

Top Drive Technologies



National Oilwell Varco Makes History

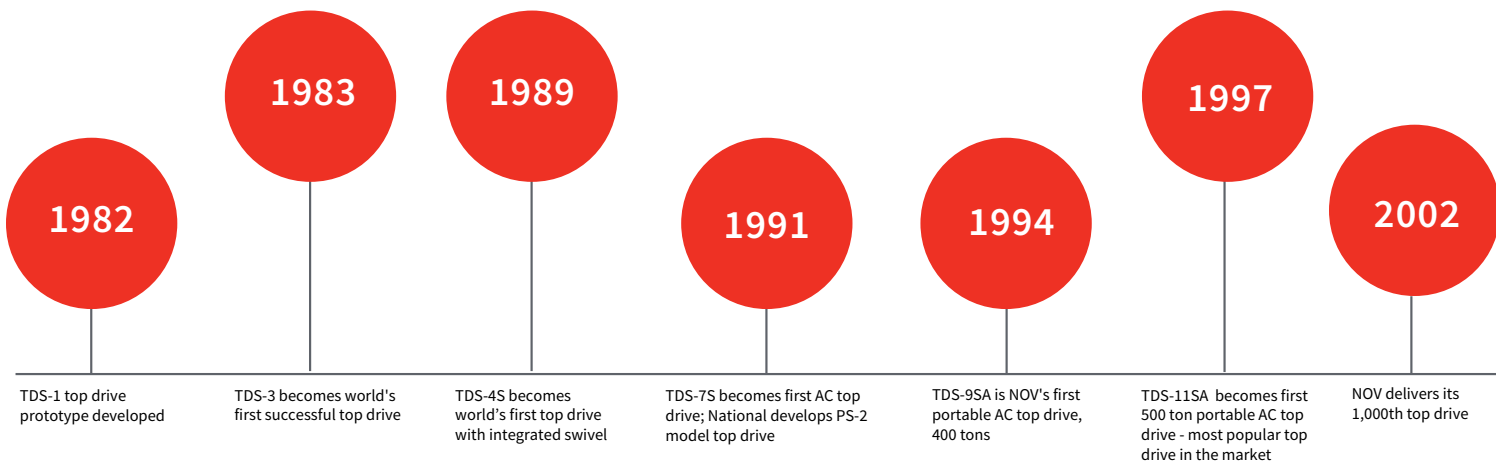


Since 1841, we have dedicated our time and resources to producing the highest quality oilfield products and services to help you get the job done efficiently and safely. From a spare part to a comprehensive drilling system, from rig-up to on-site support, we are here to assist you throughout the whole drilling process. A testament to our continual development of new technology to better serve you, our top drive line continues to grow today from the strong foundation laid decades ago.

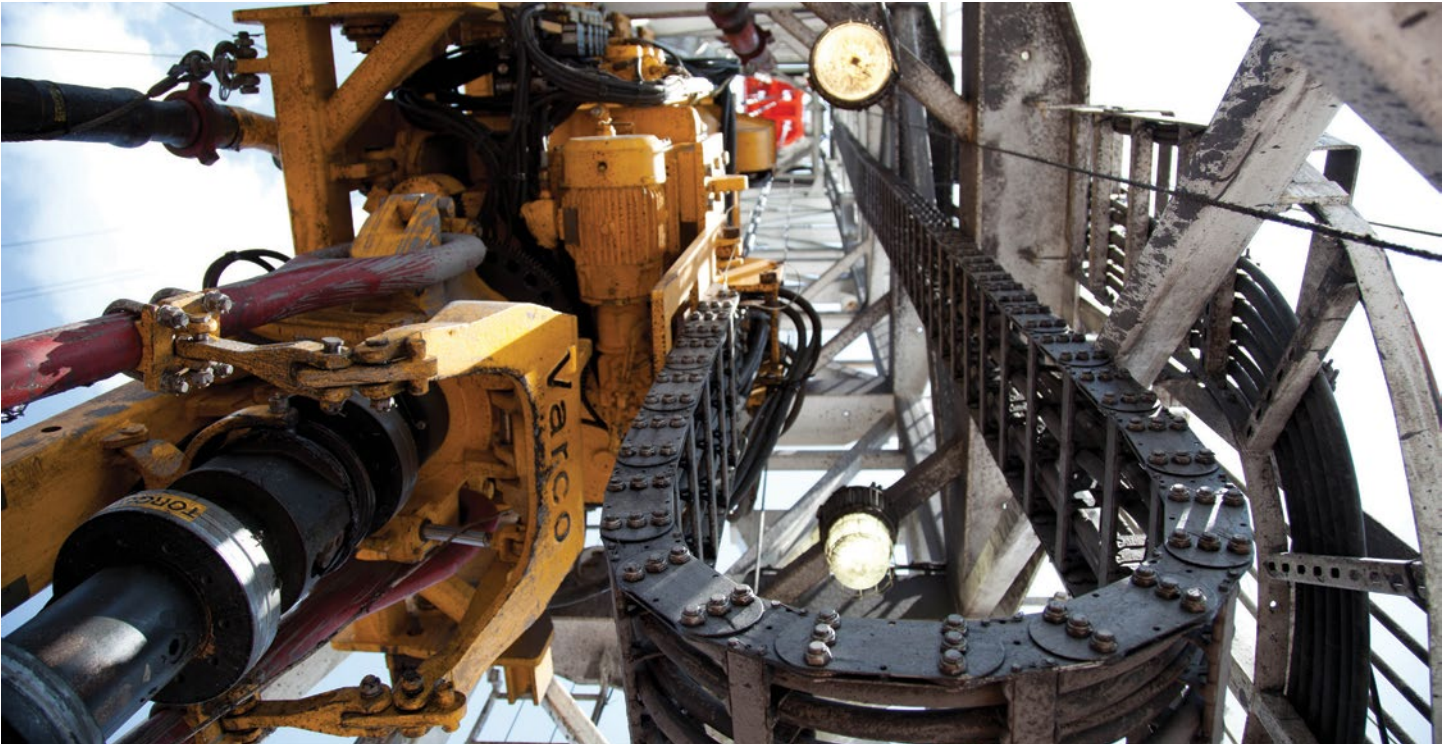
At the forefront of the top drive's drilling industry revolution, George Boyadjieff and Jim Brugman of Varco partnered with Duke Zinkgraf to take the first steps of top drive development. The first prototypes were quickly developed and made their way into the field. Through the early groundwork years, top drive technology continued to improve; its value and potential in the oil industry were quickly realized by drillers everywhere.

Continuous engineering advancements led to the first AC-powered top drive in 1991 and further performance improvements. In 1997, the TDS-11SA Top Drive was developed with an 800 horsepower twin motor and quickly became the largest-selling single design in the product line's history. Today, over 2,000 TDS-11SA top drives have been delivered to satisfied customers, and we're continuing to advance our equipment line with new improvements and products.

With your input, field service feedback and the experiences of the leading legacy top drive suppliers — National Oilwell™, Varco™, Hydralift™ and Bowen™ — we build the widest range and variety of high performance, reliable top drive systems in the world, providing you with the best selection to fit your specific needs.



Technological Integration



Continuing to push drilling boundaries, we built off the successful TDX-1250 Top Drive with the 2014 release of the 1,500 ton TDX-1500, the highest rated hoisting capacity top drive on the market. Throughout our long history, we have been and continue to be at the leading edge of new development in drilling technology.

In 2017 NOV developed the TDS-11HD, a higher torque and more powerful top drive that enables faster and deeper drilling, even in the most demanding well operations. The TDS-11HD features two 600-horsepower induction motors capable of 58,800 ft-lbs of continuous torque at 110 RPM.

- SoftSpeed™ II helps cure and prevent torsional stick-slip oscillations of the drill string over a wide range of conditions, including extremely long wells where competitive systems normally fail.
- Twister™ assists the top drive in rotating the drill string through desired angles of rotation to provide improved performance of directional BHAs without adding costly pieces of equipment.
- NOVOS enabled— NOV Top Drives are NOVOS ready, providing precise control and consistency

2003

TDS-1000SA - upgrades TDS-8S design for 1,000 ton capacity

2008

TDX-1250 becomes NOV's first 1,250 ton top drive

2010

NOV delivers 1,000th TDS-11 top drive

2012

TDS-11SH is NOV's first dual motor portable top drive

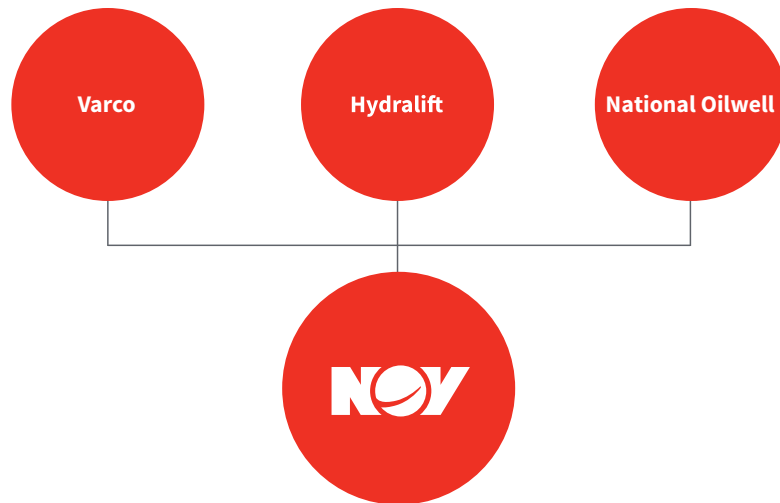
2014

TDX-1500 is NOV's first 1,500 ton top drive and the highest rated hoisting capacity top drive on the market

2017

TDS-11HD is introduced featuring two 600 horsepower induction motors, for 1,200 horsepower - 45% more power and torque

The Top Drive Story



With the merging of the three leading top drive suppliers – National Oilwell, Hydralift and Varco – the newly formed company under the NOV roof pulled together field service feedback, customer input and the experiences of the three design teams to develop the top drive designs for the future. Today, NOV produces the premier model top drives such as the TDX-1250 and the TDS-11HD.



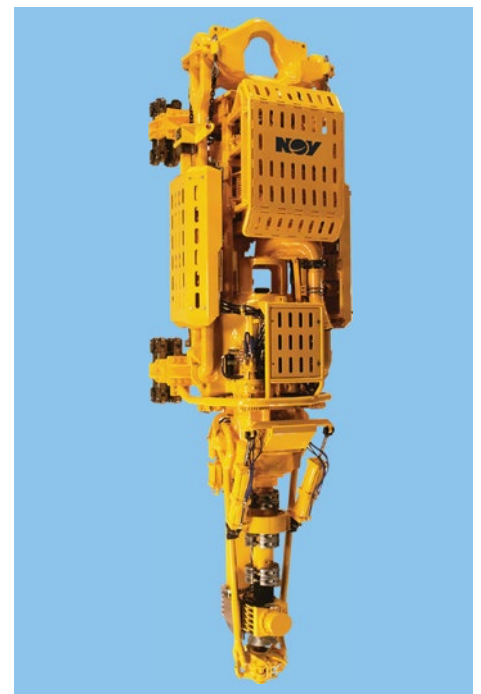
Varco

VARCO began with one man and a vision of drilling down from the top of the drill string. Duke Zinkgraf partnered with Varco and began the initial designs of the top drive. Through the years, the Varco engineering team improved on the top drive design and the TDS series was paving the road of innovation, modularity, and reliability.



Hydralift

Hydralift developed the Hydralift™ Power Swivel – 500 (HPS), a unit that continually made improvements to the market-standard TDS.



National Oilwell

National Oilwell first brought to the market the National™ PS-500, a design focused on more serviceability and redundancy than the TDS and DDM designs. Key to the design was the pipehandling unit, which featured a more robust dual-actuated IBOP, with side in-line motor couplings that enabled a quick disengage system for drilling motors from the gear train, and a system for modular motor replacement.

1,000 to 1,500 Ton Electric Top Drives



TDX-1500



TDX-1250



TDX-1000

Installation / Technical Specifications

	TDX-1500	TDX-1250	TDX-1000
Motor Type	NOV AC Induction Motors	NOV AC Induction Motors	ABB Permanent Magnet Motors
Horsepower Rating	2 x 1,340 HP	2 x 1,340 HP	2 x 1,150 HP
TDS Working Height	29 ft (8,839 mm)	26.5 ft (8,077 mm)	22 ft (6,705 mm)
Weight	95,000 lb (43,091 kg)	89,700 lb (40,687 kg)	85,000 lb (38,555 kg)
Transmission			
Gear Ratio	6.1:1	6.1:1	6.9:1
Drilling Parameters			
Max Speed	275 RPM	275 RPM	250 RPM
Max Continuous Torque	105,000 ft-lb (142,360 N-m)	105,000 ft-lb (142,360 N-m)	91,000 ft-lb (123,379 N-m)
Speed at Max Continuous Torque	130 RPM	130 RPM	116 RPM
Max Breakout Torque	150,000 ft-lb (203,372 N-m)	150,000 ft-lb (203,372 N-m)	150,000 ft-lb (203,372 N-m)
Max Makeup Torque	120,000 ft-lb (162,698 N-m)	120,000 ft-lb (162,698 N-m)	120,000 ft-lb (162,698 N-m)
Static Lock Brake	105,000 ft-lb (142,360 N-m)	105,000 ft-lb (142,360 N-m)	105,000 ft-lb (142,360 N-m)
Rating Capacities			
Hoisting	1,500 ton (1,360,777 kg)	1,250 ton (1,133,980 kg)	1,000 ton (907,184 kg)
Main Shaft Water Course	4 in (101.6 mm)	4 in (101.6 mm)	3½ in (95.3 mm)
Washpipe Packing	7,500 psi (517 bar)	7,500 psi (517 bar)	7,500 psi (517 bar)
Pipe Handler	PH-CLK	PH-150	PH-203
Breakout Torque Capacity	150,000 ft-lb (203,372 N-m)	150,000 ft-lb (203,372 N-m)	150,000 ft-lb (203,372 N-m)
Drill Pipe Range	3½ in – 6½ in (88.9 mm – 168.2 mm)	3½ in – 6½ in (88.9 mm – 168.2 mm)	3½ in – 6½ in (88.9 mm – 168.2 mm)
Connection OD	4 in – 8½ in (101.6 mm – 215.9 mm)	4 in – 8½ in (101.6 mm – 215.9 mm)	4 in – 8½ in (101.6 mm – 215.9 mm)
IBOP Pressure Rating	20,000 psi (1,379 bar)	15,000 psi (1,034 bar)	15,000 psi (1,034 bar)
Upper IBOP	NC84 x NC77	NC84 x NC77	NC77 x NC77
Lower IBOP	API NC77 x API NC77 (manual)	API NC77 x API NC77 (manual)	API NC77 x API NC77 (manual)
Rotation/Orientation	360°/Proportional control with position feedback	360°/Proportional control with position feedback	360°/Unlimited
Other			
Cooling System	Water Cooled	Water Cooled	Water Cooled
Hydraulic Power	HPU Required	HPU Required	HPU Required
Temperature Range	-20°C to +50°C (-4°F to +122°F)	-20°C to +50°C (-4°F to +122°F)	-20°C to +50°C (-4°F to +122°F)
Casing Running Tool Ready	Yes	Yes	Yes
Elevator Links	350, 500, 750, 1000, 1250 or 1500 ton API	350, 500, 750, 1000 or 1250 ton API	350, 500, 750 or 1000 ton API

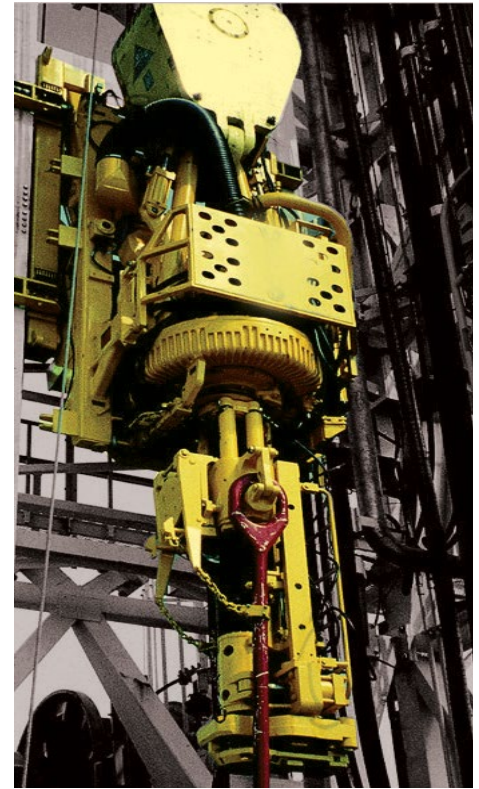
750 to 1,000 Ton Electric Top Drives



TDS-1000



TDS-85



TDS-4S

Installation / Technical Specifications

	TDS-1000	TDS-85	TDS-4S
Motor Type	GE AC Induction Motor	GE AC Induction Motor	GE 752 Hi-Torque Series/Shunt DC
Horsepower Rating	1 x 1,150 HP	1 x 1,150 HP	1,100 HP
TDS Working Height	24 ft (7,315 mm)	24 ft (7,315 mm)	20.8 ft (6,339 mm)
Weight	40,000 lb (18,143 kg)	38,000 lb (17,236 kg)	32,000 lbs (14,514 kg)
Transmission			
Gear Ratio	8.5:1	8.5:1	Low: 7.95:1, High: 5.08:1
Drilling Parameters			
Max Speed	270 RPM	270 RPM	Low: 130 RPM, High: 205 RPM
Max Continuous Torque	62,250 ft-lb (84,399 N-m)	62,250 ft-lb (84,399 N-m)	45,500 ft-lb (61,689 N-m) in low gear
Speed at Max Continuous Torque	95 RPM	95 RPM	120 rpm
Max Breakout Torque	103,000 ft-lb (139,649 N-m)	103,000 ft-lb (139,649 N-m)	85,000 ft-lb (115,244 N-m)
Max Makeup Torque	95,000 ft-lb (128,802 N-m)	95,000 ft-lb (128,802 N-m)	85,000 ft-lb (115,244 N-m)
Static Lock Brake	76,000 ft-lb (103,042 N-m)	76,000 ft-lb (103,042 N-m)	34,000 ft-lbs (46,097 N-m)
Rating Capacities			
Hoisting	1,000 ton (907,184 kg)	750 ton (680,388 kg)	750 ton (680,388 kg)
Water Course	3.82 in (97 mm)	3.82 in (97 mm)	3.82 in (97 mm)
Washpipe Packing	5,000 or 7,500 psi (344 or 517 bar) (Hammerless option)	5,000 or 7,500 psi (344 or 517 bar) (Hammerless option)	5,000 or 7,500 psi (344 or 517 bar)
Pipe Handler	PH-100	PH-100	PH-85
Breakout Torque Capacity	103,000 ft-lb (139,649 N-m)	103,000 ft-lb (139,649 N-m)	85,000 ft-lbs (115,244 N-m)
Drill Pipe Range	3½ in – 6½ in (88.9 mm – 168.2 mm)	3½ in – 6½ in (88.9 mm – 168.2 mm)	3½ in - 6½ in (88.9 mm - 168.2 mm)
Connection OD	4 in – 8½ in (101.6 mm – 215.9 mm)	4 in – 8½ in (101.6 mm – 215.9 mm)	4 in - 8½ in (101.6 mm - 215.9 mm)
IBOP Pressure Rating	15,000 psi (1,034 bar)	15,000 psi (1,034 bar)	15,000 psi (1,034 bar)
Upper IBOP	7% in API Reg. RH Box (remote operated)	7% in API Reg. RH Box (remote operated)	7% in API Reg. RH Box (remote operated)
Lower IBOP	7% in API Reg. RH Pin/Box (manual)	7% in API Reg. RH Pin/Box (manual)	7% in API Reg. RH Box (remote operated)
Rotation/Orientation	360°/Unlimited	360°/Unlimited	360°/Unlimited
Other			
Cooling System	Local Blower	Local Blower	Local or Remote
Hydraulic Power	HPU Required	HPU Required	HPU Required
Temperature Range	-20°C to +45°C (-4°F to +113°F)	-20°C to +45°C (-4°F to +113°F)	-20°C to +45°C (-40°F to +113°F)
Casing Running Tool Ready	Yes	Yes	Yes
Elevator Links	350, 500, 750 or 1000 ton API	350, 500 or 750 ton API	300, 500, or 750 ton API

500 Ton Electric Top Drives



TDS-11SA



TDS-11SH



TDS-11HD

Installation / Technical Specifications

	TDS-11SA	TDS-11SH	TDS-11HD
Motor Type	AC Induction Motors	AC Permanent Magnet Motors	AC Induction Motors
Horsepower Rating	2 x 400 HP	2 x 550 HP	2 x 600 HP
TDS Working Height	17.8 ft (5,425 mm)	19 ft (5,791 mm)	21 ft 6 in with 120 in Bail (6,553 mm)
Weight	27,000 lb (12,246 kg)	28,000 lb (12,700 kg)	30,000 lb (13,608 kg)
Transmission			
Gear Ratio	10.5:1	10.56:1	10.56:1
Drilling Parameters			
Max Speed	228 RPM	228 RPM	228 RPM
Max Continuous Torque	37,100 ft-lb (50,300 N-m)	54,600 ft-lb (74,027 N-m)	58,800 ft-lb (79,722 N-m)
Speed at Max Continuous Torque	125 RPM	125 RPM	110 RPM
Max Breakout Torque	60,000 ft-lb (81,349 N-m)	75,000 ft-lb (101,686 N-m)	75,000 ft-lb (101,686 N-m)
Max Makeup Torque	50,000 ft-lb (67,790 N-m)	62,500 ft-lb (84,738 N-m)	62,500 ft-lb (84,738 N-m)
Static Lock Brake	50,000 ft-lb (67,790 N-m)	50,000 ft-lb (67,790 N-m)	50,000 ft-lb (67,790 N-m)
Rating Capacities			
Hoisting	500 ton (453,592 kg)	500 ton (453,592 kg)	500 ton (453,592 kg)
Water Course	3 in (76.2 mm)	3 in (76.2 mm)	3 in (76.2 mm)
Washpipe Packing	7,500 psi (517 bar)	7,500 psi (517 bar)	7,500 psi (517 bar)
Pipe Handler	PH-75	PH-75	PH-75
Breakout Torque Capacity	75,000 ft-lb (101,686 N-m)	75,000 ft-lb (101,686 N-m)	75,000 ft-lb (101,686 N-m)
Drill Pipe Range	3½ in – 6 in (88.9 mm – 168.2 mm)	3½ in – 6 in (88.9 mm – 168.2 mm)	3½ in – 6 in (88.9 mm – 168.2 mm)
Connection OD	4 in – 8½ in (101.6 mm – 215.9 mm)	4 in – 8½ in (101.6 mm – 215.9 mm)	4 in – 8½ in (101.6 mm – 215.9 mm)
IBOP Pressure Rating	15,000 psi (1,034 bar)	15,000 psi (1,034 bar)	15,000 psi (1,034 bar)
Upper IBOP	6% in API Reg. RH Box (remote operated)	6% in API Reg. RH Box (remote operated)	6% in API Reg. RH Box (remote operated)
Lower IBOP	6% in API Reg. RH Pin/Box (manual)	6% in API Reg. RH Pin/Box (manual)	6% in API Reg. RH Pin/Box (manual)
Rotation/Orientation	360°/Unlimited	360°/Unlimited	360°/Unlimited
Other			
Cooling System	Local Blower	Local Blower	Local Blower
Hydraulic Power	Onboard	Onboard	Onboard
Temperature Range	-40°C to +55°C (-40°F to +131°F)	-40°C to +55°C (-40°F to +131°F)	-40°C to +55°C (-40°F to +131°F)
Casing Running Tool Ready	Yes	Yes	Optional
Elevator Links	250, 350 and 500 ton API	250, 350 and 500 ton API	250, 350 and 500 ton API

150 to 350 Ton Electric Top Drives

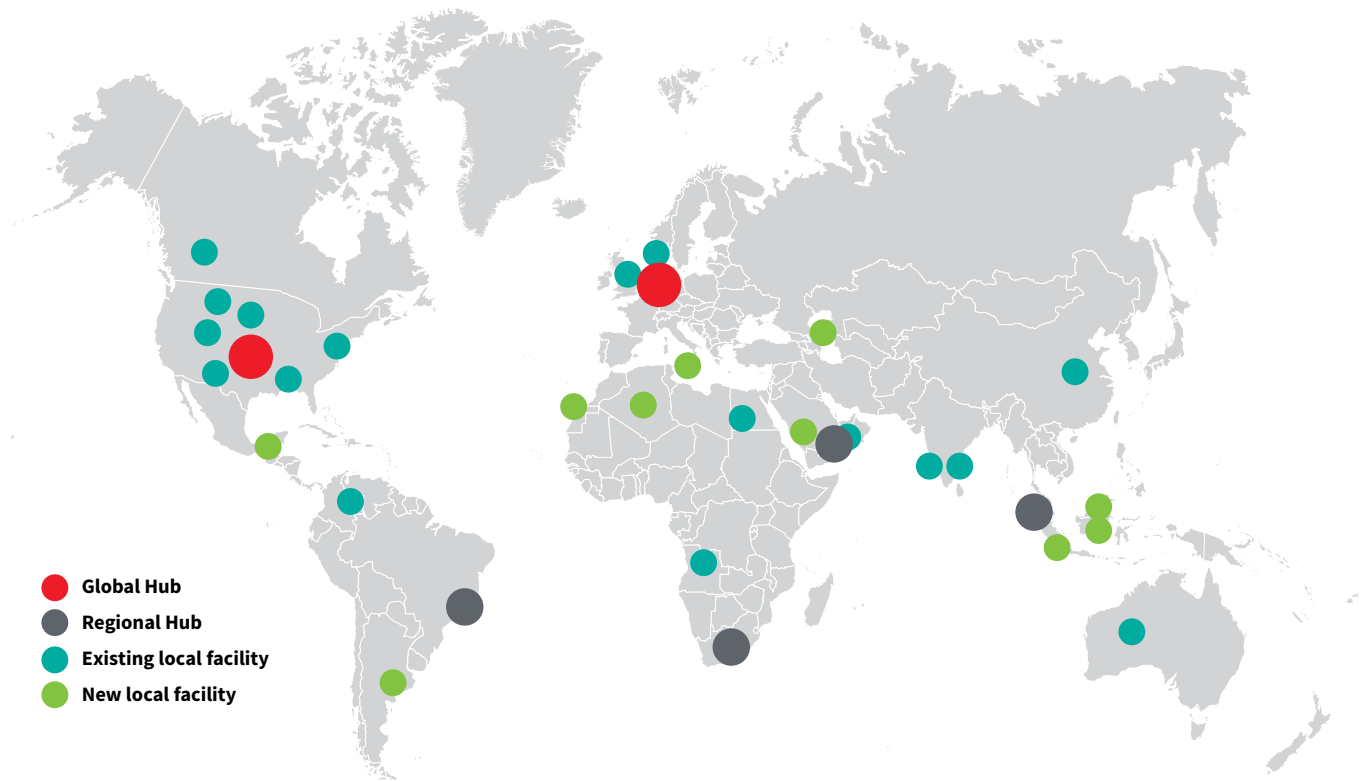


TDS-10SH

Installation / Technical Specifications

	TDS-10SH
Motor Type	AC Induction Motor
Horsepower Rating	1 x 400 HP
TDS Working Height	15.3 ft (4,663 mm)
Weight	18,000 lb (8,164 kg)
Transmission	
Gear Ratio	13.1:1
Drilling Parameters	
Max Speed	182 RPM
Max Continuous Torque	22,288 ft-lb (30,218 N-m)
Speed at Max Continuous Torque	85 RPM
Max Breakout Torque	55,000 ft-lb (74,569 N-m)
Max Makeup Torque	42,680 ft-lb (57,866 N-m)
Static Lock Brake	50,000 ft-lb (67,790 N-m)
Rating Capacities	
Hoisting	250 ton (226,796 kg)
Water Course	3 in (76.2 mm)
Washpipe Packing	7,500 psi (517 bar)
Pipe Handler	PH-55
Breakout Torque Capacity	55,000 ft-lb (74,569 N-m)
Drill Pipe Range	2½ in – 5 in (73 mm – 127 mm)
Connection OD	4 in – 6½ in (101.6 mm – 168.2 mm)
IBOP Pressure Rating	15,000 psi (1,034 bar)
Upper IBOP	6½ in API Reg. RH Box (remote operated)
Lower IBOP	6½ in API Reg. RH Pin/Box (manual)
Rotation/Orientation	360°/Unlimited
Other	
Cooling System	Local Blower
Hydraulic Power	Onboard
Temperature Range	-40°C to +40°C (-40°F to +104°F)
Casing Running Tool Ready	No
Elevator Links	250 ton API

Aftermarket Operations



Comprehensive Aftermarket Products and Services — NOV is with you every step of the way

Field Service

Our growing staff of proven field service personnel is available 24/7 to support all NOV products. Knowledgeable field service technicians can quickly deploy to your operating site to resolve your equipment issues, whether structural, mechanical, electrical or software-related. Our FAST solution service trucks are stocked with an extensive list of NOV's top drive, iron roughneck, BOP, EDS, and Amphion replacement parts, filters, consumables and tools to get your NOV equipment running at OEM specifications. Expert on-call technicians are ready to provide FAST, on-site service and repair.

Training

Field technicians train extensively on NOV Rig Systems product lines including competency training and evaluations through our NOV technical colleges and training facilities to ensure the highest quality service and support for your equipment repairs on-site.

Repair

Our highly skilled shop technicians overhaul, repair, rebuild, and re-certify a wide range of NOV equipment to the NOV Quality Assurance and OEM specifications — using only OEM parts. Our worldwide network of repair centers provides unrivaled quality customer service, on-time delivery and unmatched technical integrity. In addition, equipment exchange programs are available at various facilities. Through the Used Equipment Refurbishment Program, we provide viable, short turnaround solutions to immediate capital equipment needs, complete with data books and certificates of conformance as required.

Technical Support

One phone call to one of our technical support centers initiates a technical support team of multi-skilled backgrounds to troubleshoot and resolve your worldwide equipment needs, 24/7/365. Our team of highly skilled and experienced technical support members work together with our global pool of qualified field service technicians and subject matter experts to keep your rigs operating. The technical support team utilizes our web-based application "Tracker" to record, manage, and resolve issues.

Field Engineering

Our field engineering groups offer the unique service of providing one-off, rig-specific equipment designs, modifications and solutions to your rig-specific issues. This includes rig surveys, proposal drawings, design drawings, product manufacturing, service manuals, data books, and equipment installations. Field Engineering capabilities include mechanical and electrical engineering, software/programming modifications, training and troubleshooting.

For 24/7 Support Services:

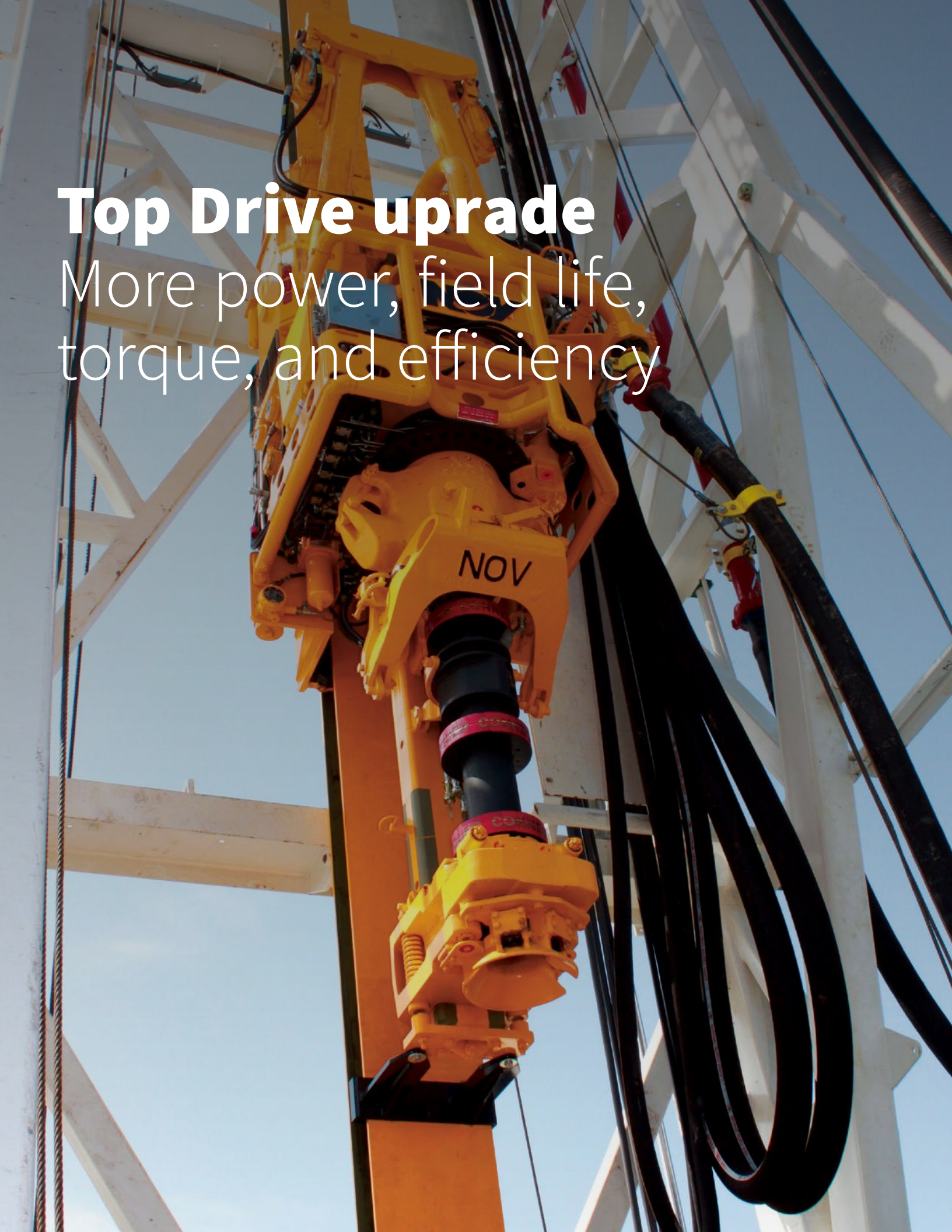
[1.713.395.5000 \(US\)](tel:17133955000)

[47.3819.1000 \(Norway\)](tel:4738191000)

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Top Drive upgrade

More power, field life,
torque, and efficiency



TDS-11SA: The World's Most Popular Top Drive

TDS-11SA to TDS-11SAE upgrade advantage

There are distinct benefits that differentiate our top drive upgrade package versus third parties simply installing new motors with higher horsepower. The upgrade is less expensive than installing new motors, provides significant improvements to performance, and ensures customers are receiving the quality and experience of the OEM.

We collaborated with three engineering partners to conduct a comprehensive analysis of the TDS-11SA gearbox, allowing us to determine how stress and fatigue would be affected by the increase in horsepower.

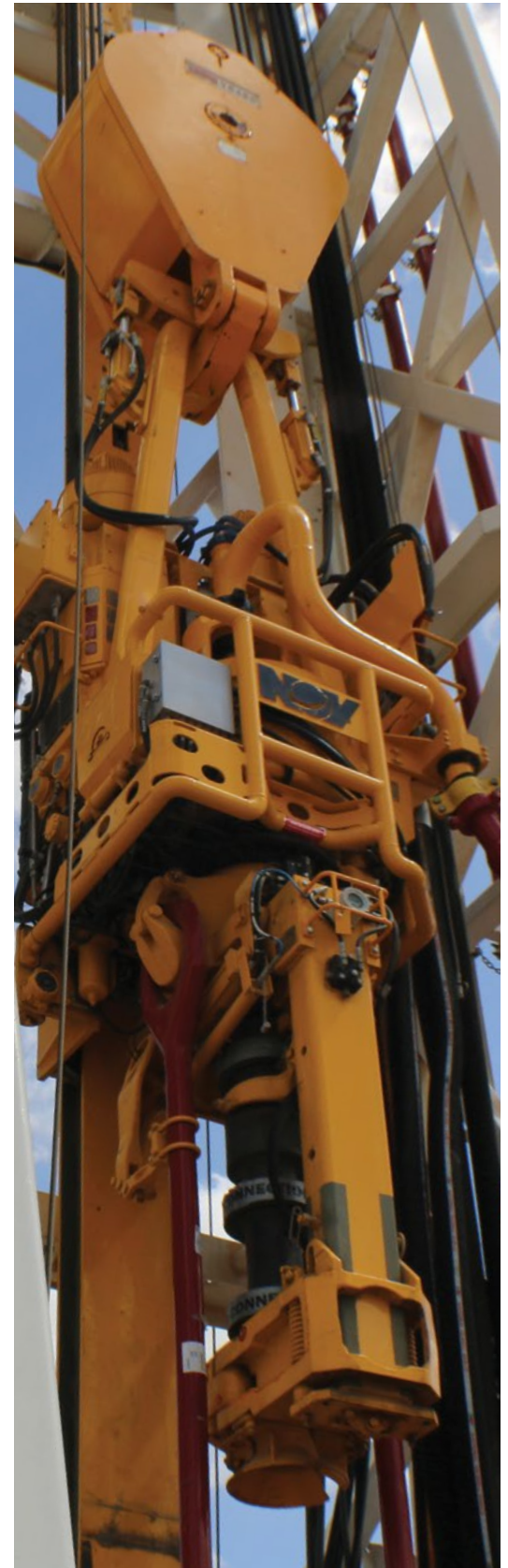
Gearbox improvements

- To maintain the proven service life and design safety factor of the TDS-11SA while still enabling the upgrade, major internal changes were necessary to the gearbox.
- Compound and pinion gears and the bull gear mounting all required changes to accommodate the loads from the increase in power
- Bearing sizes and housings, as well, had to be adjusted to accommodate the increased load.
- The gear box cover required new casting and machining to accommodate changes to the bearing.

These important changes come together to provide our customers with a cost-effective solution to upgrade a critical piece of drilling equipment while knowing that they have the design and engineering expertise of the OEM.

Installation / Technical Specifications

	TDS-11SAE
Motor Type	AC Induction Motors
Horsepower Rating	2 x 600 HP
TDS Working Height	19 ft 4 in (21 ft 8 in with 120 in Bail) (5,893 mm)
Weight	35,000 lb (15,875 kg)
Transmission	
Gear Ratio	10.56:1
Drilling Parameters	
Max Speed	228 RPM
Max Continuous Torque	58,800 ft-lb (79,722 N-m)
Speed at Max Continuous Torque	110 RPM
Max Breakout Torque	75,000 ft-lb (101,686 N-m)
Max Makeup Torque	62,500 ft-lb (84,738 N-m)
Static Lock Brake	39,000 ft-lb (52,877 N-m)
Rating Capacities	
Hoisting	500 ton (453,592 kg)
Water Course	3 in (76.2 mm)
Washpipe Packing	7,500 psi (517 bar)
Pipe Handler	PH-75
Breakout Torque Capacity	75,000 ft-lb (101,686 N-m)
Drill Pipe Range	2½ in - 4½ in (73 mm - 114.3 mm)
Connection OD	4 in - 8½ in (101.6 mm - 215.9 mm)
IBOP Pressure Rating	15,000 psi (1,034 bar)
Upper IBOP	6% in API Reg. RH Box (remote operated)
Lower IBOP	6% in API Reg. RH Pin/Box (manual)
Rotation/Orientation	360°Unlimited
Other	
Cooling System	Local Blower
Hydraulic Power	Onboard
Temperature Range	-40°C to +55°C (-40°F to +131°F)
Casing Running Tool Ready	Optional
Elevator Links	250, 350 and 500 ton API



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