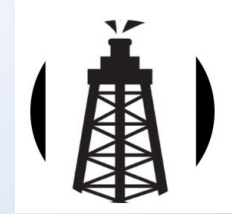
NOZZLE SIZE

	1	2	3	4	5	6	7	8	9	10
7	0.038	0.075	0.113	0.150	0.188	0.225	0.263	0.301	0.338	0.376
8	0.0490	0.0981	0.1472	0.1963	0.2454	0.2945	0.3436	0.3926	0.4417	0.4908
9	0.0621	0.1242	0.1863	0.2485	0.3106	0.3727	0.4348	0.4970	0.5591	0.6212
10	0.0766	0.1533	0.2300	0.3067	0.3854	0.4601	0.5368	0.6135	0.6902	0.7669
11	0.0928	0.1856	0.2784	0.3712	0.4640	0.5568	0.6496	0.7424	0.8352	0.9280
12	0.1104	0.2208	0.3313	0.4417	0.5522	0.6626	0.7731	0.8835	0.9940	1.1044
13	0.1296	0.2592	0.3888	0.5184	0.6481	0.7777	0.9073	1.0369	1.1665	1.2962
14	0.1503	0.3006	0.4509	0.6013	0.7516	0.9019	1.0523	1.2026	1.3529	1.5032
15	0.1725	0.3451	0.5177	0.6902	0.8628	1.0354	1.2080	1.3805	1.5531	1.7257
16	0.1963	0.3926	0.5890	0.7853	0.9817	1.1780	1.3744	1.5707	1.7671	1.9634
18	0.2485	0.4970	0.7455	0.9940	1.2425	1.4910	1.7395	1.9880	2.2365	2.4850
20	0.3067	0.6135	0.9203	1.2271	1.5339	1.8407	2.1475	2.4543	2.7611	3.0679
22	0.3712	0.7424	1.1136	1.4848	1.8561	2.2273	2.5985	2.9697	3.3410	3.7122
24	0.4417	0.8835	1.3253	1.7671	2.2089	2.6507	3.0925	3.5342	3.9760	4.4178

API gauge tolerances for Fixed cutter and roller cone bits

Bit size, in	Fixed Cutter, in	Roller Cone, in
6 3/4 and smaller	-0.015 – +0.00	-0.0 – +1/32
6 25/32 to 9	-0.020 – +0.00	-0.0 – +1/32
9 1/32 to 13 3/4	-0.030 – +0.00	-0.0 – +1/32
13 25/32 to 17 1/2	-0.045 – +0.00	-0.0 – +1/16
17 17/32 and larger	-0.063 – +0.00	-0.0 – +3/32

**Premium Drilling Tools
Pty Ltd**



**Nothing but the
PREMIUM !**



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