Weatherford®

Defyer™ Series Drillable Casing Bits

Drilling

Evaluation

Completion

Production

Intervention

Drilling hazard mitigation

- Drilling-with-casing (DwC™) systems
- Secure Drilling℠ services
- Solid expandable systems

Defy convention, deliver results.

Go beyond conventional limits to deliver technology, features and adaptability to defy any challenge.

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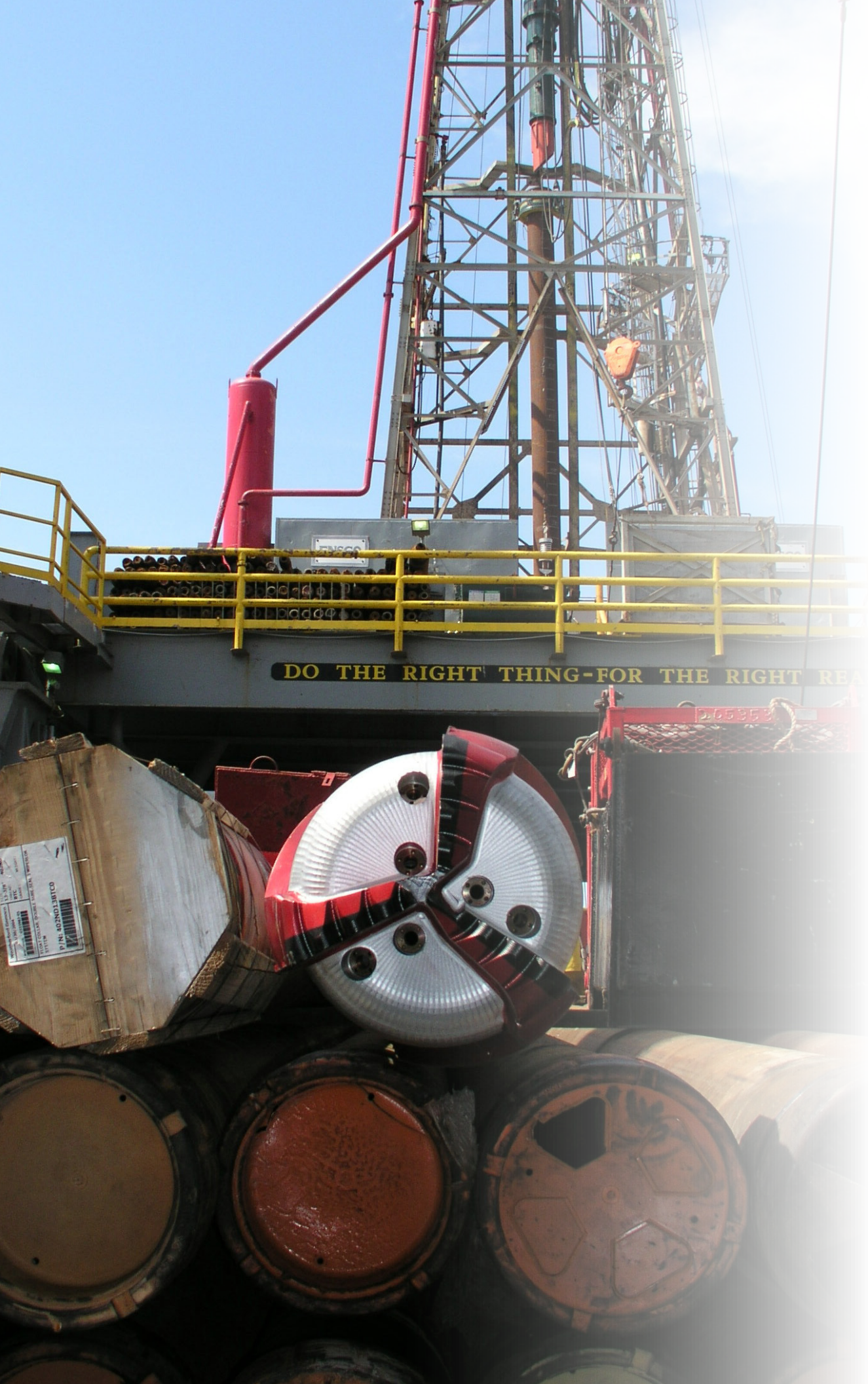

ENSCO
DO THE RIGHT THING-FOR THE RIGHT

Introduction

Weatherford's *Defyer* series drillable casing bits provide custom solutions for drilling-with-casing (DwC™) operations in any environment. The innovative, robust design of the *Defyer* is capable of penetrating soft, medium, or hard formations. The *Defyer* series delivers the technology, features, and adaptability that conventional methods cannot offer.

Defyer series drillable casing bits are made up directly onto the casing and use the casing as the drillstring. This procedure contrasts with competing casing-while-drilling systems, which do not operate by rotating the casing. These systems are complex, and involve substantial sophisticated downhole equipment. The *Defyer* series is a step-change technology which transforms well construction efficiency.

Designed for use with our *DwC* and drilling-with-liner (DwL™) systems, Weatherford's *Defyer* series drillable casing bits are cost effective and easy to operate without rig modifications. Using *Defyer* tools enables the casing to be drilled to planned depth, reducing wellbore exposure and isolating drilling hazards so that cementing operations can begin immediately.

Weatherford's *DwC* systems have the capability to implement *Defyer* technology in a subsea environment with the development of the SeaLance™ subsea casing system. *SeaLance* subsea casing systems push shallow casing seats even deeper for a more efficient well design.

We offer our *Defyer* tools in a wide range of sizes. *Defyer* series technology defies convention, delivers results, and maximizes operational efficiency.

Defyer™ Nomenclature

Blade Count

Cutter Size (mm)

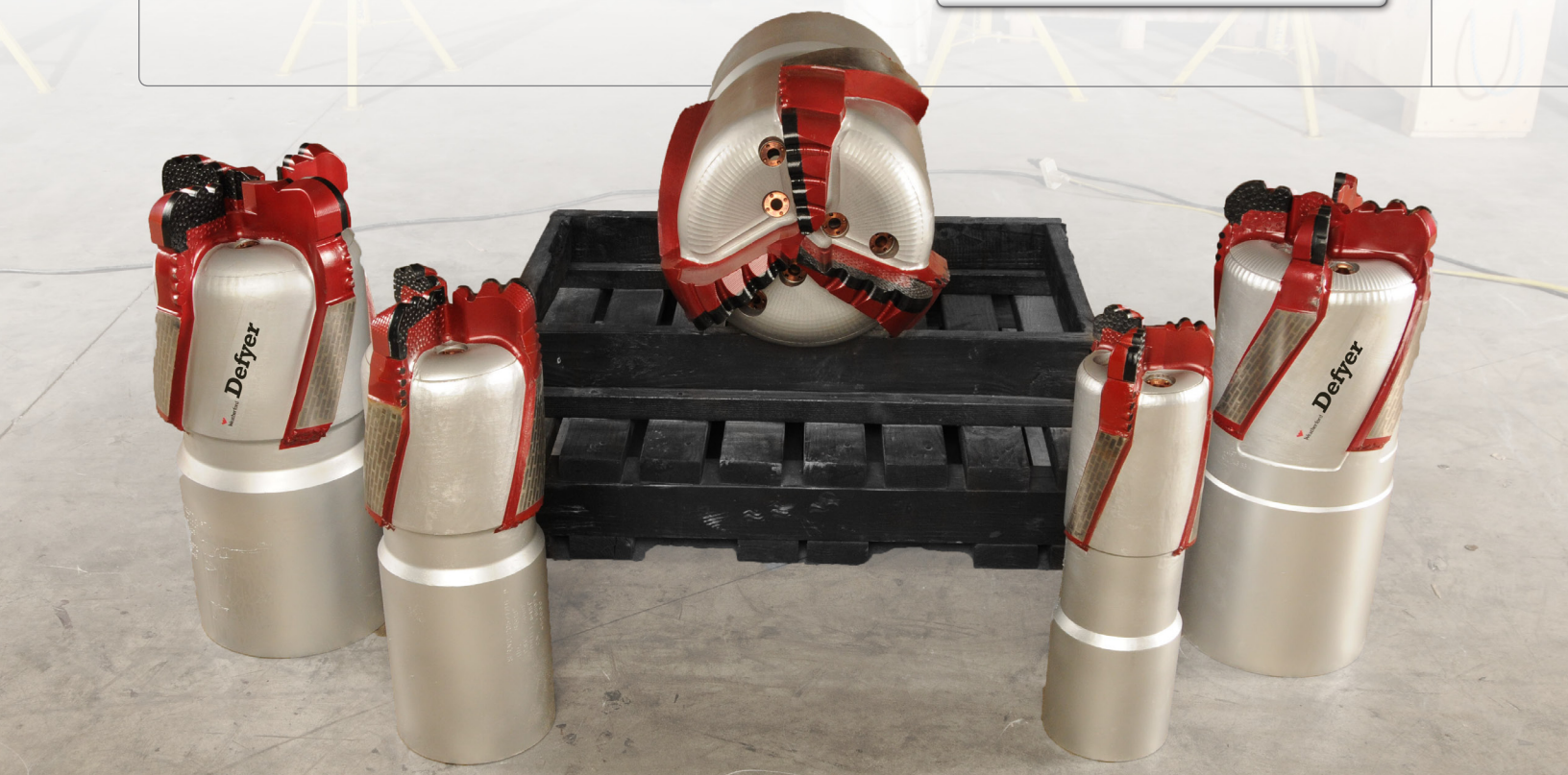
D P C 5 09 *

Defyer

P - PDC
T - TSP
V - HVOF
H - Hybrid

Convertible (DS3)

Suffix
B - Bi-center or dual axis
G - Enhanced gage protection
K - Backreaming
L - Light version
N - Nudging
S - Special drift
V - Extra face volume or blade stand-off
X - Mixed cutter size

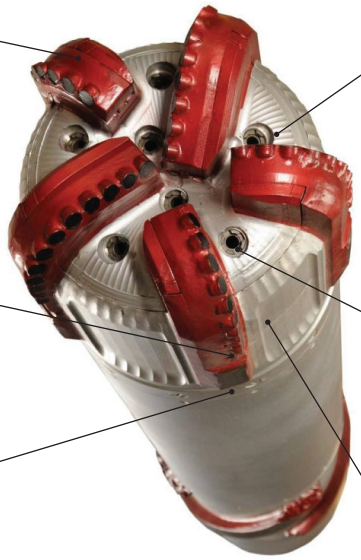


Features, Advantages and Benefits

Reliable diamond PDC cutting structure, mounted on high-standoff, displaceable blades, enhances cutting efficiency, rate of penetration, and durability—saving time and reducing hole problems.

Gauge pads with tungsten carbide inserts, or optional TSP diamonds, maintain gauge protection, reducing the potential for undergauge hole.

Backreaming feature enables reaming of swelling formations and tight spots for improved hole quality.



Fully drillable inner piston allows rapid, damage-free drillout with conventional PDC bits, roller-cone bits, or another *Defyer* series assembly, which eliminates the need for a special drillout run or retrieval of the bottomhole assembly after drilling to total depth, saving operational time.

Hydraulic optimization with interchangeable, drillable nozzles increases hydraulic horsepower at the bit, improving penetration rates and reducing rig time and operational costs.

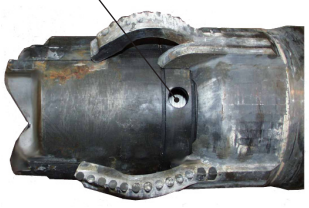
Threaded connection between the aluminum nose and steel body/shoulder.

High-velocity oxy fuel (HVOF) hardfacing in aluminum surface increases durability and enhances retention of the cutting structure.

6-mm round, thermally stable polycrystalline (TSP) pressed into the aluminum provides a durable cutting structure. Small cutters are easily drilled out and removed from the hole with drilling fluid.

Diamond cutting structure, with high-standoff fishtail blades and a wave cutting profile, enhances cutting efficiency, rate of penetration, and durability—saving time, extending drilling distances, and reducing hole problems.

Large cementing ports open to the annulus upon inner piston displacement to increase the flow area for cement, improving cement quality and reducing cementation time.



Displaceable blades enhance cutting efficiency, rate of penetration, and durability saving time and reducing hole problems.

Defyer™ DV Series

The *Defyer* DV is designed for drilling with casing in very soft and soft unconsolidated formations with confined compressive strengths up to 2,000 psi (13.8 MPa). This tool incorporates an aluminum inner core with integral cutting blades. The blades are coated with a thin layer of tungsten carbide to provide resistance to abrasion during drilling. Carbide inserts are mounted onto the shoulder, outside drift diameter, to reduce shoulder wear and ensure effective cutting operations.

Weatherford's *Defyer* DV is available in a range of sizes from 9-5/8 to 20 in. and can be easily made up on conductor and surface casing strings. To optimize the hydraulic performance of these tools, a variety of interchangeable drillable nozzles is available.

Defyer DT Series

The *Defyer* DT is designed for drilling with casing or liners in soft to medium formations with confined compressive strengths up to 7,000 psi (48.3 MPa) (gumbo, shales, claystones, unconsolidated sands, chalk, shaley sandstones, soft evaporites, and soft siltstones). This tool incorporates PDC cutters on the shoulder with a proprietary diamond cutting structure mounted in drillable blades.

The *Defyer* DT is available in a wide range of sizes from 4-1/2 to 30 in. and can be run on most standard casing or liner systems. To optimize the hydraulic performance of these tools, a variety of interchangeable drillable nozzles is available.

The *Defyer* DT Series is available in 3-, 4- and 5-blade models. With higher diamond content on the nose section, the 5-blade models are designed to drill longer sections than 3-blade and 4-blade models. The 5-blade *Defyer* DT is available in sizes to suit standard casing or liner systems. To optimize the hydraulic performance of these tools, a range of interchangeable drillable nozzles is available.

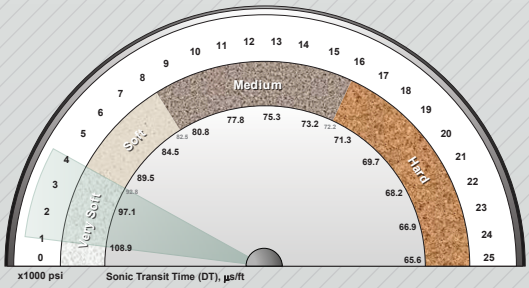
Defyer DPC Series

The *Defyer* DPC is a premium drillable casing bit assembly designed for drilling with casing in medium to medium-hard formations with confined compressive strengths up to 15,000 psi (103.4 MPa). This tool incorporates a pressure-cycled, PDC-drillable piston that displaces PDC blades into the annulus after reaching total depth. The steel and PDC blades are coated with a thin layer of tungsten carbide to provide resistance to erosion and abrasion during drilling. The PDC cutters are uniquely mounted on the face of the tool to achieve an efficient drilling operation and maximize durability. All *Defyer* series drillable casing bits can be drilled out with any standard oilfield drill bit without compromising the cutting structure.

The *Defyer* DPC series' unique and innovative design is a natural progression of Weatherford's *Defyer* DV and DT providing significant savings in both time and money in many daily operations. This tool allows drilling with casing in firmer and more abrasive formations than was previously possible. The *Defyer* DPC incorporates erosion-resistant ceramic nozzles with specially designed extension tubes that raise the fluid profile to mitigate the risk of erosion damage to the aluminum nose section. Like the *Defyer* DV and DT the *Defyer* DPC features interchangeable drillable nozzles to optimize hydraulic performance.

Applications

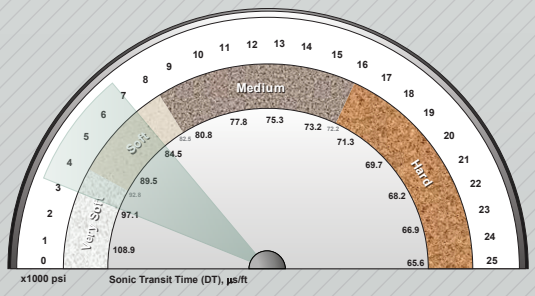
- Drilling surface and conductor casing in very soft and soft unconsolidated formations
- Reaming casing through unstable hole conditions, excessive borehole caving, or in severely swollen formations
- Backreaming feature enables reaming of swelling formations and tight spots to improve hole quality



***Defyer* DV Series**
Unconfined Compressive Strength (UCS) Range
1,000 - 4,000 psi

Applications

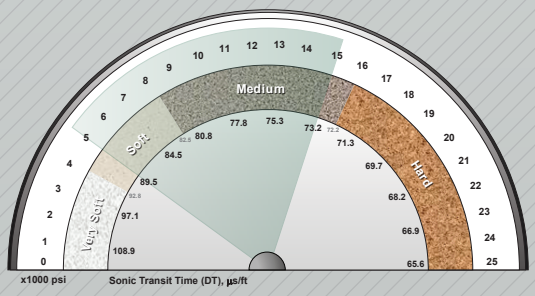
- Drilling with casing in soft to medium-soft formations
- Drilling surface or intermediate casing strings
- Drilling or reaming with intermediate casing strings
- Drilling short intervals in conjunction with a drilling-with-liner (DwL™) system
- Extending existing hole sections by drilling with casing or liner through hazards such as pressure transitions or depleted zones
- Drilling through cement and LCM plugs set to isolate losses, pressure, or unstable hole
- Reaming liners through unstable hole conditions, excessive borehole caving, or in severely swollen formations
- Drilling deviated hole sections in soft formations (nudge-type *Defyer* DT) formations
- Reaming casing through unstable hole conditions, excessive borehole caving, or in severely swollen formations
- Backreaming feature allows reaming of swelling formations and tight spots to improve hole quality



***Defyer* DT Series**
Unconfined Compressive Strength (UCS) Range
3,000 - 7,000 psi

Applications

- Drilling with casing in medium to medium-hard formations
- Drilling with casing or liner over short sections in hard formations <20,000 psi (<137.9 MPa)
- Drilling surface and conductor casing in areas where competent rock is encountered near the surface
- Drilling or reaming with intermediate casing strings
- Drilling short intervals in conjunction with a drilling-with-liner (*DwL*) system
- Drilling through cement plugs that have been set to isolate losses, pressure, or unstable holes
- Reaming liners through unstable hole conditions, excessive cavings, or in severely swollen formations



***Defyer* DPC Series**
Unconfined Compressive Strength (UCS) Range
5,000 - 15,000 psi

DwC™ Non-Rotating Centralizer

Weatherford's drilling-with-casing (*DwC*) non-rotating centralizer is designed to reduce torque and the risk of casing wear and optimize fluid displacement and cuttings removal in vertical, inclined, and horizontal wells. Based on Weatherford's field-proven SpiraGlider™ system, the tool consists of a steel centralizer designed with an elastomer bearing lining and two integrated stop collars. Special rounded blades reduce sliding friction on the casing as the special stop collar performs as a positioning device. The interrupted blade design increases the junk-slot volume, enhances cutting removal, and strengthens the tool so it can withstand greater sidewall forces.

The non-rotating centralizer is recommended when rotation of the casing is required or when extremely high axial loads are anticipated to provide reliable, highly capable performance while simultaneously drilling the hole. The tool can be run free-floating between casing couplings or with specially designed stop collars.

Applications

- Drilling with casing
- Drilling with liner
- Reaming with casing or liner
- Vertical, inclined, and horizontal wells
- Extended-reach and extreme-dogleg wells

CleanReam™ Reaming Shoe

Weatherford's *CleanReam* reaming shoe is designed to reduce reaming time during liner or casing installations. It is especially advantageous where the likelihood of hole problems is high. The nose structure and external gauge, for example, are designed to avoid the potential of sidetracking in soft formations. The concentric nose features six TSP (thermally stable polycrystalline) diamond blades. The tool is also fitted with nozzles to increase the flow penetration and enhance hole and blade cleaning.

Applications

- Liner reaming
- Casing reaming

Features, Advantages and Benefits

- The steel centralizer's design provides a bearing surface for lower drag forces which, when combined with mud lubricity, require less rotational torque than conventional centralizers, enhancing rotation and running efficiency.
- Spiral-blade configuration capitalizes on the "sled effect", minimizing drag forces while running pipe. The blades glide smoothly on the low side of the borehole wall. Wide symmetrical fins, beveled smooth at both ends, glide easily over restrictions.
- The robust steel design—combined with innovative manufacturing methods, make the DwC™ non-rotating centralizer ideal for the most demanding well conditions.
- The hydrodynamic shape of the system's spiral blades enables fluid displacement and cuttings removal, minimizing pressure drop and local turbulences across the centralizer.
- The large flow-by area of the system minimizes equivalent circulating density (ECD) concerns.
- Enhanced side-loading capacity-interrupted blade structure significantly reduces stress.
- Centralizers with internal elastomer bearing offer a significant friction factor reduction and eliminate the risk of damage to casing with high rotating speeds.

Features, Advantages and Benefits

- The combination of a six-bladed concentric nose and nozzle configuration enhances reaming and hole-cleaning capabilities to save time and costs and increase efficiency.
- External-gauge PDC cutters provide an aggressive cutting structure for reaming through tight spots. The nose can penetrate restrictions in the wellbore deeply enough to expose the PDC cutters and transfer the reaming action to the external gauge. This design prolongs the life of the reaming shoe and increases rate of penetration.
- The backreaming capability, which allows for both upward and downward reaming through tight sections, is especially advantageous before a new connection is made, ensuring that casing will be free to move when the next joint of casing is run.
- Several design elements of the aluminum nose and copper nozzles facilitate drilling and minimize post-drillout debris:
  - The nose and nozzles are PDC or rock-bit drillable.
  - The drillable nose has an internal guiding profile to center the drill bit upon entry.

Reaming Tool Features Comparison

	 ReamerShoe™	 CleanReam™	 Defyer™ DV	 *Defyer* DT	 *Defyer* DP	 *Defyer* DPC
Nose-cutting structure	None	TSP	Dense Layer Tungsten Carbide	TSP	PDC	PDC
Gauge-cutting structure	Carbide	PDC	Carbide	PDC	PDC	PDC
Blade count (size dependent)	None	6	3	3, 4, 5	6, 8, 10	5
Backreaming	Yes	Yes	Yes	Yes	Yes	Yes
Reciprocating	Yes	No	No	No	No	No
Interchangeable nozzle	No	Yes	Yes	Yes	Yes	Yes
Bit-face cleaning	Fair	Very Good	Very Good	Very Good	Very Good	Very Good
Drillout	PDC, TCI, milltooth	PDC, TCI, milltooth	PDC, TCI, milltooth	PDC, TCI, milltooth	TCI, milltooth	PDC, TCI, milltooth
Drillout anti-rotation	Yes	Yes	Yes	Yes	Yes	Yes
Risk of sidetracking	Negligible	Negligible	Low	Low	Low	Low
Casing size (in.)	4-1/2 to 30	7	9-5/8, 13-3/8, 18-3/8, 20	4-1/2 to 30	7-5/8, 9-5/8, 13-3/8, 16	7, 9-5/8, 13-3/8

Specifications

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Specifications

Defyer™ DV Series

Nominal size (in.)	**9-5/8 × 10-5/8**	**9-5/8 × 11-3/4**	**9-5/8 × 12**	**9-5/8 × 12**	**9-5/8 × 12-1/4**	**13-3/8 × 15-1/4**	**13-3/8 × 17**
Part number	DS1-095105-S1	DS1-095116U	DS1-095120	DS1-095120U	DS1-095122U	DS1-133152	DS1-133170
Defyer code	DV300-095105	DV300-095116U	DV300-095120	DV300-095120U	DV300-095122U	DV300-133152	DV300-133170
OD (in./*mm*)	10-5/8 *269.9*	11-3/4 *298.5*	12 *304.8*		12-1/4 *311.2*	15-1/4 *387.4*	17 *431.8*
Casing size (in./*mm*)	9-5/8 *244.5*					13-3/8 *339.7*	
Casing weight and grade	As requested						
Connection	As requested						
Length (ft/*m*)	2.27 *0.69*					2.59 *0.79*	
Weight (lb/*kg*)	150.0 *68.0*	170.0 *77.0*	178.6 *81.0*	170.0 *77.0*	178.0 *80.7*	273.4 *124.0*	383.6 *174.0*
Number of blades	3						
Number of nozzles	3					9	
Cutting structure (drillable core)	Dense, thin layer of tungsten carbide						
Cutting structure (on casing body)	Carbide						
Gauge length (in./*mm*)	6.60 *167.6*	6.89 *175.0*	6.74 *171.2*	6.89 *175.0*		9.42 *239.3*	8.55 *217.2*
Gauge protection	Tungsten carbide briquettes	Machined steel	Tungsten carbide briquettes	Machined steel		Tungsten carbide briquettes	
Total flow area	Dependent on nozzle selection						
Junk slot area (in.^{2}/*cm*^{2})	11.98 *77.3*	18.27 *117.9*	22.07 *142.4*	21.75 *140.3*	25.32 *163.4*	16.06 *103.6*	41.38 *267.0*
Body material	51 ksi Minimum yield						
Nose material	Drillable alloy						

Nominal size (in.)	**18-5/8 × 21**	**18-5/8 × 21**	**18-5/8 × 24**	**18-5/8 × 24**	**20 × 24**	**20 × 24**
Part number	DS1-185210	DS1-185210W*	DS1-185240	DS1-185240W*	DS1-200240	DS1-200240W*
Defyer code	DV300-185210	DV300-185210W	DV300-185240	DV300-185240W	DV300-200240	DV300-200240W
OD (in./*mm*)	21 *533.4*		24 *609.6*			
Casing size (in./*mm*)	18-5/8 *473.1*				20 *508.0*	
Casing weight and grade	As requested					
Connection	As requested					
Length (ft/*m*)	2.18 *0.66*				2.41 *0.73*	
Weight (lb/*kg*)	418.9 *190.0*		440.0 *199.6*			
Number of blades	3					
Number of nozzles	6	9				
Cutting structure (drillable core)	Dense, thin layer of tungsten carbide					
Cutting structure (on casing body)	Carbide					
Gauge length (in./*mm*)	6.85 *174.0*		6.35 *161.6*			
Gauge protection	Tungsten carbide briquettes					
Total flow area	Dependent on nozzle selection					
Junk slot area (in.^{2}/*cm*^{2})	39.08 *252.1*		76.95 *496.5*			
Body material	51 ksi Minimum yield					
Nose material	Drillable alloy					

*Weld-prep model

Defyer DT Series

Nominal size (in.)	**4-1/2 × 6-1/8**	**5 × 6**	**5 × 6-1/8**	**5-1/2 × 6-1/2**	**5-1/2 × 7-7/8**
Part number	DS2-044061	DS2-050060	DS2-050061	DS2-054064	DS2-054077
Defyer code	DT306-044061	DT306-050060	DT306-050061	DT306-054064	DT306-054077
OD (in./*mm*)	6-1/8 *155.6*	6 *152.4*	6-1/8 *155.6*	6-1/2 *165.1*	7-7/8 *200.0*
Casing size (in./*mm*)	4-1/2 *114.3*	5 *127.0*		5-1/2 *139.7*	
Casing weight and grade	As requested				
Connection	As requested				
Length (ft/*m*)	1.62 *0.49*	1.63 *0.50*	1.62 *0.49*	1.80 *0.55*	2.00 *0.61*
Approximate weight (lb/*kg*)	37 *17*	44 *20*	44 *20*	51 *23*	68 *31*
Number of blades	3				
Number of nozzles	3				
Cutting structure (drillable core)	6-mm TSP				
Cutting structure (on casing body)	PDC				
Gauge length (in./*mm*)	8.53 *216.7*	5.43 *137.8*	5.36 *136.1*	5.76 *146.3*	
Gauge protection	Tungsten carbide briquettes				
Total flow area	Dependent on nozzle selection				
Junk slot area (in.^{2}/*cm*^{2})	7.4 *47.9*	4.8 *30.7*	5.7 *37.0*	4.7 *30.1*	13.9 *89.7*
Body material	110 ksi Minimum yield				
Nose material	Drillable alloy				

Nominal size (in.)	**7 × 8-1/4**	**7 × 8-3/8**	**7 × 8-1/2**	**7-5/8 × 8-1/2**	**7-5/8 × 8-1/2**	**7-5/8 x 8-7/16**	**7-5/8 × 9-7/8**	**7-5/8 × 9-7/8**
Part number	DS2-070082	DS2-070083	DS2-070084	DS2-075084	DS2-075084-S1	DS2-075084	DS2-075097	DS2-075097
Defyer code	DT306-070082	DT306-070083	DT306-070084	DT306-075084	DT406-075084	DT306-075084	DT306-075097	DT406-075097
OD (in./*mm*)	8-1/4 *209.6*	8-3/8 *212.7*	8-1/2 *215.9*	8-1/2 *215.9*	8-1/2 *215.9*	8-7/16 *214.3*	9-7/8 *250.8*	9-7/8 *250.8*
Casing size (in./*mm*)	7 *177.8*			7-5/8 *193.7*				
Casing weight and grade	As requested							
Connection	As requested							
Length (ft/*m*)	1.93 *0.59*	1.90 *0.58*			1.92 *0.59*		1.90 *0.58*	1.92 *0.59*
Approximate weight (lb/*kg*)	92 *42*	94 *43*	97 *44*	108 *49*		110 *50*	123 *56*	115 *52*
Number of blades	3				4	3		
Number of nozzles	3				4	3		
Cutting structure (drillable core)	6-mm TSP							
Cutting structure (on casing body)	PDC							
Gauge length (in./*mm*)	5.83 *148.1*	5.77 *146.6*	5.76 *146.3*	5.70 *144.8*	5.76 *146.3*	5.51 *140.0*	5.50 *140.0*	5.34 *135.6*
Gauge protection	Tungsten carbide briquettes							
Total flow area	Dependent on nozzle selection							
Junk slot area (in.^{2}/*cm*^{2})	8.3 *53.9*	6.7 *43.4*	7.6 *48.8*	6.9 *44.8*	4.6 *29.6*	5.8 *37.7*	23.0 *148.1*	19.9 *128.2*
Body material	110 ksi Minimum yield							
Nose material	Drillable alloy							

Specifications

Defyer™ DT Series *(continued)*

Nominal size (in.)	8-5/8 × 10-5/8	8-5/8 × 12	9-3/8 x 9.7	9-5/8 × 10-5/8	9-5/8 × 10-7/8	9-5/8 × 11-7/8	9-5/8 × 12	9-5/8 × 12
Part number	DS2-085105	DS2-085120-S1	DS2-093096-S1	DS2-095105	DS2-095107	DS2-095117	DS2-095120	DS2-095120-S1
Defyer code	DT406-085105	DT406-085120	DT406-093096	DT406-095105	DT406-095107	DT306-095117	DT306-095120	DT406-095120
OD (in./*mm*)	10-5/8 269.8	12 *304.8*	9.7 *246.4*	10-5/8 269.8	10-7/8 269.8	11-7/8 *301.6*	12 *304.8*	
Casing size (in./*mm*)	8-5/8 *219.1*		9-3/8 238.1	9-5/8 *244.5*				
Casing weight and grade	As requested							
Connection	As requested							
Length (ft/*m*)	2.12 *0.65*		1.94 *0.59*	2.05 *0.63*		2.12 *0.65*		2.05 *0.63*
Approximate weight (lb/*kg*)	200 *91*	207 *94*	123 *56*	210 *96*	212 *96*	123 *56*	212 *96*	216 *98*
Number of blades	4					3		4
Number of nozzles	4					3		4
Cutting structure (drillable core)	6-mm TSP							
Cutting structure (on casing body)	PDC							
Gauge length (in./*mm*)	5.91 *150.0*	6.35 *161.3*	6.47 *164.4*	6.54 *166.2*	6.39 *162.2*	6.19 *157.2*	6.54 *166.1*	5.74 *145.7*
Gauge protection	Tungsten carbide briquettes							
Total flow area	Dependent on nozzle selection							
Junk slot area (in.^{2}/*cm*^{2})	9.1 *58.7*	22.9 *147.7*	7.6 *19.3*	11.2 *72.1*	12.6 *81.1*	17.4 *112.2*	23.5 *151.6*	24.6 *159.0*
Body material	110 ksi Minimum yield							
Nose material	Drillable alloy							

Nominal size (in.)	9-5/8 × 12-1/4	9-5/8 × 12-1/4	9-5/8 × 12-1/4	9-7/8 x 10-5/8	9-7/8 × 12	9-7/8 × 10.6	9-7/8 x 12-1/4	10-3/4 × 12	10-3/4 × 13-1/2
Part number	DS2-095122	DS2-095122	DS2-095122-S1	DS2-097105-S1*	DS2-097120*	DS2-097105-S1	DS2-097122	DS2-106120	DS2-106134
Defyer code	DT306-095122	DT306-095122	DT406-095122	DT406-097105	DT306-097120	DT406-097105	DT306-097122	DT306-106120	DT306-106134
OD (in./*mm*)	12-1/4 *311.2*			10-5/8 *269.9*	12 *304.8*	10.6 *269.2*	12-1/4 *311.15*	12 *304.8*	13-1/2 *342.9*
Casing size (in./*mm*)	9-5/8 *244.5*			9-7/8 *250.8*				10-3/4 *273.1*	
Casing weight and grade	As requested								
Connection	As requested								
Length (ft/*m*)	2.12 *0.65*		2.05 *0.63*	2.05 0.63	2.12 *0.65*	2.05 *0.63*	2.12 *.65*	2.21 *0.68*	2.08 *0.63*
Approximate weight (lb/*kg*)	232 *105*		243 *110*	154 *70*	190 *86*	210 *96*	212 *96*	215 *98*	320 *145*
Number of blades	3		4		3	4	3		3
Number of nozzles	3	6	4		3	4	3		6
Cutting structure (drillable core)	6-mm TSP								
Cutting structure (on casing body)	PDC								
Gauge length (in./*mm*)	6.42 *165.6*		5.76 *146.3*	6.57 *166.8*	6.54 *166.1*	6.56 *166.6*	6.57 *167.0*	6.35 *161.4*	6.15 *156.2*
Gauge protection	Tungsten carbide briquettes								
Total flow area	Dependent on nozzle selection								
Junk slot area (in.^{2}/*cm*^{2})	27.2 *175.6*		28.2 *182.1*	11.2 *72.0*	23.5 *151.6*	10.8 *69.9*	30.1 *194.5*	13.7 *88.4*	24.5 *157.8*
Body material	110 ksi Minimum yield								
Nose material	Drillable alloy								

Nominal size (in.)	**11-3/4 × 12-1/4**	**11-7/8 × 12-1/4**	**13-3/8 × 14-3/4**	**13-3/8 × 15-1/2**	**13-3/8 × 16**	**13-3/8 × 16**	**13-3/8 × 17**	**13-3/8 × 17**	**13-3/8 × 17**
Part number	DS2-116122*	DS2-117122	DS2-133146*	DS2-133154	DS2-133160	DS2-133160NDG	DS2-133170	DS2-133170-S1	DS2-133170-S15
Defyer code	DT306-116122	DT306-117122	DT306-133146	DT306-133154	DT306-133160	DT306N-133160	DT306-133170	DT406-133170	DT506-133170
OD (in./*mm*)	12-1/4 *311.1*		14-3/4 *374.7*	15-1/2 *393.7*	16 *406.4*		17 *431.8*		
Casing size (in./*mm*)	11-3/4 *298.5*	11-7/8 *301.6*	13-3/8 *339.7*						
Casing weight and grade	As requested								
Connection	As requested								
Length (ft/*m*)	2.08 *0.63*		2.59 *0.79*			2.27 *0.694*	2.59 *0.79*		2.66 *0.81*
Approximate weight (lb/*kg*)	243 *110*		368 *167*	380 *173*	388 *176*	388 *176*	454 *206*	372 *169*	564 *256*
Number of blades	3							4	5
Number of nozzles	6							8	7
Cutting structure (drillable core)	6-mm TSP								
Cutting structure (on casing body)	PDC								
Gauge length (in./*mm*)	6.74 *171.2*		10.32 *262.2*	9.25 *234.8*	9.02 *229.1*	3.77 *95.8*	8.55 *217.1*	8.53 *216.7*	7.01 *178.0*
Gauge protection	Tungsten carbide briquettes								
Total flow area	Dependent on nozzle selection								
Junk slot area (in.^{2}/*cm*^{2})	7.4 *47.9*		14.0 *90.2*	23.8 *153.8*	29.2 *188.3*	48.3 *311.7*	49.1 *317.0*	48.4 *312.5*	44.8 *288.9*
Body material	110 ksi Minimum yield								
Nose material	Drillable alloy								

*S13 (With baffle plate)-version available

Nominal size (in.)	**13-3/8 × 17-1/4**	**13-3/8 × 17-1/2**	**13-3/8 × 17-1/2**	**16 x 17-1/2**	**16 × 19-1/2**	**18-5/8 × 21**	**18-5/8 × 21**	**18-5/8 x 23**	**20 × 23-7/8**
Part number	DS2-133172	DS2-133174	DS2-133174	DS2-160174	DS2-160194	DS2-185210-S1	DS2-185210-S15	DS2-185230-S15	DS2-200237W
Defyer code	DT306-133172	DT306-133174	DT406-133174	DT306-160174	DT306-160194	DT506-185210	DT506-185210	DT506-185230	DT306-200237W
OD (in./*mm*)	17-1/4 *438.2*	17-1/2 *444.5*			19-1/2 *495.3*	21 *533.4*		23 *584.2*	23-7/8 *606.4*
Casing size (in./*mm*)	13-3/8 *339.7*			16 *406.4*		18-5/8 *473.1*			20 *508.0*
Casing weight and grade	As requested								
Connection	As requested								
Length (ft/*m*)	2.59 *0.79*			2.64 0.81	2.59 *0.79*			2.64 *0.80*	2.59 *0.79*
Approximate weight (lb/*kg*)	485 *220*		379 *172*	390 *177*	434 *197*	412 *187*	540 *245*	592 *268*	1,477 *670*
Number of blades	3		4	3		4	5		3
Number of nozzles	6		8	6		12		10	9
Cutting structure (drillable core)	6-mm TSP								
Cutting structure (on casing body)	PDC								
Gauge length (in./*mm*)	8.40 *213.4*	8.32 *211.3*	8.35 *212.1*	9.56 *242.8*	8.32 *211.3*	8.52 *216.4*	8.56 *218.0*	7.20 *182.9*	7.41 *188.2*
Gauge protection	Tungsten carbide briquettes								
Total flow area	Dependent on nozzle selection								
Junk slot area (in.^{2}/*cm*^{2})	54.4 *350.8*	59.7 *385.2*	59.2 *382.1*	18.8 *121.4*	50.2 *323.7*	33.2 *214.3*	30.1 *194.5*	97.8 *631.0*	75.7 *488.5*
Body material	110 ksi Minimum yield			51 ksi Minimum yield					
Nose material	Drillable alloy								

Specifications

Defyer™ DT Series *(continued)*

Nominal size (in.)	**20 × 24**	**20 × 24**	**20 × 24**	**20 × 24**	**20 × 24**
Part number	DS2-200240	DS2-200240W	DS2-200240W	DS2-200240-S15	DS2-200240W-S15
Defyer code	DT306-200240	DT306-200240W	DT406-200240W	DT506-200240	DT506-200240W
OD (in./*mm*)	24 *609.6*				
Casing size (in./*mm*)	20 *508.0*				
Casing weight and grade	As requested				
Connection	As requested				
Length (ft/*m*)	2.58 *0.79*		2.44 *0.74*	2.64 *0.80*	1.98 *0.60*
Approximate weight (lb/*kg*)	882 *400*	1,367 *620*	616 *280*	749 *340*	
Number of blades	3		4	5	
Number of nozzles	9		12	10	
Cutting structure (drillable core)	6-mm TSP				
Cutting structure (on casing body)	PDC				
Gauge length (in./*mm*)	7.33 *186.2*			6.79 *172.4*	8.22 *208.7*
Gauge protection	Tungsten carbide briquettes				
Total flow area	Dependent on nozzle selection				
Junk slot area (in.^{2}/*cm*^{2})	79.9 *515.1*		74.3 *479.1*	65.9 *425.0*	
Body material	51 ksi Minimum yield				
Nose material	Drillable alloy				

Nominal size (in.)	**20 × 26**	**20 × 26**	**20 × 26**	**20 × 26***	**20 × 27**	**24 x 27**
Part number	DS2-200260	DS2-200260W	DS2-000260-S15	DS2-000260W-S15	DS2-200270W	DS2-240270-S15
Defyer code	DT306-200260	DT306-200260W	DT506-000260	DT506-000260W	DT306-200270W	DT506-240270
OD (in./*mm*)	26 *660.4*				27 *655.8*	
Casing size (in./*mm*)	20 *508.0*					24 *609.6*
Casing weight and grade	As requested					
Connection	As requested					
Length (ft/*m*)	2.58 *0.79*	2.03 *0.62*	2.64 *0.80*	2.08 *0.63*	2.03 *0.62*	1.89 *0.58*
Approximate weight (lb/*kg*)	1,402 *636*	1,323 *600*	947 *430*	802 *364*	828 *376*	617 *280*
Number of blades	3	3	5		3	5
Number of nozzles	9	9	10		9	13
Cutting structure (drillable core)	6-mm TSP					
Cutting structure (on casing body)	PDC					
Gauge length (in./*mm*)	6.91 *175.6*	8.03 *204.1*	7.413 *188.3*		6.33 *160.7*	7.95 *202.0*
Gauge protection	Tungsten carbide briquettes					
Total flow area	Dependent on nozzle selection					
Junk slot area (in.^{2}/*cm*^{2})	113.4 731.4	91.3 *589.0*	98.6 *636.4*		90.0 *580.9*	86.0 *555.1*
Body material	51 ksi Minimum yield					
Nose material	Drillable alloy					

*S13 (With baffle plate)-version available

Defyer DPC Series

General Data

Nominal size (in.)	**7 × 8-1/2**	**9-5/8 × 12-1/4**		**13-3/8 × 17-1/2**	
Part number	DS3-070084	DS3-095122		DS3-133174	
Defyer code	DPC513-070084	DPC516-095122		DPC519-133174	
Number of blades	5	5	6	5	
Drilling diameter (in./*mm*)	8-1/2 *215.9*	12-1/4 *311.2*		17-1/2 *444.5*	
Casing size (in.)	7	9-5/8		13-3/8	13-5/8
Casing weight (lb/ft)	26.0 to 32.0	43.5 to 53.5		61.0 to 72.0	88.2
Connection	Blank to suit multiple 7-in. connections	As requested			
Blank connection length (in./*mm*)	7.98 *202.64*	9.88 *250.91*		9.84 *250.00*	
Casing ID	To API 5CT				
Casing drift	To API 5CT				
Tool ID below casing connection (in./*mm*)	6.181 *157.00*	8.642 *219.50*		12.309 *312.65*	
Tool length (ft/*m*)	4.18 *1.27*	5.90 *1.80*		6.20 *1.90*	
Tool weight (lb/*kg*)	271 *123*	814 *370*		1,300 *590*	

Technical Data

Nominal size (in.)	**7 × 8-1/2**	**9-5/8 × 12-1/4**		**13-3/8 × 17-1/2**	
Legacy part number	DS3-070084	DS3-095122		DS3-133174	
Defyer code	DPC513-070084	DPC516-095122		DPC519-133174	
Cutting structure	PDC on steel blades and HVOF				
Cutter diameter (in./*mm*)	0.51 *13*	0.63 *16*	0.51 *13*	0.75 *19*	0.51 *13*
Number of face cutters	31	44	N/A	50	6
Number of gauge cutters	10	N/A	10	N/A	10
Near-bit gauge length (in./*mm*)	1.850 *47.0*				
Stabilizer gauge length (in./*mm*)	8.09 *205.6*	9.53 *242.0*		9.59 *243.5*	
Gauge protection	Tungsten carbide				
Number of nozzles	7	7		12	
Maximum total flow area, drilling nozzles (in.²/*cm²*)	0.41 to 0.89 *2.65 to 5.74*	1.37 *8.84*		1.80 *11.64*	
Junk slot area (in.²/*cm²*)	7.7 *49.9*	20.0 *129.0*	15.9 *102.6*	47.2 *304.3*	
Maximum tool body OD (in./*mm*)	8.091 *205.5*	11.220 *285.0*		15.945 *405.0*	
Drop ball size (in./*mm*)	1.75 to 2.00 *44.45 to 50.80*	3.00 *76.20*			
Optimal pressure to shear and displace[b] (psi/*bar*)	1,800 to 2,200 *124 to 152*	2,250 to 2,700 *155 to 186*		2,000 to 2,400 *138 to 165*	
Total flow area, cement ports (in.²/*cm²*)	2.44 *15.74*	5.47 *35.30*	6.56 *42.30*	10.96 *70.71*	
Face volume (in.³/cm³)	184.82 *3,029*	266.36 *4,365*	221.97 *3,637*	380.51 *6,235*	

[a]Fixed ports are 14/32-in. (11.11-mm) nozzle size equivalent.
[b]Value can be adjusted.

Specifications

Defyer™ DPC Series *(continued)*

Recommended Operating Parameters

Nominal size (in.)	**7 × 8-1/2**	**9-5/8 × 12-1/4**	**13-3/8 × 17-1/2**
Legacy part number	DS3-070084	DS3-095122	DS3-133174
Defyer code	DPC513-070084	DPC516-095122	DPC519-133174
Weight on bit (lb/*kg*)	1,000 to 15,000 *454 to 6,804*	2,000 to 30,000 *907 to 13,608*	2,000 to 40,000 *907 to 18,144*
DrillShoe torque (ft-lb, *N·m*)	7,500 *10,168*	10,000 *13,558*	20,000 *27,116*
Rotary speed (RPM)	30 to 100	30 to 120	30 to 120
Optimal flow rate range (gal/min, *l/min*)	300 to 500 *1,136 to 1,893*	500 to 800 *1,893 to 3,028*	800 to 1,200 *3,028 to 4,542*
Optimal pressure drop range* (psi, *bar*)	125 to 650 *8.62 to 44.82*	175 to 850 *12.06 to 58.61*	155 to 650 *10.69 to 44.82*
Hydraulic horsepower/in.^{2} (HHSI)	0.4 to 3.3	1.0 to 7.0	1.3 to 8.0

*Assumes mud weight of 8.6 to 16.0 ppg.

Strength Limits

Nominal size (in.)	**7 × 8-1/2**	**9-5/8 × 12-1/4**	**13-3/8 × 17-1/2**
Legacy part number	DS3-070084	DS3-095122	DS3-133174
Defyer code	DPC513-070084	DPC516-095122	DPC519-133174
Ultimate compressive load[a] (lbf/*kgf*)	202,405 *91,809*	400,000 *181,437*	704,675 *319,634*
Ultimate tensile load[a] (lbf/*kgf*)	506,013 *229,523*	1,000,000 *453,592*	1,761,687 *799,087*
Maximum allowable torque[a] (ft-lb, *N·m*)	20,000 *27,117*	40,000 *54,233*	80,000 101,*688*

[a]Values represent tool body ratings only. Depending on style, string connections may be weaker.

Materials

Nominal size (in.)	**7 × 8-1/2**	**9-5/8 × 12-1/4**	**13-3/8 × 17-1/2**
Legacy part number	DS3-070084	DS3-095122	DS3-133174
Defyer code	DPC513-070084	DPC516-095122	DPC519-133174
Body	110 ksi Min yield	110 ksi Min yield	80 ksi Min yield
Nose	Aluminum alloy		

DwC™ Non-Rotating Centralizer

Nominal size (in.)	**7 × 8-1/4**	**9-5/8 × 12**	**13-3/8 × 16- 3/4**
Part number centralizer	1113217	903520	1123744
Part number stop collar assembly*	1171101	1171100	1171099
Part number set screw	777084	777409	777409
Casing size (in./*mm*)	7 *177.80*	9-5/8 *245.47*	13-3/8 *339.73*
Centralizer OD (in./*mm*)	8-1/4 *215.90*	12 *304.80*	16.75 *425.45*
Liner ID (in./*mm*)	7.100 *180.34*	9.750 *247.65*	13.540 *343.92*
Centralizer length (in./*mm*)	10.00 *254.00*	12.00 *304.80*	18.00 *457.20*
Weight centralizer (lb/*kg*)	19.50 *8.8*	61.50 *27.9*	115.80 *52.50*
Weight assembly (lb/*kg*)	32.20 *14.60*	83.50 *37.90*	162.80 *73.80*
Centralizer material	Cast steel		
Liner material	Elastomer		
Stop collar OD (in./*mm*)	7-3/4 *196.85*	10.56 *268.22*	14.79 *375.67*
Stop collar length (in./*mm*)	3.00 *76.20*		
Stop collar gap (in./*mm*)	0.50 *12.70*		
Set screw torque (ft-lb/*N•m*)	22.13 *30.00*		
Set screw size (in.)	3/8 - 16UNC × 7/16	1/2 - 13UNC × 1/2	1/2 - 13UNC × 1/2

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