

Hole Volume and Annular Volume, m ³ /100m (Pipe in Hole)																
Pipe Size	Hole Diameter, mm															
mm	143	152	156	159	171	194	200	219	222	229	251	279	311	349	381	445
0	1.61	1.81	1.91	1.99	2.30	2.96	3.14	3.77	3.87	4.12	4.95	6.11	7.60	9.57	11.40	15.55
60	1.31	1.51	1.61	1.68	2.00	2.65	2.84	3.47	3.57	3.82	4.65	5.81	7.30	9.27	11.10	15.25
73	1.16	1.37	1.47	1.54	1.85	2.51	2.70	3.32	3.43	3.68	4.51	5.67	7.15	9.12	10.96	15.11
89	0.96	1.16	1.26	1.33	1.65	2.30	2.49	3.12	3.22	3.47	4.30	5.46	6.95	8.92	10.75	14.90
102	0.75	0.95	1.05	1.12	1.44	2.09	2.28	2.91	3.01	3.26	4.09	5.25	6.74	8.71	10.54	14.69
114	0.52	0.73	0.83	0.90	1.21	1.87	2.06	2.68	2.78	3.03	3.68	5.03	6.51	8.48	10.31	14.47
127	0.27	0.48	0.57	0.65	0.96	1.62	1.80	2.43	2.53	2.78	3.61	4.78	6.26	8.23	10.06	14.21
140	0.02	0.23	0.32	0.40	0.71	1.37	1.55	2.18	2.28	2.53	3.36	4.52	6.01	7.98	9.81	13.96

Note: To determine the total hole volume (pipe in hole) add the pipe capacity to the annular volume.

Tank Volume, m ³ /m (Rectangular Tanks Only)																
Width	Length, m															
mm	3.05	3.66	4.27	4.88	5.49	6.10	7.62	9.14	10.67	12.19	13.72	15.24	16.76	18.29	19.81	21.23
1.83	5.58	6.70	7.81	8.93	10.05	11.16	13.94	16.73	19.53	22.31	25.11	27.89	30.67	33.47	36.25	38.85
2.13	6.50	7.80	9.10	10.39	11.69	12.99	16.23	19.47	22.73	25.96	29.22	32.46	35.70	38.96	42.20	45.22
2.44	7.44	8.93	10.42	11.91	13.40	14.88	18.59	22.30	26.03	29.74	33.48	37.19	40.89	44.63	48.34	51.80
2.74	8.36	10.03	11.70	13.37	15.04	16.71	20.88	25.04	29.24	33.40	37.59	41.76	45.92	50.11	54.28	58.17
3.05	9.30	11.16	13.02	14.88	16.74	18.61	23.24	27.88	32.54	37.18	41.85	46.48	51.12	55.78	60.42	64.75

Note: Multiply factor by tank depth to bet volume in m³.

Pump Output - Duplex, L/Stroke (at 90% efficiency) with rod displacement										
Stroke	Liner Size, mm									
mm	127	140	152	159	165	171	178	184	191	197
305	12.79	15.78	18.79	20.67	22.36	24.08	26.19	27.47	29.73	31.74
356	14.93	18.42	21.95	24.14	25.09	26.12	30.58	32.08	34.71	37.07
381	15.63	19.36	23.14	25.48	27.58	29.75	32.38	34.72	37.14	39.65
406	16.24	20.22	24.24	26.74	28.97	31.29	34.09	36.59	39.58	42.27
457	18.28	22.76	27.29	30.10	32.61	35.22	38.38	41.18	44.55	47.56

Pump Output - Triplex, L/Stroke (at 100% efficiency)											
Stroke	Liner Size, mm										
mm	102	114	127	140	152	159	165	171	178	184	191
178	4.32	5.47	6.75	8.18	9.72	10.55	11.42	12.31	13.24	14.20	15.20
203	4.94	6.26	7.72	9.34	11.12	12.06	13.05	14.07	15.13	16.22	17.37
229	5.56	7.04	8.68	10.51	12.51	13.57	14.68	15.82	17.02	18.25	19.54
254	6.17	7.82	9.65	11.68	13.90	15.07	16.31	17.58	18.92	20.28	21.72
305	7.41	9.38	11.58	14.02	16.67	18.08	19.57	21.09	22.70	24.33	26.06

Drill Pipe Capacities and Displacements				
OD, mm	ID, mm	Mass, kg/m	Capacity, m ³ /100m	Displacement, m ³ /100m
60	46.1	10.42	0.168	0.133
73	54.6	16.67	0.230	0.212
89	76.0	15.46	0.454	0.197
89	70.2	20.63	0.388	0.263
89	66.1	24.43	0.346	0.311
102	84.8	19.56	0.612	0.249
114	97.1	24.70	0.742	0.333
114	92.5	29.76	0.671	0.379
127	108.6	29.01	0.926	0.370
140	118.6	34.59	1.106	0.445
140	121.4	32.58	1.158	0.419

Drill Collar Capacity and Displacement					
OD mm	ID, mm				
	51	57	64	71	76
Capacity, m ³ /100 m					
	0.20	0.26	0.32	0.40	0.45
Displacement, m ³ /100 m					
105	0.66	0.61	0.54		
121	0.94	0.89	0.83		
127	1.06	1.01	0.95		
152	1.62	1.57	1.51	1.42	1.37
159	1.78	1.72	1.66	1.58	1.52
165	1.94	1.88	1.82	1.74	1.68
171	2.11	2.05	1.99	1.91	1.85
178	2.28	2.23	2.17	2.08	2.03
184	2.46	2.41	2.35	2.26	2.21
197	2.84	2.79	2.73	2.64	2.59
203	3.04	2.99	2.93	2.84	2.79
229	3.90	3.85	3.79	3.70	3.65
254					4.61
279					5.68

Casing Capacities							
OD, mm	ID, mm	Mass, kg/m	Capacity m ³ /100m	OD, mm	ID, mm	Mass, kg/m	Capacity m ³ /100m
114	103.9	14.0	0.848	219	203.6	40.3	3.256
114	101.6	16.9	0.811	219	198.8	52.3	3.104
127	112.0	22.1	0.985	244	228.6	46.2	4.104
127	108.6	26.7	0.926	244	226.6	51.9	4.033
140	125.7	22.9	1.241	244	224.4	58.0	3.955
140	124.3	25.1	1.213	244	222.4	63.6	3.885
178	166.1	24.9	2.167	273	255.3	57.9	5.119
178	159.4	38.2	1.996	273	252.7	65.9	5.015
178	157.1	42.7	1.938	340	317.9	88.6	7.937
				340	315.3	98.5	7.808

SI Units for Drilling Industry				
Quantity or Property	Previous Units	SI Unit	Symbol	To Convert to SI Units Multiply By
Depth Hole & Pipe Diameter	feet	metres	m	0.304 8
Bit Size	inches	millimetres	mm	25.4
Bit Size Weight on Bit	pounds	decanewtons	daN	0.445
Nozzle Size	32nds inch	millimetres	mm	0.794
Drill Rate	feet/hour	metres per hr.	m/h	0.304 8
Volume	barrels	cubic metres	m ³	0.159 0
Pump Output per Stroke	US gal/stroke	cubic metres per stroke	m ³ /stroke	0.003 785
	US gal/stroke	litres per stroke	L/stroke	3.785
	bbl/stroke	cubic metres per stroke	m ³ /stroke	0.159 0
	bbl/stroke	litres per stroke	L/stroke	159.0
Flow Rate	US gal/min	cubic metres per minute	m ³ /min	0.003 785
	bbl/min	cubic metres per minute	m ³ /min	0.159 0
Annular Velocity	feet/min	metres per minute	m/min	0.304 8
Pressure	psi	kilopascals	kPa	6.895
		megapascals	MPa	0.006 895
Mud Density	lb/US gal	kilograms per cubic metre	kg/m ³	119.826
Mud Gradient	psi/foot	kilopascals metre	kPa/m	22.621
Apparise & Plastic Viscosity	centipoise	millipascals seconds	mPa • s	1
Yield Point	lb/100 ft ²	pascals	Pa	0.5
Gel Strength	lb/100 ft ²	pascals	Pa	0.478 8
Shear Rate	reciprocal sec	reciprocal sec	s ⁻¹	1
Cake Thickness	32nds inch	millimetres	mm	0.794
Concentrations	lbs/bbl	kilograms per cubic metre	kg/m ³	2.85
Torque	ft lbs	newton metres	N • m	1.3558

Annular Velocity Multipliers																	
Pipe Size, mm	Bit Size, mm																
	136	143	152	156	159	171	194	200	219	222	229	251	279	311	349	381	445
73	84.7	77.9	71.1	67.5	64.2	52.5	39.7	36.8	29.9	29.0	27.2						
76	87.0	82.0	73.4	68.6	65.3	54.3	40.0	37.2	30.2	29.3	27.4	22.3					
89	120.4	101.6	83.9	77.6	73.3	59.7	42.8	39.7	31.8	30.8	28.6	23.1	18.2	14.3			
102	157.3	125.7	99.6	90.9	85.1	67.3	46.5	42.9	33.8	32.7	30.2	24.2	18.9	14.7	11.4	9.4	6.8
114				103.6	78.4	51.7	47.2	36.4	35.1	32.3	25.5	19.6	15.2	11.7	9.6	6.9	
127						39.9	38.4	35.1	27.2	20.6	15.8	12.0	9.9	7.0			
140							42.8	38.9	29.3	21.9	16.5	12.5	10.2	7.1			
152								48.5	43.4	31.9	23.3	17.3	12.9	10.4	7.3		
165									57.7	50.5	35.6	25.2	18.3	13.5	10.8	7.15	

Kick Data

- Data required:
 - Drill pipe capacity DPC, (m³/m)
 - Pump output PO, (m³/Stroke)
 - True vertical depth (TVD, m)
 - Measured depth (MMD, m)
 - Mud density (MD, kg/m³)
 - Shut in drill pipe pressure (SIDPP, KPa)
 - Shut in casing pressure (SICP, KPa)
- Calculate formation pressure: KPa
 $FP = 0.0098 \cdot TVD \cdot MD + SIDPP, KPa$
- Calculate mud density to kill: kg/m³

$$MDK = \frac{102 \cdot FP}{TVD}$$

- Mix Barite to reach MDK
- Calculate surface to bit strokes:

$$SBS = \frac{DPC \cdot MMD}{PO}, \text{ Sk}$$

- Set pump at 1/2 normal drilling SPM and begin to circulate, maintaining a constant pump speed.
- Adjust the choke and maintain 350 - 650 KPa over initial SICP until kill mud reaches bit.
- When kill mud reaches bit, record standpipe pressure. Continue displacing to kill mud while maintaining constant standpipe pressure. Use adjustable choke as required.

Handy Formulas

Rheology

Plastic Viscosity, PV (mPa • s)
 $PV = \ominus 600 - \ominus 300$
 $\ominus 600 =$ Fann dial reading @ 600 rpm
 $\ominus 300 =$ Fann dial reading @ 300 rpm

Yield Point, YP (Pa)

$$YP = \frac{\ominus 300 - PV}{2}$$

Hydrostatic Pressure, kPa

Density, kg/m³ x 0.00981 x Depth, m

Hydraulics

Pump Output, Q (m³/min)

$$Q = \frac{Q_1 \times SPM}{1000}$$

Q₁ = pump output (L/S)
 SPM = strokes per min (S/min)

Annular Velocity, V(m/min)

$$V = \frac{Q_1 \times 1.273 \times 10^3}{d_h^2 - d_p^2}$$

d_h = hole diameter (mm)