

Top Drive System

The top drive system is a high-tech content products, which integrates mechanical, electrical hydraulic, and communications integration, and was used to replace traditional rotary table-kelly stem drilling module. The top drive system is one of three modern scientific and technological achievements.

The power of top drive system generates from swivel instead of rotary table, driving the drilling tools directly from top. The rotary table and kelly stem is not necessary any more. The top drive system is able to complete the drilling using stands. In the case of pipe jamming during trip in and trip out, the top drive system can make up drilling pipe at any



height of mast, and reverse reaming, rotate drilling pipe, circulate mud etc to pass through jamming point to prevent from accidents. Comparing with normal drilling methods, top drive system has incomparable advantages. It has been used for some high challenge and complex wells, such as exploration well, direction well, horizontal well, ERD well, etc, which has been proved to be of great economical interests.

1. AC VFD Top Drive System

Technical characters

- Adopt 1 or 2 AC frequency conversion motors as power source. By use of reduction gear box, the motors drive central shaft connecting the drill pipes to drill.
- When using 2 motors as power source, adopts 1 to 1 control. Single-motor running or dual-motors running are interchangeable.
- Complete with hydraulic disc brake, which helps drill string directing in direction drilling or deflecting works.
- Mono-guide rail method, the guide rail bolted by 2 pins and locked by lock pin device, easy to disassembly.
- Centralized power supply, only with 600V 50HZ/60HZ AC power feed to Top Drive MCC cabin, all the power needs are adequate.
- The control adopts 2 sets of PLC redundancy. PLC constitutes Profibus-DP network by means of fieldbus method, which possess safety inter-locking, monitoring, alarming, self-diagnosis and other functions to ensure that the system works safely and reliably.
- Complete with monkey board EX-proof control box, by which the derrick man can control the top drive swivel and the elevator link, and simplify the derrick operation. The monkey board EX-proof control box can be closed by driller at the driller' s cabin.
- Electrical cables and hydraulic hoses are of quick-connection to simplify the field installation and disassembly.
- Modularized design and package in order to make shipment and field installation fast and convenient.

Main advantages of AC VFD top drive system

- Adopt AC frequency conversion motor as power source, no spark of DC motor carbon brush and more safe.
- Drill with stands, reduce 2/3 time of making a connection.
- Adopt drilling motor to tight/loose, make up/break down to simplify drilling operation.
- Matched with pipe handler device, which improve mechanization level of make-up/break down and drilling pipe setting out, significantly reduce the driller's labor intensity and danger.
- The main shaft of top drive matched with remote IBOP, which can be rapidly switched off in the case of blowout and kick. Well control becomes safer.
- With the stabilizing function of elevator link inclining device as of running casing, the top drive helps to avoid error make-up and improve working efficiency.
- Rotate casing and circulate mud as of running casing, which reduces friction resistance of the hole shrinkage section and allow casing passing smoothly.
- Continually coring within one stand drilling, which reduces the frequency of tripping out as coring.
- Tight /loose torque and drilling torque become controllable.



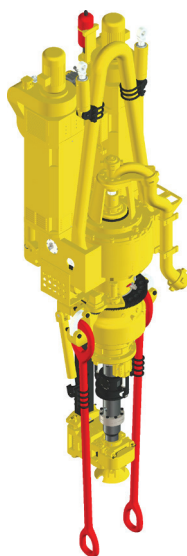
Technical parameter of series I Top Drive system

Top drive model	DQ40/2250DB	DQ50/3150DB	DQ70/4500DB	HDQ70/4500DB	DQ90/6750DB
Nominal drilling depth (114mm drill pipe) , m	2500 ~ 4000	3500 ~ 5000	4500 ~ 7000	4500 ~ 7000	6000 ~ 9000
Rated load , kN (tons)	2250 (250)	3150 (350)	4500 (500)	4500 (500)	6750 (750)
Max. continous drilling torque N·m (lb-ft)	31400 (23160)	46700 (34444)	52600 (38796)	58000 (42779)	80000 (59005)
Max. Breakout torque N·m (lb-ft)	53000 (39090)	70000 (51630)	78900 (58194)	87000 (64168)	140000 (103259)
Brake torque N·m (lb-ft)	35000 (25815)	53000 (39090)	53000 (39090)	80000 (59005)	100000 (73756)
Main shaft speed range, r/min	0 ~ 191	0 ~ 227	0 ~ 227	0 ~ 227	0 ~ 241
Thread type of saver sub and drill pipe	NC50 *	NC50 *	NC50 *	NC50 *	NC50 *
Range of Backup tong as handling drill pipe, mm (in)	Φ 79.4 ~ Φ 203.2 (2 7/8 ~ 6 5/8)	Φ 79.4 ~ Φ 203.2 (2 7/8 ~ 6 5/8)	Φ 79.4 ~ Φ 203.2 (2 7/8 ~ 6 5/8)	Φ 79.4 ~ Φ 203.2 (2 7/8 ~ 6 5/8)	Φ 73 ~ Φ 203.2 (2 7/8 ~ 6 5/8)
Max. bore diameter of backup tong ,mm	Φ 216	Φ 216	Φ 216	Φ 216	Φ 260
Mud passage, pressure mm, MPa	Φ 76, 35	Φ 76, 35	Φ 76, 35	Φ 76, 35	Φ 102, 52.5
Main motor rated power ,kW	1 × 315	2 × 280	2 × 315	2 × 350	2 × 450
Top drive working height (with hook),m	4.85	5.5	5.52	5.52	6.45
Top drive working height (with traveling block),m	5.36	5.965	5.985	5.985	6.91

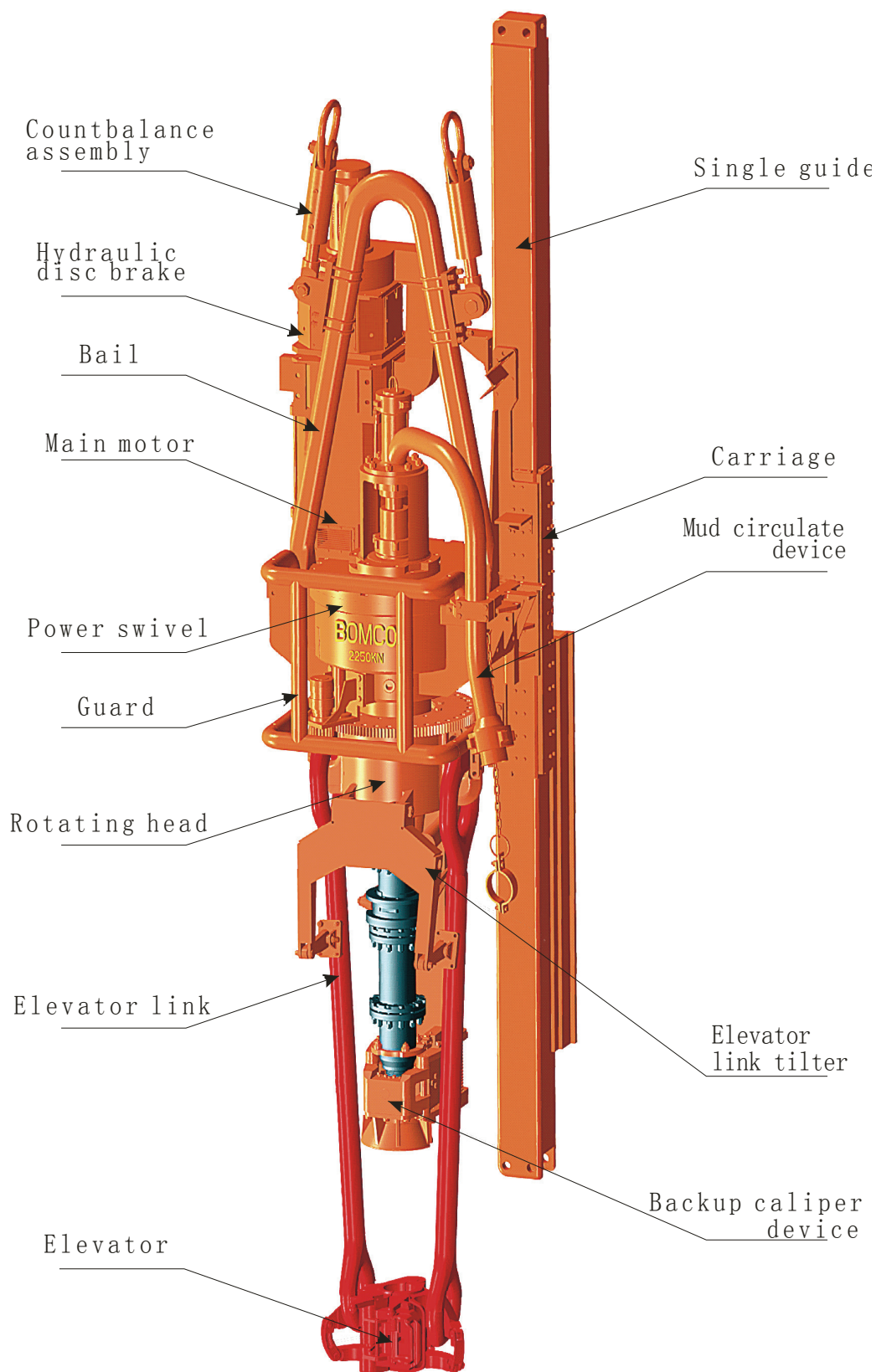
Note: Thread type labeled with mark*can be changed as customer's requirement

Technical parameter of series II Drive system

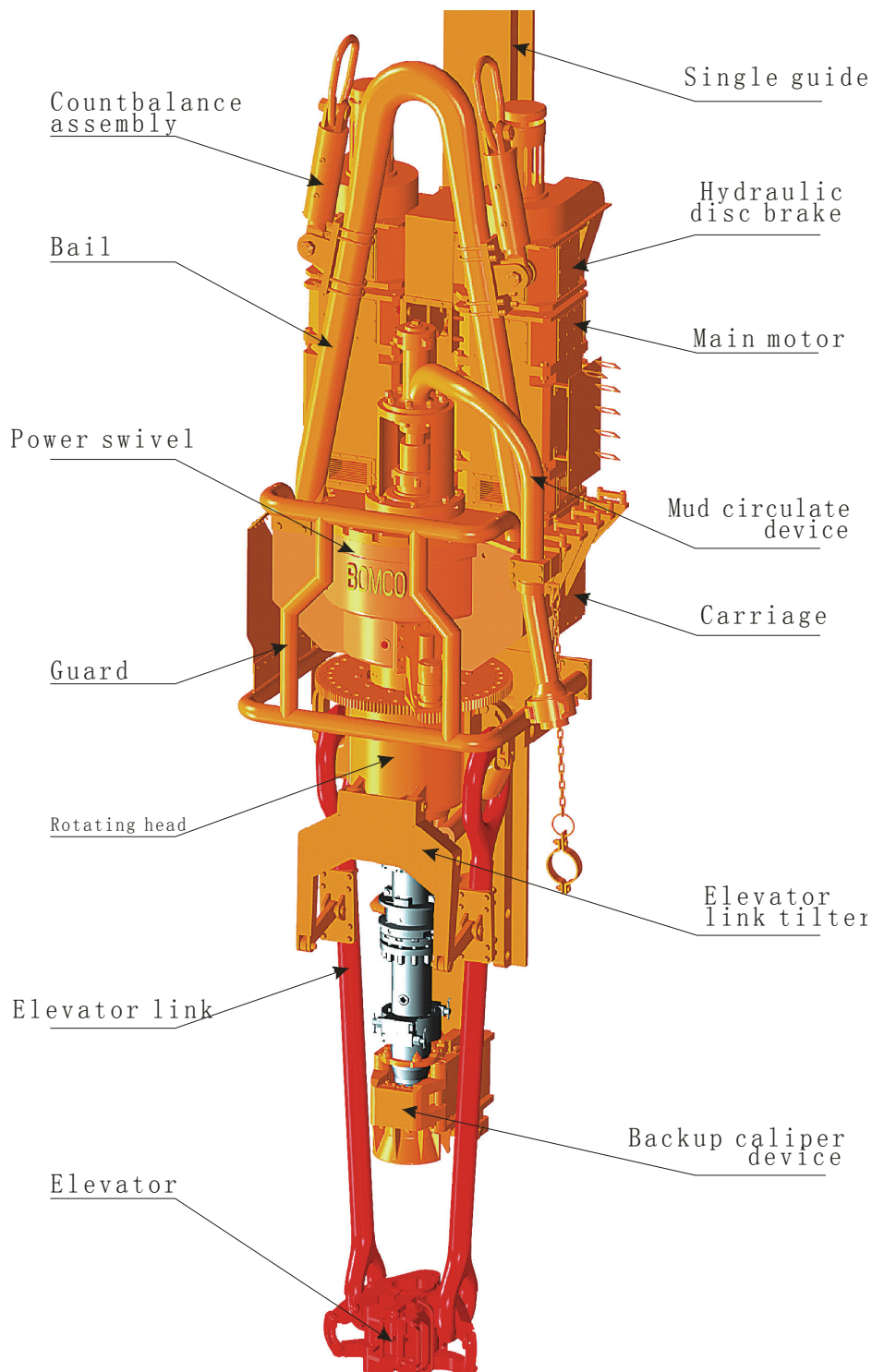
Model	DQ120BSC	DQ90BSD	DQ90BSC	DQ70BSD	DQ70BSC	DQ70BSE	DQ50BC	DQ40BCQ
Nominal Drilling Depth 114m (4 1/2")drill pipe	12,000m 39, 370ft	9,000m 29, 528ft		7,000 m 22, 966 ft			5,000 m 16,404 ft	4,000 m 13,123 ft
Rated Load (API 8A / 8C PSL 1)	9,000kN 1,000 ton(US)	6,750kN 750ton(US)		4,500 kN 500 ton(US)			3,150 kN 350 ton(US)	2,250 kN 250ton(US)
Power Supply	600VAC/50Hz(optional 60Hz)							
Main Motor Rated Power(continuous)	440kW × 2 600HP × 2	440kW × 2 600HP × 2	368 kW × 2 500HP × 2	368 kW × 2 500HP × 2	295 kW × 2 400 HP × 2		368 kW 500 HP	295 kW 400 HP
Rotary Speed	0-200r/min				0-220r/min		0-180 r/min	0-200 r/min
Drilling Torque (continuous)	62,700lbf·ft	62,700lbf·ft	51,600 lbf·ft	44,300lbf·ft	50 kN·m 36,900 lbf·ft		40 kN·m 29,500 lbf·ft	30 kN·m 22,000 lbf·ft
Maximum Torque of Break-Out	135kN·m 99,600lbf·ft	135kN·m 99,600lbf·ft	110kN·m 81, 800lbf·ft	90 kN·m 66,400lbf·ft	75 kN·m 55,300 lbf·ft		60 kN·m 44,300 lbf·ft	45 kN·m 33,200 lbf·ft
Backup Tong Range (drill pipe)	2 7/8 ~ 6 5/8 in	2 7/8 ~ 6 5/8 in	2 7/8 ~ 6 5/8 in	2 7/8 ~ 6 5/8 in	2 7/8 ~ 6 5/8 in		2 7/8 ~ 6 5/8 in	2 7/8 ~ 6 5/8 in
Hydraulic System Working Pressure	16MPa 2,280psi							
Mud Circulating Diameter	4 in	3 1/2 in	3 1/2 in	3 in	3 in	3 in	3 in	3 in
Rated Circulating Pressure	7,540psi				5000psi	5000psi	5000psi	5000psi
Top Drive Working Height	22.6ft	22ft	21.3 ft	21 ft	20 ft	20 ft	19.4 ft	17.4 ft
Top Drive Width	2,096mm 6.88ft	2,096mm 6.88ft	1,778 mm 5.83 ft	1,778 mm 5.83 ft	1,663 mm 5.46 ft	1,594 mm 5.23 ft	1,537 mm 5.04 ft	1,196 mm 3.92 ft
Distance of Guide Rail to the Center of Well	3.58ft	3.58f	3.15 ft	3.05 ft	3.05 ft	3.05 ft	Vertical:2.30 ft Horizontal: 1.53 ft	Vertical:1.72 ft Horizontal: 1.14 ft



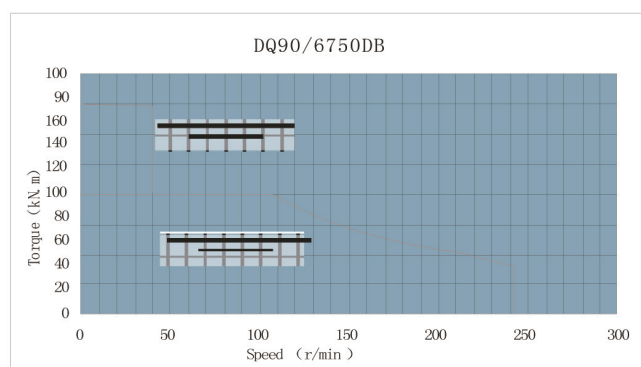
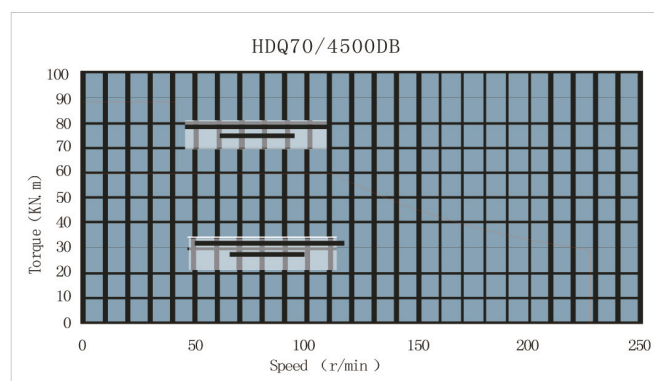
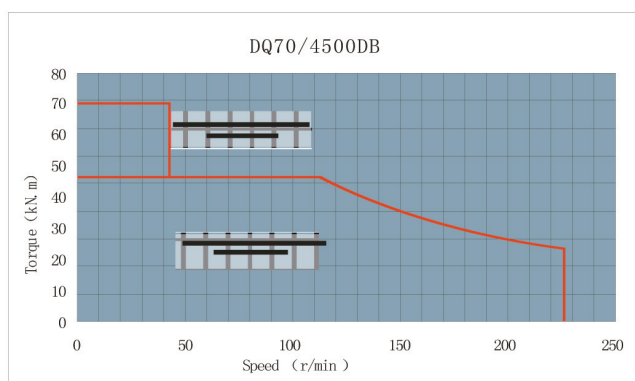
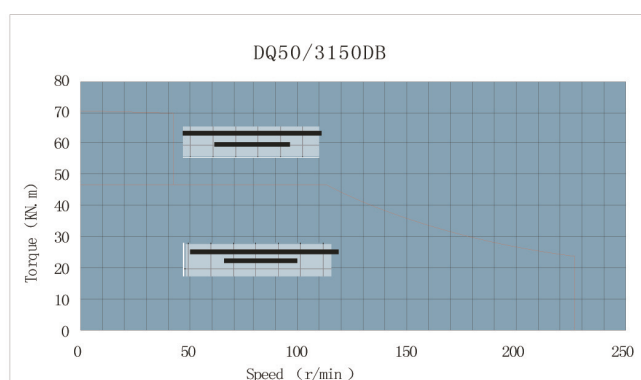
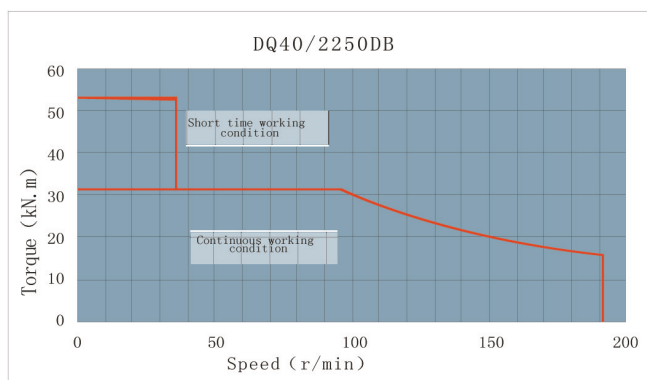
DQ40/2250DBTop Drive system



DQ50/3150DB, DQ70/4500DB, HDQ70/4500DB, DQ90/6750DB TOP DRIVE SYSTEM

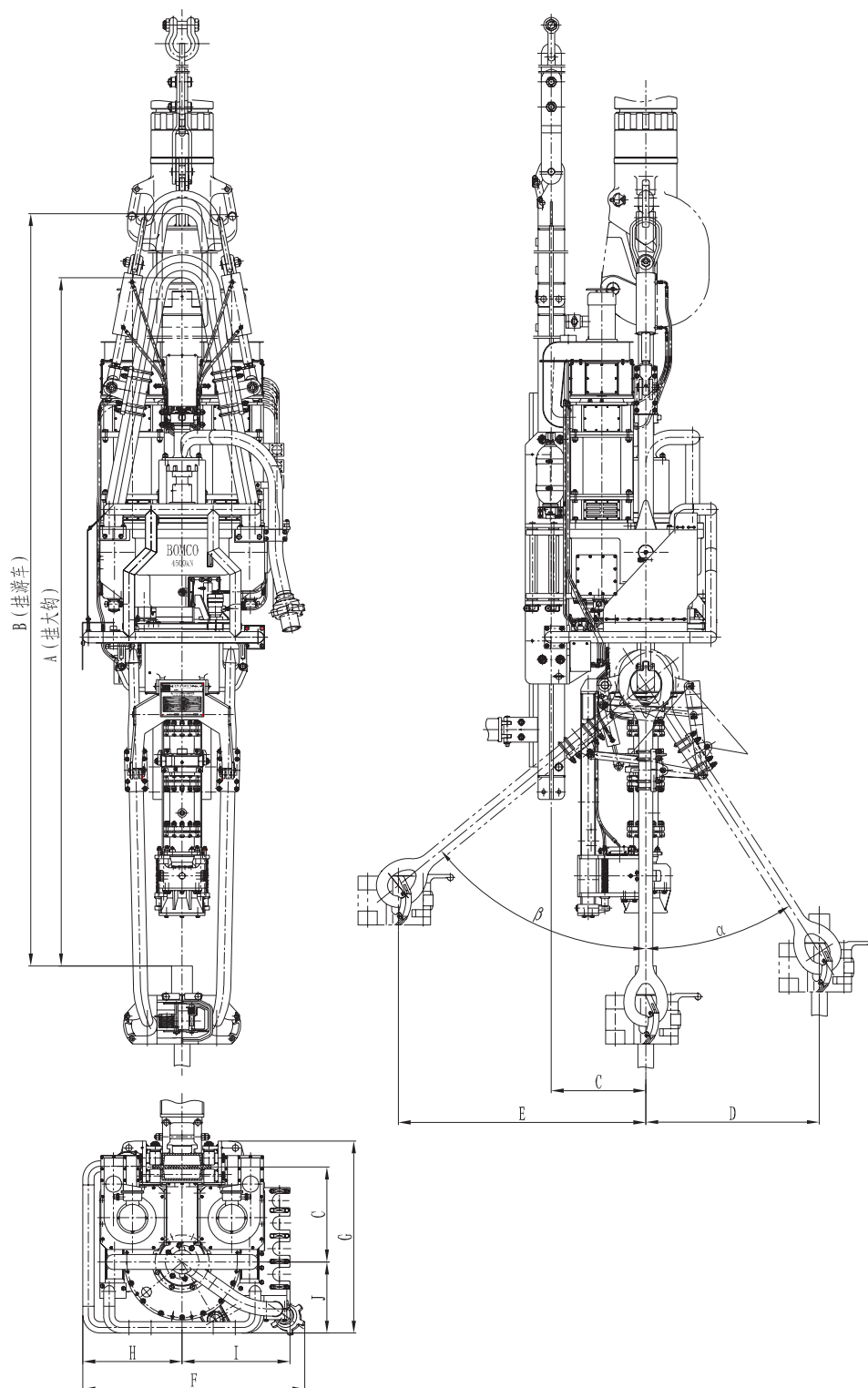


Top drive system output performance curve





DQ50/3150DB, DQ70/4500DB, HDQ70/4500DB, DQ90/6750DB Top Drive unit structure diagram



The outline dimensional sheet of AC TDS

Unit: mm (in)

	DQ50/3150DB	DQ70/4500DB	HDQ70/4500DB	DQ90/6750DB
A	5500 (216.54)	5520 (217.32)	5520 (217.32)	6450 (253.94)
B	5965 (234.84)	5985 (235.63)	5985 (235.63)	6910 (272.05)
C	762 (30)	762 (30)	762 (30)	930 (36.61)
D	~ 1400 (55.1)	~ 1400 (55.1)	~ 1400 (55.1)	~ 1480 (58.27)
E	~ 1996 (78.58)	~ 1996 (78.58)	~ 1996 (78.58)	~ 2278 (89.68)
F	~ 1789 (70.43)	~ 1789 (70.43)	~ 1789 (70.43)	~ 1905 (75)
G	~ 1542 (60.7)	~ 1542 (60.7)	~ 1542 (60.7)	~ 1796 (70.7)
H	800 (31.5)	800 (31.5)	800 (31.5)	878 (34.57)
I	870 (34.25)	870 (34.25)	870 (34.25)	1027 (40.43)
J	570 (22.44)	570 (22.44)	570 (22.44)	652 (25.67)
α	33°	33°	33°	30°
β	51°	51°	51°	50°



Hydraulic Top Drive Drilling Equipment

Technical parameter

Model	DQ40Y	DQ30Y
Nominal Drilling Depth (4 1/2 drill pipe)	13,123 ft	9,843 ft
Rated Load Capacities(API 8A / 8C PSL 1)	250 ton(US)	190/220 ton(US)
Power Supply	380 VAC / 50 Hz(60 Hz Optional)	380 VAC / 50 Hz(60 Hz Optional)
Rated Power(continuous)	544 HP	408 HP
Rotary Speed	0-180 r / min	0-150 r / min
Drilling Torque (continuous)	22,000 lbf·ft	16,200 lbf·ft
Maximum Torque of Break-Out	33,200 lbf·ft	29,500 lbf·ft
Backup Tong Range (drill pipe)	2 7/8 ~ 5 1/2 in	2 7/8 ~ 5 1/2 in
Working Pressure of Main Hydraulic System	5,000 psi	5,000 psi
Working Pressure of Main Hydraulic System	2,280 psi	2,280 psi
Mud Circulating Diameter	3 in	2 1/2 in
Rated Circulating Pressure	5,000 psi	5,000 psi
Main Body Working Height	18.4 ft	17.7 ft
Main Body Width	4.36 ft	3.25 ft
Distance of Guide Rail to the Center of Well	Vertical:2.04 ft Horizontal:1.53 ft	1.64 ft

