

Optimizing bit design improves drilling efficiency

Bit manufacturers push designs to increase ROP and performance to meet specific conditions and formations.

Scott Weeden, Senior Editor, Drilling

With the downturn in the oil and gas industry, operators have shifted their emphasis to more efficient drilling operations to further reduce costs and maintain production. Drillbit manufacturers are optimizing bit designs for improved ROP and more endurance for longer single-run bit trips.

Nearly every bit manufacturer offers bit optimization combined with application-specific designs. Halliburton now has its GeoTech matrix- and steel-body fixed-cutter bits. The company said it can determine during the design stage if modifications can result in performance enhancement under specific operating conditions.

Shear Bits noted on its website “that the most successful drillbit designs are the ones targeted at very specific drilling challenges. There is no question that improved bit performance is a major contributor to reduced drilling costs.” The company introduced its Pexus hybrid bits, which are setting records in Canada.

Schlumberger’s Smith Bits developed the IDEAS integrated drillbit design platform, which is another example of an approach to optimizing bit design. For example, with strategic placement of conical diamond elements across the face of the StingBlade bit, ROP and footage can be improved in hard-rock formations.



The Shear Bits 12¼-in. Pexus Hybrid Drill Bit was developed to drill Western Canadian surface intervals through glacial fills, finishing in Tertiary and late Cretaceous shales and sand stringers.

(Source: Shear Bits)

These are all examples of record-setting technology for the industry. For 2015, the complete drillbit records have been updated on *EPMag.com* under quick links on the home page and can be accessed by *E&P* subscribers. In this listing, only 35% of the complete records are listed, including all of the new records for 2014 to 2015. **E&P**

SINGLE-RUN FOOTAGE									
SIZE, IN.	BIT STYLE	TYPE	FOOTAGE	ROP, FT/HR	LOCATION	YEAR	FIELD	OPERATOR	MANUFACTURER
2.250	Natural Diamond	221NDU	115.0	14.4	Offshore Aberdeen	1997	Montrose	Amoco North Sea	National Oilwell Varco
2.750	PDC	STR324XLDG2K	821.0	73.3	North Slope, Alaska	1998	Prudhoe Bay	Arco Alaska	Baker Hughes
2.875	Biocenter	SR533	426.0	27.1	Colorado	2000	Keota	HS Resources	National Oilwell Varco
3.000	Biocenter	SRRE3408M-B1	2,622.0	79	Beechy Point, Alaska	2010	Kuparuk River	ConocoPhillips	National Oilwell Varco
3.125	Biocenter	SR933	469.0	53.6	Weld Co., Colo.	2000	Keota	HS Resources	National Oilwell Varco
3.250	Biocenter	SRF340	1,709.0	52	North Slope, Alaska	2012	Kuparuk	ConocoPhillips	National Oilwell Varco
3.375	Biocenter	SRRE3208S-B1	387.0	39	Beechy Point, Alaska	2009	Prudhoe Bay	BP Exploration (Alaska)	National Oilwell Varco
3.625	PDC	DSR611S-A1	2,511.0	17	Saudi Arabia	2010	Hawiyah	Saudi Aramco	National Oilwell Varco
3.750	Biocenter	BC27Q	1,388.0	55.5	Muscat, Oman	2000	Yibal	PDO	Smith Bits
3.875	PDC	DS19	7,115.0	73.7	Abu Dhabi	2007	JY, 07	Adeo	National Oilwell Varco
4.000	PDC	FM2421	354.0	6.16	New South Wales, Australia	2011	Unnamed	OCA	Halliburton DBS
4.125	Insert	MF3	1,673.0	60.7	Qatar	2002	Dukhan	Qatar General Petroleum	Smith Bits
4.250	PDC	M20	1,082.0	8.6	Hidalgo Co., Texas	1999	McAllen Ranch	Texaco	Smith Bits
4.375	Milled Tooth	S44	4,881.0	41.5	Gulf of Mexico	2007	Unnamed	Arco Alaska	Halliburton DBS
4.625	Biocenter	SR533	1,057.0	7.5	Lavaca Co., Texas	1998	Salifleetby	Candecca	National Oilwell Varco

SINGLE-RUN FOOTAGE (continued)

SIZE, IN.	BIT STYLE	TYPE	FOOTAGE	ROP, FT/HR	LOCATION	YEAR	FIELD	OPERATOR	MANUFACTURER
4.750	Insert	MF15G	1,732.0	119.5	Alberta, Canada	1997	Brintnell	C.S. Resources	Smith Bits
4.875	PDC	FX53	3,841.9	88.32	Volga District, Russia	2011	Dolgovskoe	Orenburgneft	Halliburton DBS
5.000	Hammer	C683G	6,911.0	68.4	Texas	2006	Wildcat	Willo	Atlas Copco O&G Drilling
5.250	PDC	M09PX	840.0	8.5	Alyrau, Kazakhstan	2002	Tengiz	TCO	Smith Bits
5.375	Bicenter	CSDRE3311S-A1-Z	4,265.0	17	Russia	2009	Listvenskoe	TNK-BP	National Oilwell Varco
5.625	Natural Diamond	D71H	1,225.0	7.2	Vermilion Parish, La.	1992	Kaplan	Mobil	Smith Bits
5.750	PDC	MKS70R	4,941.0	27.2	Onshore Saudi Arabia	2006	Shedgum	Precision Drilling International	Varel International
5.875	Hammer	C623G	6,308.0	59.5	Atoka Co., Okla.	2006	Atoka	Brighton	Atlas Copco O&G Drilling
6.000	Milled Tooth	XR+RP	6,391.0	65.7	Oman	2002	Burhaan	PDO	Smith Bits
6.125	Natural Diamond	K705TBPXC	2,913.0	23.62	Offshore Taranaki, New Zealand	2007	Pohokura	STOS	Smith Bits
6.250	Hybrid	SHP613D	4,878.6	94.16	Alberta, Canada	2015	Hussar	Cenovus	Shear Bits
6.500	Natural Diamond	IQ308D	2,074.0	9.92	Freestone Co., Texas	2010	Unnamed	Devon Energy	Halliburton DBS
6.625	PDC	FX54R	6,338.6	115.25	Alberta, Canada	2011	Unnamed	Encana	Halliburton DBS
6.750	Bicenter	CSD544	8,243.0	44.7	Gulf of Mexico	2002	South Timbalier	ChevronTexaco	National Oilwell Varco
7.000	Insert	XR15T	540.0	23.1	Rivers State, Nigeria	2002	Agbada	Shell	Smith Bits
7.125	Bicenter	CSD444	11,109.0	91.4	Gulf of Mexico	2000	High Island 469	Spirit Energy	National Oilwell Varco
7.250	Bicenter	SRF444M	2,016.0	30.3	Niobrara Co., Wyo.	2000	Brooks Draw	Abraxas	National Oilwell Varco
7.375	Bicenter	QDG54PX	2,563.0	6.7	Goliad, Texas	2003	Alkek North	Zinke & Trumbo	Smith Bits
7.500	PDC	MM55DH	2,437.0	18.31	Sichuan, China	2012	Unnamed	CCDC	Halliburton DBS
7.625	Insert	HP62	7,424.0	100.3	Texas	2001	NBU	LDNG	National Oilwell Varco
7.875	Natural Diamond	D47H	3,942.0	31.5	Permian Basin	1983	Sprabery	Holiday	Smith Bits
8.250	Hammer	C623G	2,783.0	64.7	Lycoming Co., Pa.	2011	Marcellus	Anadarko	Atlas Copco O&G Drilling
8.375	Bicenter	SBX152	1,456.0	29.5	Venezuela	2006	Onado	CGC	National Oilwell Varco
8.500	Milled tooth	TCT+R	32,586.0	186.15	Qatar	2009	Al Shaheen	Maersk Oil Qatar AS	Smith Bits
8.625	Hammer	H28M8	2,260.0	46.8	Alberta, Canada	1990	Jumping Pond	Shell Canada	Smith Bits
8.750	Milled Tooth	MX-C1	7,528.0	162.8	Alberta, Canada	2001	Brintnell	AEC Oil & Gas	Baker Hughes
9.000	Hammer	C683G	1,325.0	85.5	Faulkner Co., Ark.	2010	Fayetteville	Chesapeake Energy Corp.	Atlas Copco O&G Drilling
9.500	Bicenter	PSD5413	7,473.0	9,278	Assumption Parish, La.	2014	Ramos	Drilling Risk Management	National Oilwell Varco
9.500	Milled Tooth	EQHC1RC	3,667.0	46.13	Eldfish, Norway	2013	Unnamed	ConocoPhillips	Halliburton DBS
9.750	Hammer	H1209D+	5,155.0	122.7	Faulkner Co., Ark.	2011	B-43	Chesapeake	Smith Bits
9.875	Hybrid	SVP619	2,064.0	120	Alberta, Canada	2013	Wild Hay	Shell	Shear Bits
10.250	Insert	EQH20D2R	21.0	0.54	Santa Cruz, Bolivia	2012	Tacobo	PlusPetrol Bolivia	Halliburton DBS
10.375	Insert	F4	1,098.0	84.5	Knoff Co., Ky.	1983	Unnamed	Inland Gas	Smith Bits
10.500	Insert	SLS3A	4,804.0	64.9	Saudi Arabia	2005	Shaybah	Saudi Aramco	National Oilwell Varco
10.625	Hybrid	SDP616	1,670.0	73.5	Alberta, Canada	2014	Cadorna	Shell	Shear Bits
10.875	Milled Tooth	DSJ	1,850.0	112.1	Acadia Parish, La.	1983	IOTA	Petrus	Smith Bits
11.000	Hybrid	SVP516	2,024.0	98.8	Alberta, Canada	2014	Pouce Coupe	Birchcliff Energy	Shear Bits
11.125	Bicenter	CSD144	6,200.0	47.9	Lavaca Co., Texas	2005	Morales	Hunt Oil	National Oilwell Varco
11.375	Milled Tooth	QHC1RC	1,709.3	170.93	Alberta, Canada	2010	Unnamed	Imperial Oil Resources	Halliburton DBS
11.500	Natural Diamond	S280G89	133.0	2.8	Niedersachsen, Germany	2001	Klosterseele	BEB Erdgas & Erdoel	Baker Hughes
11.625	PDC	M516LHPX	7,218.0	54.3	Yamalo-Nenets, Russian Federation	2006	Achimov	Achimov	Smith Bits
11.750	Bicenter	CSD266	4,343.0	62	Starr Co., Texas	2002	North Rincon	Shell E&P Co.	National Oilwell Varco
12.000	Natural Diamond	IQ616D	391.0	5.18	Al Jawf, Saudi Arabia	2012	Unnamed	Saudi Aramco	Halliburton DBS
12.125	PDC	S88BHPX	17,100.0	200.8	Offshore Malaysia	1998	Tapis	Esso Malaysia	Halliburton DBS
12.250	Insert	MX-C09H	8,353.3	1,519	Offshore Norway	2010	Unnamed	Statoil	Baker Hughes
12.375	Insert	EQH51D2RC	3,529.0	58.82	Belmont Co., Ohio	2014	Unnamed	Rice Drilling D LLC	Halliburton DBS
12.500	Natural Diamond	445	707.0	3.2	Wyoming	2001	Winklerman Dome	Burlington Resources	National Oilwell Varco
13.125	PDC	FM2565Z	1,663.4	130.46	Alberta, Canada	2011	Unnamed	Husky Oil Operations	Halliburton DBS
13.500	Hammer	H45S2	2,799.0	44.8	Terrell Co., Texas	1994	Wildcat	Conoco	Smith Bits
13.625	PDC	S91BPX	5,695.0	74.4	Offshore Louisiana	2001	West Cameron	El Paso Production	Smith Bits
13.750	Hybrid	SVP616	2,123.0	198	Alberta, Canada	2014	Wahigan	Talisman Energy	Shear Bits
14.000	Insert	3JS	357.0	2.9	Fremont Co., Wyo.	1987	Madden Deep	BHP Petroleum	Smith Bits
14.125	Milled tooth	DSJ	4,000.0	210.5	South Timbalier, Offshore Louisiana	1969	South Timbalier	Chevron	Smith Bits
14.500	Hammer	O624G	1,426.0	79.2	Hughes Co., Okla.	2005	Unnamed	Newfield Exploration	Atlas Copco O&G Drilling
14.750	Hybrid	SVP619	2,241.0	71.9	Alberta, Canada	2014	Sawn Lake	Pennwest Energy	Shear Bits
15.000	Milled Tooth	DSJ	4,542.0	245.5	Acadia Parish, La.	1967	Midland	Edwin L. Cox	Smith Bits
15.625	PDC	DSX11	5,143.0	17.4	North Dakota	2005	Unnamed	Nance Petroleum	National Oilwell Varco
16.000	Hybrid	SVP619	1,457.0	69.2	British Columbia, Canada	2014	Sandy	Apache Corp.	Shear Bits
16.125	Bicenter	CSD244M	5,616.0	67.5	U.K. North Sea	2002	Joanne	Phillips UK	National Oilwell Varco
16.250	Milled Tooth	MSDSSH	5,175.0	48.8	Pointe Coupee, La.	2001	Judge Digby	Amoco	Smith Bits

SINGLE-RUN FOOTAGE (continued)

SIZE, IN.	BIT STYLE	TYPE	FOOTAGE	ROP, FT/HR	LOCATION	YEAR	FIELD	OPERATOR	MANUFACTURER
16.375	Milled Tooth	MSDSSHC	2,310.0	65.1	US Gulf of Mexico	2002	Mississippi Canyon 730	Shell	Smith Bits
16.500	PDC	MDI716LHBPX	12,410.0	92.1	Offshore Louisiana	2015	Tiber	BP Americas	Smith Bits
16.625	PDC	Texas447	9,638.0	52.2	Offshore Louisiana	2001	Walker Ridge 70	Texaco Offshore	Baker Hughes
16.875	PDC	DS26	2,022.0	32.6	U.K.	1992	North Sea	Petrofina	National Oilwell Varco
17.375	Insert	MS43	440.0	21.5	Colorado	2003	Mamm Creek	Encana	National Oilwell Varco
17.500	Hybrid	HP633F	6,127.0	40	Aberdeen, Scotland	2013	Unnamed	Tullow Oil	Baker Hughes
17.625	Insert	T41C	15,801.0	12.9	Oman	2006	Saih Rawl	PDO/Dalma Energy	National Oilwell Varco
18.000	Bicenter	CSD244	4,176.0	38.8	Gulf of Mexico	2000	Mississippi Canyon 727	Chevron USA	National Oilwell Varco
18.125	Milled Tooth	XR+C	3,182.0	159.1	Amazon, Brazil	2004	Algodaal	BP	Smith Bits
18.250	Insert	2JS	669.0	4.7	Fremont Co., Wyo.	1987	Madden Deep	BHP Petroleum	Smith Bits
18.500	PDC	FX76R	5,036.0	40.82	Tobasco, Mexico	2013	Sen	Alianza II	Halliburton DBS
18.625	PDC	DS147	5,298.0	89	Texas	2006	Giddings	Stroud Energy	National Oilwell Varco
18.875	Bicenter	QDS91PX	1,142.0	40.1	U.K. North Sea	2001	Penguin Block 211/14	Shell UK	Smith Bits
19.250	Milled Tooth	XT1GRC	771.0	23.19	Volga District, Russia	2014	Unnamed	JSC	Halliburton DBS
19.625	Bicenter	DOSRWD	3,285.0	38	Offshore Louisiana	2002	Atwater Valley 63	ChevronTexaco	Baker Hughes
19.750	PDC	S88EHPX	149.0	48.7	Offshore Trinidad	2005	Coconut	BP Trinidad	Smith Bits
19.875	Natural Diamond	DDR3039	3,694.2	7.32	Alberta	2006	Panther River	Suncor Energy	National Oilwell Varco
20.000	Milled Tooth	DGJC	5,156.0	74.2	Pointe Coupee, La.	1999	Judge Digby	BP Amoco	Smith Bits
20.125	PDC	S91VPX	4,026.0	101.9	Offshore Newfoundland	1999	Terra Nova	Terra Nova Alliance	Smith Bits
20.625	Insert	3JSCE	1,536.0	10	Beckham Co., Okla.	1991	SE Sweetwater	Exxon	Smith Bits
20.750	Milled Tooth	XR+C	1,857.0	34.5	Baikpapan, Indonesia	2010	Trekulu	Total E&P Indonésie	Smith Bits
20.875	Bicenter	DOSRWD	1,850.0	44.6	Offshore Louisiana	2000	Mississippi Canyon 707	Chevron USA	Baker Hughes
21.125	Milled Tooth	R-1	1,450.0	60.4	Offshore Louisiana	1999	Garden Banks 168	Shell Offshore	Baker Hughes
21.750	Milled Tooth	XT1GRC	223.0	318.71	Ural District, Russia	2011	Verkhnekolik-Egan VNG		Halliburton DBS
21.875	Milled Tooth	XR+C	1,968.0	10.6	Burdur, Turkey	2007	Yukavoy	Turkish Petroleum Co.	Smith Bits
22.000	Bicenter	BC91	3,600.0	105.9	Offshore Louisiana	1999	Eugene Island	Seneca Resources	Smith Bits
22.000	Hammer	C624G1	1,036.0	49.33	Greene Co., Pa.	2015	Marcellus	Rice Energy	Atlas Copco O&G Drilling
22.000	PDC	HC609S	3,269.0	16.1	Kuwait	2008	Unnamed	Kuwait Oil Co.	Baker Hughes
22.125	PDC	S88PX	2,290.0	19.9	Salta, Argentina	2008	Tuyunti	Pan American	Smith Bits
22.250	Insert	GS12BVEJ3C	2,270.0	66.76	Offshore Qatar	2007	North Field Shell - NFP 1-8	Shell	Smith Bits
22.375	Insert	GS12BC	2,145.0	30.3	Qatar	2007	North Field	QG 3&4	Smith Bits
22.500	Insert	GS10UBVEJ3C	2,733.0	61	Offshore Sakhalin, Russia	2012	Lunskoye	Sakhalin Energy Investment Co.	Smith Bits
22.750	Insert	GS10SUNVEJ3C	2,277.0	39.9	Offshore Sakhalin, Russia	2011	Lunskoye	Sakhalin Energy Investment Co.	Smith Bits
22.875	Milled Tooth	MSDGH	3,704.0	126	Norwegian North Sea	1992	Oseberg	Norsk Hydro	Smith Bits
23.000	Milled Tooth	XT1GSC	4,025.0	45.23	Germany	2011	Unnamed	RWE DEA AG	Halliburton DBS
23.125	Milled Tooth	DSJC	4,921.0	37.6	Ferrara, Italy	1991	Polesi	ENI Agip	Smith Bits
23.500	Insert	GSO4BCPS	2,742.0	49.9	Offshore Qatar	2005	North Field	Dolphin Energy Ltd.	Smith Bits
23.625	Insert	T41C	15,800.5	12.94	Oman	2006	Saih Rawl	Petroleum Development Oman/Dalma Energy	National Oilwell Varco
24.000	Hammer	C824G1	440.0	36.67	Greene Co., Pa.	2014	Marcellus	Vantage Energy	Atlas Copco O&G Drilling
24.125	Milled Tooth	MSDSSHC	5,677.0	48.1	Gulf of Mexico	2002	South Marsh Island	El Paso Production	Smith Bits
25.000	Milled Tooth	XN1GC	187.0	11.1	Azerbaijan	2010	Unnamed	BP	Halliburton DBS
26.000	Hammer	C824G1	380.0	33.04	Allegheny Co., Pa.	2014	Marcellus	EQT Production	Atlas Copco O&G Drilling
26.000	Insert	ER14JMS	5,591.0	65.39	Western Australia	2012	Crown-1	Santos Petroleum	Varel International
27.000	Milled Tooth	XR+C	927.0	16.8	Saudi Arabia	2006	Manifa	Saudi Aramco	Smith Bits
28.000	Hybrid	KM634X	4,226.0	35	Offshore Brazil	2013	Unnamed	Repsol	Baker Hughes
28.000	Milled Tooth	XT1GRC	3,153.0	67.66	Offshore Mexico	2013	Unnamed	Pemex	Halliburton DBS
28.125	Insert	GS18BVQC	5,375.0	25.1	Dhabi, Kuwait	2009	North	Kuwait Oil Co.	Smith Bits
32.000	Insert	GS18B	99.0	0.5	Iceland	2004	Unnamed	Jardboranir	Smith Bits
32.125	Milled Tooth	SS1LRGSP	1,181.0	62.2	Offshore Norway	2002	Valhall	BP	Ultrerra Drilling Technologies
32.875	PDC	DS132	4,528.0	33.5	Carmen	2005	Bloque	Pemex	National Oilwell Varco
33.000	Milled Tooth	MSDSSVEJ3C	689.0	57.4	Baikpapan, Indonesia	2010	Trekulu	Total E&P Indonésie	Smith Bits
36.000	Milled Tooth	XR+	722.0	45.1	Comodoro, Chubut, Argentina	2009	Unnamed	YPF	Smith Bits
36.125	Milled Tooth	MGSS+	236.0	4.4	Salta, Argentina	2001	Aguarague	Tecpetrol	Smith Bits
44.000	Milled Tooth	L111	165.0	55	Saudi Arabia	2012	HSBH	Saudi Aramco	Varel International
45.000	Milled Tooth	L111	289.0	22.64	Offshore Denmark	2015	South Arne	Hess Operating	Varel International

RATE OF PENETRATION										
SIZE, IN.	BIT STYLE	TYPE	FOOTAGE	ROP, FT/HR	LOCATION	YEAR	FIELD	OPERATOR	MANUFACTURER	
2.250	Natural Diamond	221NDU	115	14.4	Offshore Aberdeen	1997	Montrose	Amoco North Sea	National Oilwell Varco	
2.750	Natural Diamond	D331GEB	294	49.0	North Slope, Alaska	2001	Prudhoe Bay	BP Exploration	Baker Hughes	
2.875	PDC	ST3ALT	427	71.2	Weld Co., Colo.	2001	Girard Red	Patina	National Oilwell Varco	
3.000	Bicenter	SRR3408M-B7-Z	1,501	102.6	North Slope, Alaska	2012	Kuparuk	ConocoPhillips	National Oilwell Varco	
3.125	Bicenter	SR933	469	53.6	Weld Co., Colo.	2000	Carter	HS Resources	National Oilwell Varco	
4.625	Insert	MF5DP	1,755	42.5	Williams Co., N.D.	1997	Bay Batiste	Pend Orielle	Smith Bits	
4.750	PDC	FM2000	1,282	249.9	LeFlore Co., Okla.	2003	Wildcat	CDX Gas	Halliburton DBS	
4.875	Bicenter	CSDX4208-A1	1,191	17.1	The Netherlands	2005	Unnamed	NAM	National Oilwell Varco	
5.625	Bicenter	QDS3209PX	1,335	25.5	Yamalo-Nenets, Russia	2007	Pagranichnoe	Sibneft	Smith Bits	
5.750	PDC	FXD64	1,624	117.4	Tyumen Region, Russia	2014	Unnamed	OOO SBK	Halliburton DBS	
5.875	Hammer	H55R6S2	2,745	61.7	La Plata Co., Colo.	1999	South Ute	Sierra	Smith Bits	
6.000	Insert	XR15T	2,155	187.4	Abu Dhabi, UAE	2004	Asab	ADCO	Smith Bits	
6.000	Natural Diamond	IQ610	3,333	14.8	Oman	2010	Unnamed	PDO	Halliburton DBS	
6.000	PDC	V613UX	9,371	127.5	Dunn Co., N.D.	2013	Murphy Creek	Marathon Oil	Smith Bits	
6.125	Bicenter	MBC58	3,311	37.6	Saudi Arabia	2008	Zulf	Saudi Aramco	Varel International	
6.125	Hammer	H52R6R2	4,335	96.3	Rio Arriba Co, N.M.	1998	Basin Dakota	Burlington Resources	Smith Bits	
6.125	Hybrid	HP322	771	38.0	Fort St. John, Canada	2013	Unnamed	Encana Corp.	Baker Hughes	
6.125	Milled Tooth	FDS+P	1,410	282.0	Oman	1998	Amin	PDO	Smith Bits	
6.250	Hybrid	SHP613D	4,879	94.2	Alberta, Canada	2015	Hussar	Cenovus	Shear Bits	
6.250	Insert	ER6310	2,188	324.2	Alberta, Canada	2003	Suffield	Encana Corp.	Smith Bits	
6.500	Bicenter	STRWD444	3,995	99.9	Gulf of Mexico	2001	Main Pass 313	Chevron USA	Baker Hughes	
6.500	Hammer	H41H6R2	5,752	152.4	Clearfield Co., Pa.	2007	Wildcat	EOG Resources	Smith Bits	
6.750	Natural Diamond	901L	883	19.4	Jackson Parish, La.	2002	Vernon	Anadarko	National Oilwell Varco	
6.875	PDC	MGR84YPX	3,706	44.9	Offshore Zulia, Venezuela	2001	Lagunillas	Chevron	Smith Bits	
7.125	Natural Diamond	KER20573PX	159	6.1	Leon Co., Texas	2005	Bald Prairie	Burlington Resources	Smith Bits	
7.250	Hammer	C683G	6,911	68.4	Crockett Co., Texas	2006	Wildcat	Willo Oil & Gas	Atlas Copco O&G Drilling	
7.375	Bicenter	QDG54PX	981	11.7	Kleberg Co., Texas	2001	Yeary Wildcat	El Paso Production	Smith Bits	
7.500	PDC	MM55DH	2,437	18.3	Sichuan, China	2012	Unnamed	CCDC	Halliburton DBS	
7.625	Insert	ATJ-55A	1,133	125.9	Westmoreland Co., Pa.	1994	G.H. King 842	Parker & Parsley	Baker Hughes	
7.750	PDC	FX65M	6,046	99.1	Rio Arriba Co, N.M.	2013	Unnamed	Loges Resources	Halliburton DBS	
7.875	Hammer	H42R8R3	3,420	126.7	Terrell Co., Texas	1997	Deer Canyon	Conoco	Smith Bits	
7.875	Natural Diamond	D12ST	328	48.6	Andrews Co., Texas	1995	Andrews	Unocal	Smith Bits	
8.000	Insert	ER5662	2,070	86.3	Sublette Co., Wyo.	2002	Stud Horse Butte	Encana Oil & Gas	Smith Bits	
8.625	PDC	FMX653Z	2,671	277.6	Ural District, Russia	2010	Muravelenkovskvo	OAO Gaspromneft NNG	Halliburton DBS	
8.750	Insert	HE04JMRSV	2,008	167.3	Weld Co., Colo.	2015	Wattenburg	Bonanza Creek Energy Operating Co.	Varel International	
8.875	Insert	EQH41R	3,040	70.9	Greene Co., Pa.	2014	Marcellus	Rice Drilling B LLC	Halliburton DBS	
9.000	Bicenter	BC75PX	3,789	142.3	Oman	2001	Al Noor	PDO	Smith Bits	
9.250	Hammer	C683G	1,110	92.5	Faulkner Co., Ark.	2010	Fayetteville	Chesapeake	Atlas Copco O&G Drilling	
9.375	PDC	M50P	3,561	66.5	Webb Co., Texas	2002	El Gato	Chevron	Smith Bits	
9.625	Milled Tooth	SDS	4,819	224.1	Zulia, Venezuela	1984	Bachaquero	Lagoven	Smith Bits	
9.750	Natural Diamond	K705TBPXC	1,838	9.6	Jackson Parish, La.	2006	Wildcat	Devon	Smith Bits	
9.875	Bicenter	CSDR4219S	2,763	396.4	Colombia	2009	Infantas	OXY	National Oilwell Varco	
9.875	Hybrid	SVP619	2,064	120.0	Alberta, Canada	2013	Wild Hay	Shell	Shear Bits	
10.500	PDC	S91HPX	2,199	733.0	Gulf of Thailand	2007	Tantawan	Chevron Offshore Thailand Ltd.	Smith Bits	
10.625	Hybrid	SDP616	748	83.0	Alberta, Canada	2014	Swan Hills	Calterra	Shear Bits	
10.750	Milled Tooth	QHC2RC	1,985	128.1	Alberta, Canada	2011	Unnamed	Husky Oil Operations	Halliburton DBS	
10.875	Hammer	Q10R4XH-G12XXXGPX	1,551	156.7	Tioga Co., Pa.	2014	Marcellus	Shell Energy	Atlas Copco O&G Drilling	
10.875	Insert	7JA	923	42.9	Jefferson Parish, La.	1984	Unnamed	Snyder Bros.	Smith Bits	
11.000	Hybrid	SVP516	1,306	145	Alberta, Canada	2014	Pouce Coupe	Birchcliff Energy	Shear Bits	
11.000	Insert	F47A	1,055	191.8	Holmes Co., Ohio	1993	Unnamed	Buckeye Oil	Smith Bits	
11.250	Bicenter	CSD133	4,549	101.3	Gulf of Mexico	2000	Green Canyon 158	Shell	National Oilwell Varco	
12.000	Natural Diamond	IQ616D	391	5.2	Saudi Arabia	2012	Unnamed	Saudi Aramco	Halliburton DBS	
12.125	PDC	FS2563Z	1,459	165.8	Casanare, Colombia	2013	Tarotaro	Geopark	Halliburton DBS	
12.250	Hammer	Q12R4HXXXGPX	1,678	279.7	Carroll Co., Ohio	2014	Utica	Chesapeake Energy	Atlas Copco O&G Drilling	
12.250	Natural Diamond	IQ516D	302	9.2	St. Mary Parish, La.	1997	NE Franklin	Bass	Smith Bits	
12.250	PDC	RS619DGU	2,121	606.0	Dunn Co., N.D.	2014	Bailey	Marathon Oil	Varel International	
12.375	Insert	EQH40D2R	1,518	126.5	Greene Co., Pa.	2014	Marcellus	EQT Production	Halliburton DBS	
13.250	BiCenter	SB4219S-A1	2,868	99.0	Denmark	2005	Unnamed	Maersk	National Oilwell Varco	

RATE OF PENETRATION (continued)

SIZE, IN.	BIT STYLE	TYPE	FOOTAGE	ROP, FT/HR	LOCATION	YEAR	FIELD	OPERATOR	MANUFACTURER
13.500	PDC	HC605S	2,218	492.9	Dickinson, N.D.	2013	Unnamed	ConocoPhillips	Baker Hughes
13.750	Hybrid	SVP616	2,074	202.0	Alberta, Canada	2015	Saxon	Encana Corp.	Shear Bits
14.000	Milled Tooth	DSJ	4,000	210.5	Gulf of Mexico	1969	South Timbalier	Chevron	Smith Bits
14.125	Bicenter	CSD244	1,337	107.0	Offshore Indonesia	2003	Bangau	Unocal	National Oilwell Varco
14.250	Bicenter	DOSRWD	4,309	94.0	Gulf of Mexico	2003	South Timbalier 37	Chevron	Baker Hughes
14.500	Insert	XT20	1,280	167.9	Offshore Mexico	2010	Sihil	Halliburton	Halliburton DBS
14.500	Milled Tooth	DSJ	3,000	117.6	Terrebonne Parish, La.	1983	Dularge	K&B Exploration	Smith Bits
14.500	PDC	RSX616S	5,974	217.6	Campeche, Mexico	2009	Cantarell	Pemex	National Oilwell Varco
14.750	Hammer	C623G	1,715	228.7	Faulkner Co., Ark.	2009	Fayetteville	Chesapeake Energy	Atlas Copco O&G Drilling
14.750	Hybrid	SVP619	719	240.0	Alberta, Canada	2013	Cadotte	Shell	Shear Bits
15.000	Bicenter	SC19HBC	2,671	71.2	Gulf of Mexico	1995	Garden Banks	Shell Offshore	National Oilwell Varco
15.500	PDC	FX56	1,230	214.0	Ural District, Russia	2013	Vostochnotarkos	Novatech Tarkosale-Neftegaz	Halliburton DBS
16.000	Bicenter	BC75PX	1,614	293.5	Offshore Brunei	2000	Champion West	Brunei Shell Petroleum	Smith Bits
16.000	Hybrid	SVP619	620	82.7	Alberta, Canada	2014	Cadotte	Shell	Shear Bits
16.250	Milled Tooth	MSDSSHCH	1,750	71.0	Gulf of Mexico	2000	Mississippi Canyon 899	Shell Deepwater	Smith Bits
16.875	PDC	DSX69	2,792	558.4	Syria	2005	Omar	AFPC	National Oilwell Varco
17.000	Bicenter	CSD144M	4,367	126.2	Gulf of Mexico	2001	Keathley Canyon 774	Spirit Energy 76	National Oilwell Varco
17.250	Milled Tooth	SDS	1,618	93.8	Beaver Co., Okla.	1984	Cates	H&L Operating	Smith Bits
17.500	Hammer	C824G1	1,003	250.8	Greene Co., Pa.	2013	Marcellus	EQT Production	Atlas Copco O&G Drilling
18.000	PDC	SP43M	5,227	43.0	Gulf of Mexico	2002	Spa, Walker Ridge 285	Conoco	National Oilwell Varco
18.125	Milled Tooth	XR+C	3,182	159.1	Amazon - (BM-FZA-1)	2004	Algodool	BP	Smith Bits
18.250	PDC	FMF3663Z	3,757	138.1	Offshore Mexico	2008	Unnamed	Halliburton	Halliburton DBS
18.500	Hammer	H42S2R3PD	1,002	19.6	Webster Co., W.Va.	2000	Cleveland	Columbia Nat'l Resources	Smith Bits
18.750	Bicenter	QDS91PX	1,142	40.1	U.K. North Sea	2001	Penguin, Block 211/14	Shell UK	Smith Bits
19.250	Milled Tooth	XR+	187	29.5	Azerbaijan	2012	Garadagh	Socar	Smith Bits
19.500	Bicenter	DOSRWD	1,575	57.0	Gulf of Mexico	2002	Atwater Valley 63	Chevron	Baker Hughes
20.000	Bicenter	CSD066	2,308	213.7	U.K. Offshore	2002	Judy	Phillips	National Oilwell Varco
20.500	Bicenter	CSD044	2,905	88.6	Gulf of Mexico	2003	Atwater Valley 63	Unocal	National Oilwell Varco
20.750	Milled Tooth	XR+C	1,857	34.5	Baikpapan, Indonesia	2010	Trekulu	Total E&P Indonésie	Smith Bits
21.000	Milled Tooth	R-1	1,018	96.9	Gulf of Mexico	2000	Henderson, Block 119	Flores & Rucks	Baker Hughes
22.000	Bicenter	CSD044	1,956	210.3	Gulf of Mexico	2003	Green Canyon 380	Dominion E&P	National Oilwell Varco
22.000	Hammer	C624G1	1,036	49.3	Greene Co., Pa.	2015	Marcellus	Rice Energy	Atlas Copco O&G Drilling
22.375	Insert	GS12B	1,306	40.5	Qatar	2007	North Field	QG 3&4	Smith Bits
22.500	Insert	GS106UBVE	2,733	61.0	Sakhalin, Sea of Okhotsk	2012	Lunskoye	Sakhalin Energy Investment Co.	Smith Bits
22.750	Insert	GS106UNBVE	2,277	39.9	Sakhalin, Sea of Okhotsk	2011	Lunskoye	Sakhalin Energy Investment Co.	Smith Bits
23.000	Milled Tooth	MSDGHC	2,419	366.5	Sarawak, Malaysia	2007	B11	Sarawak Shell Berhad	Smith Bits
23.500	Insert	T41	2,763	55.7	Qatar offshore	2005	North Field	Dolphin Energy	National Oilwell Varco
23.500	Milled Tooth	DSJC	1,657	163.6	U.K. North Sea	2001	Dunbar	Total/FinaElf	Smith Bits
24.000	Hammer	C824G1	301	52.8	Morgan Co., Ohio	2014	Ufica	PDC Energy	Atlas Copco O&G Drilling
24.000	Milled Tooth	XR+CPS	1,697	404.0	Deepwater, Southeast Asia	2008	Gumusat Kakap	Sabah Shell Petroleum	Smith Bits
25.000	PDC	DSR416S-B3	1,899	542.5	Gulf of Thailand	2007	Lanta	Chevron	National Oilwell Varco
26.000	Hammer	C824G1	204	45.3	Allegheny Co., Pa.	2014	Marcellus	EQT Production	Atlas Copco O&G Drilling
26.000	PDC	QD509S	4,208	226.0	Offshore Australia	2010	Unnamed	Woodside Energy	Baker Hughes
26.500	Milled Tooth	DSJC	1,224	87.4	Gulf of Mexico	1990	Matagorda Island	Amoco	Smith Bits
27.000	Milled Tooth	XR+C	927	16.8	Saudi Arabia	2006	Manifa	Saudi Aramco	Smith Bits
28.000	Hybrid	KM634X	4,226	35.0	Offshore Brazil	2013	Unnamed	Repsol	Baker Hughes
29.000	Milled Tooth	MSDGH	2,395	71.7	Offshore Nigeria	2002	EA	Shell	Smith Bits
30.000	Insert	VG-03M	938	112.0	Offshore Australia	2013	Unnamed	Shell Development (Australia)	Baker Hughes
32.000	Milled Tooth	SS1LRGSP	1,181	62.2	Offshore Norway	2002	Valhall	BP	Uiterra Drilling Technologies
33.000	Milled Tooth	MSDSSVEJ3C	689	57.4	Baikpapan, Indonesia	2010	Trekulu	Total E&P Indonésie	Smith Bits
34.000	Milled Tooth	L3A	449	33.3	Saudi Arabia	2010	HRDH	Saudi Aramco	Varel International
36.000	Milled Tooth	XR+	620	119.7	Tabasco, Mexico	2013	Kuil	Pemex	Smith Bits
44.000	Milled Tooth	L111	165	55.0	Saudi Arabia	2012	HSBH	Saudi Aramco	Varel International
45.000	Milled Tooth	L111	289	22.6	Offshore Denmark	2015	South Arne	Hess Operating	Varel International

CUMULATIVE FOOTAGE										
SIZE, IN.	BIT STYLE	TYPE	FOOTAGE	ROP, FT/HR	LOCATION	YEAR	FIELD	OPERATOR	MANUFACTURER	
2.750	PDC	STR324XLDG2K	2,686	12	North Slope, Alaska	1998	PBU	Arco Alaska	Baker Hughes	
2.875	PDC	STR324XLDG3	2,206	8	Texas	2000	Multiple	Patina/HS Resources	Baker Hughes	
3.000	Bicenter	QDMI4209LQBPX	5,997	7	North Slope, Alaska	2008	Multiple	Multiple	Smith Bits	
3.125	Bicenter	SR933	2,423	6	Weld Co., Colo.	2000	Multiple	HS Resources/Patina	National Oilwell Varco	
3.250	Bicenter	SRF3408M-A1-Z	6,554	6	North Slope, Alaska	2012	Kuparuk	ConocoPhillips	National Oilwell Varco	
3.375	Natural Diamond	K505BPX	528	4	Hassi Messoud, Algeria	2006	Multiple	Multiple	Smith Bits	
3.500	Insert	MA15	360	2	Offshore Denmark	1994	Kraka	Maersk	Smith Bits	
3.500	PDC	MO9	2,158	2	U.K. North Sea	2002	Multiple	Multiple	Smith Bits	
3.625	Natural Diamond	K705TBPXC	826	2	Saudi Arabia	2008	Multiple	Multiple	Smith Bits	
4.500	Natural Diamond	D53BH	1,779	3	Gulf Coast, Texas/Louisiana	2006	Multiple	Multiple	Smith Bits	
4.500	PDC	M609LNUPX	8,188	4	Natrona Co., Pa	2013	Wildcats	Multiple	Smith Bits	
4.625	Milled Tooth	OFM	402	2	Jim Wells Co., Texas	1989	Ben Bolt	Coastal Management	Smith Bits	
4.750	Insert	XR15	18,858	8	Greene Co., Pa.	2008	Multiple	Multiple	Smith Bits	
4.875	PDC	M513LYPX	8,727	7	Russia	2010	Multiple	Multiple	Smith Bits	
5.625	Bicenter	SR333	17,008	10	Webb/Zapata counties, Texas	2000	Multiple	Conoco	National Oilwell Varco	
5.625	Milled Tooth	XR+	1,269	3	Kazakhstan	2013	Multiple	Multiple	Smith Bits	
5.625	Natural Diamond	K503TBPXC	1,282	2	Vermilion Parish, La.	2007	Multiple	Multiple	Smith Bits	
5.750	BiCenter	QDS3209YQPX	2,486	3	Russia	2006	Multiple	Multiple	Smith Bits	
5.750	PDC	M1516LWBPX	11,095	4	Yamalo-Nenetskiy, Russia	2013	Multiple	Multiple	Smith Bits	
5.875	Milled Tooth	HP12	6,107	2	UAE	2006	Sajaa	Amoco	National Oilwell Varco	
6.125	Hammer	H43R6R2PD	7,630	8	Pecos Co., Texas	2006	Pinion	Multiple	Smith Bits	
6.125	Natural Diamond	K505TBPXC	9,140	4	Alberta, Canada	2008	Multiple	Multiple	Smith Bits	
6.250	PDC	M75QPX	358,307	166	Alberta, Canada	2003	Multiple	Various	Smith Bits	
6.375	Hammer	H1008D	10,200	2	West Virginia	2008	Multiple	Multiple	Smith Bits	
6.375	PDC	M80BPX	3,730	2	Offshore Brunei	1999	Champion	Brunei Shell	Smith Bits	
6.500	Bicenter	STRWD444	11,703	5	Gulf of Mexico	2001	Main Pass, South Marsh Island	Shell, Chevron	Baker Hughes	
7.375	Natural Diamond	901	2,029	3	Louisiana	1990	High Island	Arco	National Oilwell Varco	
7.500	Bicenter	SR444	13,274	2	Gulf of Mexico	1999	West Delta #117	W&T Offshore	National Oilwell Varco	
7.500	Insert	F5W	664	2	Krasnoyarskiy, Russia	2011	Multiple	Multiple	Smith Bits	
7.500	PDC	MSI716LWUBPX	2,854	4	Korny, Russia	2014	Multiple	Multiple	Smith Bits	
7.625	Insert	7JA	3,175	2	Pennsylvania	1990	Janella	PC Exploration/Victory	Smith Bits	
7.875	Insert	XL-40A	16,720	4	Crockett Co., Texas	2003	Multiple	Harrison Interests	Baker Hughes	
7.875	PDC	FM2555	263,876	39	Weld Co., Colo.	2003	Denver	Kerr-McGee Julesberg Basin	Halliburton DBS	
8.000	Bicenter	SR344	2,493	2	Lavaca Co., Texas	1998	Speaks/Jefferies	Costilla/Coastal	National Oilwell Varco	
8.750	Milled Tooth	MX-CS1	16,728	9	Alberta, Canada	2000	Lindbergh	Petrovera Resources	National Oilwell Varco	
8.750	Natural Diamond	K705NQTBPXC	3,319	2	Arnett, Okla.	2011	Multiple	Multiple	Smith Bits	
8.750	PDC	HC606	107,814	28	Argentina	2002	C. Dura, Perales, V. Hermoso	Several	Baker Hughes	
8.875	Hammer	H43R8R3	23,087	22	Lewis Co., W.Va.	2005	Camden/ Freeman Creek	Dominion	Smith Bits	
9.000	Milled Tooth	FDS+CPS	6,978	4	Alberta, Canada	2004	Multiple	Multiple	Smith Bits	
9.250	Insert	GF10BV	3,810	2	Kuwait	2014	Multiple	Multiple	Smith Bits	
9.500	Bicenter	E1189	19,968	4	Ecuador	2011	Casabe	Multiple	National Oilwell Varco	
9.750	Hammer	H1509D	4,642	2	Faulkner Co., Ark.	2009	Multiple	Multiple	Smith Bits	
9.875	Hybrid	SVP619	3,091	2	Alberta, Canada	2013	Wild Hay	Shell	Shear Bits	
9.875	Milled Tooth	FGXIC	15,465	6	Australia	2004	Multiple	Multiple	Smith Bits	
10.250	PDC	MDSI716TBPXCI	12,152	6	Gulf of Mexico	2009	Multiple	Multiple	Smith Bits	
10.375	PDC	M519HBPX	1,000	6	Monagas, Venezuela	2013	Multiple	Multiple	Smith Bits	
10.500	PDC	S519HPX	6,603	4	Thailand	2013	Multiple	Multiple	Smith Bits	
10.625	Bicenter	CSD244	7,251	4	Indonesia	2000	Multiple	Unocal	National Oilwell Varco	
10.625	Hybrid	SDP616	2,418	4	Alberta, Canada	2014	Multiple	Multiple	Shear Bits	
10.625	PDC	DSX103	41,230	10	Texas	2005	Carthage	XTO	National Oilwell Varco	
10.750	Bicenter	QDG5219	18,942	5	Kern Co., Calif.	2014	Multiple	Multiple	Smith Bits	
10.750	Milled Tooth	QHC2RC	4,628	2	Alberta, Canada	2011	Multiple	Husky Oil Operations	Halliburton DBS	
11.000	Hammer	H55R2	10,103	17	Barbour Co., W. Va.	1990	Multiple	Multiple	Smith Bits	
11.000	Hybrid	PVP616	11,575	6	Alberta, Canada	2014	Pouce Coupe	Birchcliff Energy	Shear Bits	
11.625	Milled Tooth	XR+CPS	9,452	6	Kazakhstan	2010	Multiple	Multiple	Smith Bits	
11.750	PDC	VS516	10,141	3	Khanty-Mansiyskiy, Russia	2012	Multiple	Multiple	Smith Bits	
12.000	Bicenter	DOSRWD	4,856	2	Gulf of Mexico	2001	Green Canyon	Shell E&P Co.	Baker Hughes	
12.250	Bicenter	QDR54PX	17,863	9	Mexico	2007	Multiple	Multiple	Smith Bits	

CUMULATIVE FOOTAGE (continued)										
SIZE, IN.	BIT STYLE	TYPE	FOOTAGE	ROP, FT/HR	LOCATION	YEAR	FIELD	OPERATOR	MANUFACTURER	
12.250	Hammer	H42S2R3	12,794	4	Terrell Co., Texas	1996	Brown Bassett	Arco/Shell	Smith Bits	
12.250	Hybrid	SVP616	19,808	17	Canada	2014	Multiple	Multiple	Shear Bits	
13.500	PDC	S519VPX	65,201	36	Gulf Coast, Texas	2010	Multiple	Multiple	Smith Bits	
13.625	Hammer	H45M2	3,942	5	Northern Territory, Australia	1995	Multiple	Multiple	Smith Bits	
13.750	Hybrid	SVP616	12,117	8	Alberta, Canada	2014	Multiple	Multiple	Shear Bits	
13.750	Milled Tooth	XR+	20,872	29	Weld Co., Colo.	2013	Multiple	Multiple	Smith Bits	
14.000	PDC	MDI519BPXC	13,976	7	Malaysia	2011	Multiple	Multiple	Smith Bits	
14.250	Bicenter	QDS41PX	5,630	2	Louisiana Offshore Gulf of Mexico	2002	Multiple	Multiple	Smith Bits	
14.500	Hammer	H1812D	1,722	2	Cleburne Co., Ark.	2012	Multiple	Multiple	Smith Bits	
14.500	Insert	XT20R	10,146	2	Offshore Mexico	2012	Escobal	Saxon	Halliburton DBS	
14.750	Bicenter	BC27PX	26,541	8	Argentina	2004	Multiple	Multiple	Smith Bits	
14.750	Hybrid	SVP619	6,523	5	Alberta, Canada	2014	Multiple	Multiple	Shear Bits	
15.500	Insert	GS10V	6,110	7	Russia	2010	Multiple	Multiple	Smith Bits	
15.500	Milled Tooth	XR+V	17,252	28	Khanty-Mansiyskiy, Russia	2013	Multiple	Multiple	Smith Bits	
15.500	PDC	SI519HPX	20,278	13	Orenburg, Russia	2014	Multiple	Multiple	Smith Bits	
16.000	Bicenter	SHO716BPX	11,085	4	Brunei	2010	Multiple	Multiple	Smith Bits	
16.000	Hybrid	SVP619	2,644	3	Canada	2014	Multiple	Multiple	Shear Bits	
16.000	PDC	SDI519MHPX	46,932	19	Ecuador	2014	Multiple	Multiple	Smith Bits	
16.375	PDC	MDI619HSPX	20,537	4	Gulf of Mexico	2009	Multiple	Multiple	Smith Bits	
16.500	Insert	GS03BV	2,798	2	Egypt	2012	Multiple	Multiple	Smith Bits	
16.500	Milled Tooth	XR+	2,243	2	Turkey	2010	Multiple	Multiple	Smith Bits	
17.000	Bicenter	CSD144M	8,485	2	Gulf of Mexico	2001	Panza/Dendara	Spirit Energy 76	National Oilwell Varco	
17.000	Milled Tooth	XR+	11,326	7	Angola	2014	Multiple	Multiple	Smith Bits	
17.250	Insert	20GMSC	1,657	2	Norway	2006	Multiple	Multiple	Smith Bits	
17.250	PDC	MS716LHPX	5,262	2	Gabon	2014	Multiple	Multiple	Smith Bits	
17.375	Milled Tooth	SDGH	211	2	Yemen	2004	Multiple	Multiple	Smith Bits	
17.500	Bicenter	CSD066	23,889	7	Gulf of Mexico	2001	Genesis	Chevron	National Oilwell Varco	
17.500	Hammer	H1809D	7,116	7	Wetzel Co., W. Va.	2014	Multiple	Multiple	Smith Bits	
17.500	Milled Tooth	MGSSH+	23,182	14	Malaysia	2004	Multiple	Multiple	Smith Bits	
18.000	PDC	MGR89VPX	5,035	2	Gulf of Mexico	2004	Multiple	Multiple	Smith Bits	
18.125	Milled Tooth	XR+	6,096	2	Gulf of Mexico	2012	Multiple	Multiple	Smith Bits	
18.250	Hammer	C45	738	2	LeFlore/Latimer Cos., Okla.	2002	West Red Oak	BP America	Smith Bits	
18.500	PDC	S83SPX	13,385	8	Campeche, Mexico	2010	Multiple	Pernex	Smith Bits	
19.000	Bicenter	QDR89PX	4,045	2	Malaysia	2004	Multiple	Multiple	Smith Bits	
19.250	Milled Tooth	DSJ	3,360	7	Yamalo-Nenetskiy, Russia	2014	Multiple	Multiple	Smith Bits	
20.000	Bicenter	QDS5219PX	16,455	10	Kern Co., Calif.	2009	Multiple	Multiple	Smith Bits	
20.000	PDC	S91VPX	7,372	2	Newfoundland, Canada	1999	Terra Nova	Terra Nova Alliance	Smith Bits	
22.000	Insert	GS12BVEC	8,781	15	Kuwait	2014	Multiple	Multiple	Smith Bits	
22.000	Milled tooth	MSDSSHCH	11,003	3	Gulf of Mexico	2003	Multiple	El Paso Production	Smith Bits	
22.250	Insert	GS12BVE	6,770	4	Qatar	2007	Multiple	Multiple	Smith Bits	
22.500	Insert	GS106UVE	8,658	6	Sakhalin, Russia	2014	Multiple	Multiple	Smith Bits	
22.750	Milled Tooth	SS33GJ4	3,740	2	Norwegian North Sea	2003	Oseberg	Norsk Hydro	Halliburton DBS	
23.000	Bicenter	BC91PX	6,902	41	Terengganu, Malaysia	2005	Multiple	Multiple	Smith Bits	
23.500	Milled Tooth	DSJC	4,559	5	U.K. North Sea	2001	Dunbar	TotalFinaElf	Smith Bits	
24.000	Insert	MG04C	13,774	7	Norwegian North Sea	2002	Troll, Visund	Norsk Hydro	Smith Bits	
26.000	PDC	TFR616S	16,973	8	Iraq	2013	Garraf	Weatherford/Petronas	National Oilwell Varco	
27.000	Milled Tooth	XR+C	1,681	3	Saudi Arabia	2009	Multiple	Multiple	Smith Bits	
27.500	Milled Tooth	DSJ	2,526	2	Malaysia	2011	Multiple	Multiple	Smith Bits	
27.750	Milled Tooth	XR+PS	2,822	3	Malaysia	2010	Multiple	Multiple	Smith Bits	
28.000	Insert	GS18C	9,386	4	Kuwait	2006	Multiple	Multiple	Smith Bits	
28.000	Milled Tooth	MSDGH-7	7,906	7	Campeche, Mexico	2012	Multiple	Pernex	Smith Bits	
28.750	Milled Tooth	DGJC	2,360	4	Offshore Norway	1991	Gullfaks B	Statoil	Smith Bits	
30.000	Milled Tooth	XR+VE	11,104	14	Gulf of Mexico	2011	Multiple	Multiple	Smith Bits	
31.000	Milled Tooth	XR+V	55	3	Gabon	2014	Multiple	Multiple	Smith Bits	
31.625	Milled Tooth	XR+VE	686	5	Papua New Guinea	2014	Multiple	Multiple	Smith Bits	
32.000	Milled Tooth	MSDSSHVE	1,696	2	Malaysia	2010	Multiple	Multiple	Smith Bits	
32.375	Milled Tooth	XR+C	620	3	Vietnam	2009	Multiple	Multiple	Smith Bits	
33.000	Milled Tooth	XR+C	2,644	6	Malaysia	2010	Multiple	Multiple	Smith Bits	
34.000	Insert	GS03VEJ3C	157	4	Sindh, Pakistan	2014	Multiple	Multiple	Smith Bits	
34.000	Milled Tooth	MGGC	2,375	3	Saudi Arabia	2005	Multiple	Multiple	Smith Bits	
36.000	Milled Tooth	DSJW-7	7,325	24	Offshore Brazil	2013	Multiple	Multiple	Smith Bits	
44.000	Milled Tooth	L111	480	2	Philippines	2013	Malampaya	Shell Philippines Exploration	Varel International	