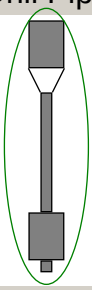
Grant Prideco | NOV Wellbore Technologies — 2-7/8" HT PAC Drill Pipe Performance Sheet

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Drill Pipe Configuration

Advisory: Drill string connection operational tension at Maximum MUT is less than 80% inspection class pipe body in tension, a lower MUT should be considered. Warning: Connection ID is too large. Advisory: Elevator Capacity is weaker than nominal pipe in tension. Note: Connection operational tension at Maximum MUT is less than 95% inspection class pipe body in tension, a lower MUT should be considered. Connection torsional strength is less than 80% pipe body torsional strength.



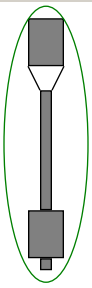
Pipe Body OD	(in)	2.875
Pipe Body Wall Thickness	(in)	0.362
Pipe Body Grade		S-135
Drill Pipe Length		Range2
Connection		HT 2-7/8 PAC
Tool Joint OD	(in)	3.125
Tool Joint ID	(in)	1.500
Pin Tong	(in)	9
Box Tong	(in)	13

95 % Inspection Class		
Nominal Weight Designation		10.40
Drill Pipe Approximate Length	(ft)	31.5
SmoothEdge Height	(in)	Not Raised
Tool Joint SMYS	(psi)	120,000
Upset Type		IU
Max Upset OD (DTE)	(in)	3.000
Friction Factor		1.0

Note: Tong space may include hardfacing.

Drill Pipe Performance

Drill-Pipe Length Range2



Performance of Drill Pipe with Pipe Body at 95 % Inspection Class

	Applied Make-up Torque (ft-lbs)		Operational Torque (ft-lbs)	Max Tension (lbs)
Maximum MUT	5,100	Tension Only	0	213,300
		Combined Loading	4,300	213,300
Minimum MUT	4,300	Tension Only	0	263,200
		Combined Loading	3,300	263,200

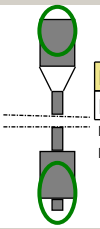
		Best Estimates (without Coating)	Best Estimates (with Coating)	Nominal (least
Drill Pipe Adjusted Weight	(lbs/ft)	10.98		10.56
Fluid Displacement	(gal/ft)	0.17		0.16
Fluid Displacement	(Bbls/ft)	0.0040		0.0038
Fluid Capacity	(gal/ft)	0.18	0.17	0.18
Fluid Capacity	(Bbls/ft)	0.0042	0.0041	0.0043
Drift Size	(in)	1.375		

Note: Oil field barrel equals 42 US gallons.

Note: Drill pipe assembly values are best estimates and may vary due to pipe body mill tolerance, internal plastic coating, and other factors.

Connection Performance

HT 2-7/8 PAC (3.125 (in) OD X 1.500 (in) ID) 120.000 (psi)



	Applied Make-up Torque (ft-lbs)	Tension at Shoulder Separation (lbs)	Tension at Connection Yield (lbs)
Maximum Make-up Torque	5,100	Tensile Limited	213,300
Minimum Make-up Torque	4,300	Tensile Limited	263.200

Note: The maximum make-up torque should be applied when possible.

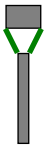
Note: To maximize connection operational tensile, a MUT (T4) = 4,200 (ft-lbs) should be applied.

Tool Joint Torsional Strength	(ft-lbs)	8,500
Tool Joint Tensile Strength	(lbs)	266,300

Tool Joint Dimensions		
Balanced OD	(in)	3.071
Minimum Tool Joint OD for API Premium Class	(in)	Not Applicable
Minimum Tool Joint OD for Counterbore	(in)	2.946

Elevator Shoulder Information

Elevator OD Not Raised 3.125 (in)



		SmoothEdge Height Not Raised	Nominal Tool Joint OD	Worn to Bevel Diameter	Worn to Min TJ OD for API Premium Class
Box OD	(in)	3.125	3.125	3.063	Not Applicable
Elevator Capacity	(lbs)	16,800	16,800	0	0

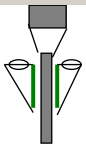
Assumed Elevator Bore Diameter	(in)	3.094

Note: Elevator capacity based on assumed Elevator Bore, no wear factor, and contact stress of 110,100psi.

Note: A raised elevator OD increases elevator capacity without affecting make-up torque.

Pipe Body Slip Crushing Capacity

Pipe Body Configuration (2.875 (in) OD 0.362 (in) Wall S-135)



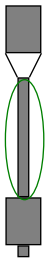
		Nominal	95 % Inspection Class	API Premium Class
Slip Crushing Capacity	(lbs)	315,000	297,900	247,300

Assumed Slip Length	(in)	16.5
Transverse Load Factor (K)		4.2

Note: Slip Crushing: Slip crushing load is calculated with the Spiri-Reinhold equation from "Why Does Drill Pipe Fail in the Slip Area" World Oil, 1959 for the slip length and transverse load factor shown and is for reference only. Slip crushing is dependent on the slip design and condition, coefficient of friction, loading conditions, time in slips, drill pipe OD and wall variation, and other factors. Consult with the slip manufacturer for additional information.

Pipe Body Performance

Pipe Body Configuration (2.875 (in) OD 0.362 (in) Wall S-135)



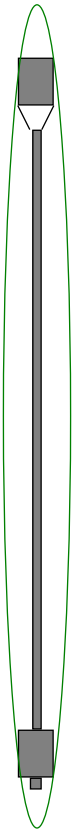
		Nominal	95 % Inspection Class	API Premium Class
Pipe Tensile Strength	(lbs)	385,800	363,900	299,800
Pipe Torsional Strength	(ft-lbs)	20,800	19,500	15,900
TJ/PipeBody Torsional Ratio		0.41	0.43	0.53
80% Pipe Torsional Strength	(ft-lbs)	16,600	15,600	12,800
Burst	(psi)	29,747	32,297	27,197
Collapse	(psi)	29,716	28,746	25,602
Pipe OD	(in)	2.875	2.839	2.730
Wall Thickness	(in)	0.362	0.344	0.290
Nominal Pipe ID	(in)	2.151	2.151	2.151
Cross Sectional Area of Pipe Body	(in^2)	2.858	2.695	2.220
Cross Sectional Area of OD	(in^2)	6.492	6.329	5.854
Cross Sectional Area of ID	(in^2)	3.634	3.634	3.634
Section Modulus	(in^3)	1.602	1.506	1.228
Polar Section Modulus	(in^3)	3.204	3.011	2.456

Note: Nominal Burst calculated at 87.5% RBW per API.

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Operational Limits of Drill Pipe

Connection	HT 2-7/8 PAC	Tool Joint OD (in)	3.125	Tool Joint ID (in)	1.500	Tool Joint Specified Minimum Yield Strength (psi)	120,000
Pipe Body	95 % Inspection Class	Pipe Body OD (in)	2.875	Wall Thickness (in)	0.362	Pipe Body Grade	S-135



Combined Loading for Drill Pipe at

Maximum Make-up Torque = 5,100 (ft-lbs)

Operational Torque (ft-lbs)	Assembly Max Tension (lbs)	Pipe Body Max Tension (lbs)	Connection Max Tension (lbs)
0	213,300	363,900	213,300
200	213,300	363,900	213,300
400	213,300	363,800	213,300
700	213,300	363,700	213,300
900	213,300	363,500	213,300
1,100	213,300	363,300	213,300
1,300	213,300	363,100	213,300
1,600	213,300	362,700	213,300
1,800	213,300	362,300	213,300
2,000	213,300	362,000	213,300
2,200	213,300	361,600	213,300
2,500	213,300	360,900	213,300
2,700	213,300	360,400	213,300
2,900	213,300	359,900	213,300
3,100	213,300	359,300	213,300
3,400	213,300	358,300	213,300
3,600	213,300	357,700	213,300
3,800	213,300	356,900	213,300
4,000	213,300	356,200	213,300
4,300	213,300	355,200	213,300

Operational drilling torque is limited by the Make-up Torque.

Combined Loading for Drill Pipe at

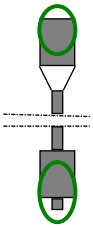
Minimum Make-up Torque = 4,300 (ft-lbs)

Operational Torque (ft-lbs)	Assembly Max Tension (lbs)	Pipe Body Max Tension (lbs)	Connection Max Tension (lbs)
0	263,200	363,900	263,200
200	263,200	363,900	263,200
300	263,200	363,800	263,200
500	263,200	363,800	263,200
700	263,200	363,700	263,200
900	263,200	363,500	263,200
1,000	263,200	363,400	263,200
1,200	263,200	363,200	263,200
1,400	263,200	363,000	263,200
1,500	263,200	362,800	263,200
1,700	263,200	362,500	263,200
1,900	263,200	362,200	263,200
2,100	263,200	361,800	263,200
2,200	263,200	361,600	263,200
2,400	263,200	361,100	263,200
2,600	263,200	360,700	263,200
2,700	263,200	360,400	263,200
2,900	263,200	359,900	263,200
3,100	263,200	359,300	263,200
3,300	263,200	358,800	263,200

Operational drilling torque is limited by the Make-up Torque.

Connection

Make-up Torque Range



	Make-up Torque (ft-lbs)	Connection Max Tension (lbs)
Min MUT	4,300	263,200
	4,400	257,600
	4,500	251,900
	4,600	246,300
	4,700	240,700
	4,700	235,700
	4,800	230,100
	4,900	224,500
	5,000	218,900
Max MUT	5,100	213,300

Note: Recommended MUT should always be used when possible. If not possible, MUT should be as close to Recommended MUT as possible.

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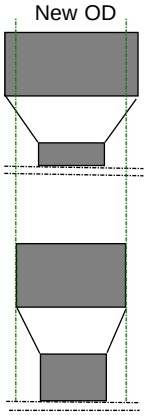
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Connection Wear Table

Connection	HT 2-7/8 PAC	Tool Joint OD (in)	3.125	Tool Joint ID (in)	1.500	Tool Joint Specified Minimum Yield Strength (psi)	120,000

Connection Wear

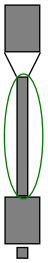


Tool Joint OD (in)	Connection Torsional Strength (ft-lbs)	Max MUT (ft-lbs)	Connection Max Tension (lbs)	Min MUT (ft-lbs)	Connection Max Tension (lbs)
3.125	8,500	5,100	213,300	4,300	263,200
3.109	8,500	5,100	212,000	4,300	261,600
3.092	8,500	5,100	210,600	4,300	259,800
3.076	8,500	5,100	209,200	4,300	258,200
3.06	8,400	5,000	213,800	4,200	262,400
3.044	8,200	4,900	218,100	4,100	266,100
3.027	8,000	4,800	222,300	4,000	261,900
3.011	7,800	4,700	226,500	3,900	257,500
2.995	7,600	4,500	236,500	3,800	253,200
2.979	7,400	4,400	240,400	3,700	248,800
2.962	7,200	4,300	244,100	3,600	244,500
2.946	7,000	4,200	247,800	3,500	240,100

Pipe Body

Combined Loading Table (Torque-Tension)

Pipe Body	95 % Inspection Class	Pipe Body OD (in)	2.875	Wall Thickness (in)	0.362	Pipe Body Grade	S-135



Pipe Body Torque (ft-lbs)	0	1,800	3,600	5,300	7,100	8,900	10,700	12,400	14,200	16,000	17,800	19,500
Pipe Body Max Tension (lbs)	363,900	362,300	357,700	350,300	339,000	324,000	304,500	281,300	250,100	209,000	150,400	25,200

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