



## *Tables & Charts*

<b>Nom. Size (inc)</b>	<b>ID (inc)</b>	<b>Wall Thk (inc)</b>	<b>Wt/ft (lb)</b>	<b>Wt/Jt. 31ft (lb)</b>	<b>Connection</b>	<b>Size &amp; Tube</b>
<b>3 1/2</b>	2 1/16	0.719	25.3	760	NC38	3 1/2 IF
<b>3 1/2</b>	2 1/4	0.625	26.7	716	NC38	3 1/2 IF
<b>4</b>	2 9/16	0.719	29.7	890	NC40	4 FH
<b>4 1/2</b>	2 3/4	0.875	41	1230	NC46	4 IF
<b>5</b>	3	1	48.5	1516	NC50	4 1/2 IF
<b>5 1/2</b>	4	1.063	50.7	1880	5 1/2 FH	–
<b>6 5/8</b>	4 1/2	1.063	57	2290	6 5/8 IF	–

## Collar Weights

lb / ft Length

OD of Drill Collar (in.)	Bore of Drill Collar (in)						
	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2
2 7/8	19	18	16				
3	21	20	18				
3 1/8	22	22	20				
3 1/4	26	24	22				
3 1/2	30	29	27				
3 3/4	35	33	32				
4	40	39	37	35	32	29	
4 1/8	43	41	39	37	35	32	
4 1/4	46	44	42	40	38	35	
4 1/2	51	50	48	46	43	41	
4 3/4			54	52	50	47	44
5			61	59	56	53	50
5 1/4			68	65	63	60	57
5 1/2			75	73	70	67	64
5 3/4			82	80	78	75	72
6			90	88	85	83	79
6 1/4			98	96	94	91	88
6 1/2			107	105	102	99	96
6 3/4			116	114	111	108	105
7			125	123	120	117	114
7 1/4			134	132	130	127	124
7 1/2			144	142	139	137	133
7 3/4			154	152	150	147	144
8			165	163	160	157	154
8 1/4			176	174	171	168	165
8 1/2			187	185	182	179	176
9			210	208	206	203	200
9 1/2			234	232	230	227	224
9 3/4			248	245	243	240	237
10			261	259	257	254	251
11			317	315	313	310	307
12			379	377	374	371	368

**lb / ft Length**

OD of Drill Collar (in.)	Bore of Drill Collar (in)					
	2 13/16	3	3 1/4	3 1/2	3 3/4	4
2 7/8						
3						
3 1/8						
3 1/4						
3 1/2						
3 3/4						
4						
4 1/8						
4 1/4						
4 1/2						
4 3/4						
5						
5 1/4						
5 1/2	60					
5 3/4	67	64	60			
6	75	72	68			
6 1/4	83	80	76	72		
6 1/2	91	89	85	80		
6 3/4	100	98	93	89		
7	110	107	103	98	93	84
7 1/4	119	116	112	108	103	93
7 1/2	129	126	122	117	113	102
7 3/4	139	136	132	128	123	112
8	150	147	143	138	133	122
8 1/4	160	158	154	149	144	133
8 1/2	172	169	165	160	155	150
9	195	192	188	184	179	174
9 1/2	220	216	212	209	206	198
9 3/4	232	229	225	221	216	211
10	246	243	239	235	230	225
11	302	299	295	291	286	281
12	364	361	357	352	347	342

Weight of 31 ft Drill Collar lb

OD of Drill Collar (in.)	Bore of Drill Collar (in)						
	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2
2 7/8	589	558	496				
3	651	620	558				
3 1/8	682	682	620				
3 1/4	806	744	682				
3 1/2	930	899	837				
3 3/4	1085	1023	992				
4	1240	1209	1147	1085	992	899	
4 1/8	1333	1271	1209	1147	1085	992	
4 1/4	1426	1364	1302	1240	1178	1085	
4 1/2	1581	1550	1488	1426	1333	1271	
4 3/4			1674	1612	1550	1457	1364
5			1891	1829	1736	1643	1550
5 1/4			2108	2015	1953	1860	1767
5 1/2			2325	2263	2170	2077	1984
5 3/4			2542	2480	2418	2325	2232
6			2790	2728	2635	2573	2449
6 1/4			3038	2976	2914	2821	2728
6 1/2			3317	3255	3162	3069	2976
6 3/4			3596	3534	3441	3348	3255
7			3875	3813	3720	3627	3534
7 1/4			4154	4092	4030	3937	3844
7 1/2			4464	4402	4309	4247	4123
7 3/4			4774	4712	4650	4557	4464
8			5115	5053	4960	4867	4774
8 1/4			5456	5394	5301	5208	5115
8 1/2			5797	5735	5642	5549	5456
9			6510	6448	6386	6293	6200
9 1/2			7254	7192	7130	7037	6944
9 3/4			7688	7595	7533	7440	7347
10			8091	8029	7967	7874	7781
11			9827	9765	9703	9610	9517
12			11749	11687	11594	11501	11408

**Weight of 31 ft Drill Collar lb**

OD of Drill Collar (in.)	Bore of Drill Collar (in)					
	2 13/16	3	3 1/4	3 1/2	3 3/4	4
2 7/8						
3						
3 1/8						
3 1/4						
3 1/2						
3 3/4						
4						
4 1/8						
4 1/4						
4 1/2						
4 3/4						
5						
5 1/4						
5 1/2	1860					
5 3/4	2077	1984	1860			
6	2325	2232	2108			
6 1/4	2573	2480	2356	2232		
6 1/2	2821	2759	2635	2480		
6 3/4	3100	3038	2883	2759		
7	3410	3317	3193	3038	2883	2604
7 1/4	3689	3596	3472	3348	3193	2883
7 1/2	3999	3906	3782	3627	3503	3162
7 3/4	4309	4216	4092	3968	3813	3472
8	4650	4557	4433	4278	4123	3782
8 1/4	4960	4898	4774	4619	4464	4123
8 1/2	5332	5239	5115	4960	4805	4650
9	6045	5952	5828	5704	5549	5394
9 1/2	6820	6696	6572	6479	6386	6138
9 3/4	7192	7099	6975	6851	6696	6541
10	7626	7533	7409	7285	7130	6975
11	9362	9269	9145	9021	8866	8711
12	11284	11191	11067	10912	10757	10602

# Drill Bit Sizes

Rotary Pin Connection	Size of Bit inches
2 3/8 REG	3 3/4
	3 7/8
	4 1/8
	4 1/4
	4 3/8
2 7/8 REG	4 1/2
	4 5/8
	4 3/4
	4 7/8
3 1/2 REG	5
	5 1/8
	5 3/8
	5 5/8
	5 3/4
	5 7/8
	6
	6 1/8
	6 1/4
	6 3/8
	6 1/2
	6 5/8
	6 3/4
7	
7 3/8	
4 1/2 REG	7 1/2
	7 5/8
	7 3/4
	7 7/8
	8 1/8
	8 3/8
	8 1/2
	8 5/8
	8 3/4
	9
9 3/8	

Rotary Pin Connection	Size of Bit inches
6 5/8 REG	9 1/2
	9 5/8
	9 3/4
	9 7/8
	10 5/8
	11
	11 1/2
	11 5/8
	11 3/4
	12
Both	12 1/4
	13 1/2
	13 3/4
	14 3/4
	15
	16
	17
	17 1/2
	18 1/2
	14 1/2
	14 3/4
	15
	16
17	
17 1/2	
18 1/2	
7 5/8 REG	20
	22
	23
	24
	26
	18 5/8
	20
22	
23	
24	
26	
27	
and larger	

Mud Weight (lbs/gal)	Mud Weight (kg/l)	Buoyancy Factor
8.5	1.02	0.870
9.0	1.08	0.862
9.5	1.14	0.855
10.0	1.20	0.847
10.5	1.26	0.839
11.0	1.32	0.832
11.5	1.38	0.824
12.0	1.44	0.816
12.5	1.50	0.809
13.0	1.56	0.801
13.5	1.62	0.793
14.0	1.68	0.786
14.5	1.74	0.778
15.0	1.80	0.771
15.5	1.86	0.763
16.0	1.92	0.755
16.5	1.98	0.748
17.0	2.04	0.740
17.5	2.10	0.732
18.0	2.16	0.725

**Example:**

**Imperial:**

$$BF = 1 - \frac{MW_1}{65.73}$$

BF=Bouyancy Factor  
MW<sub>1</sub>=Mud Weight (lbs/gal)

**Metric:**

$$BF = 1 - \frac{MW_2}{7.83}$$

BF=Bouyancy Factor  
MW<sub>2</sub>=Mud Weight (kgf/l)

**Note:** lb/gal x .11983=kgf/l



BUILD RATE DEGREES per 100 ft (30m)	Radius of Hole	
	R1 FEET	R2 METERS
2	2865	859
3	1432	430
6	955	286
8	716	215
10	573	172
12	477	143
14	409	123
16	358	107
18	318	95
20	286	86
22	260	78
24	239	72
26	220	66
28	205	61
30	191	57
32	179	54
34	169	51
36	159	48
38	151	45
40	143	43
42	136	41
44	130	39
46	125	37
48	119	36
50	115	34
52	110	33
54	106	32
56	102	31
58	99	30
60	95	29
62	92	28
64	90	27
66	87	26
68	84	25
70	82	25
72	80	24
74	77	23
76	75	23
78	73	22
80	72	21
82	70	21
84	68	20
86	67	20
88	65	20

BUILD RATE DEGREES per 100 ft (30m)	Radius of Hole	
	R1 FEET	R2 METERS
90	64	19
92	62	19
94	61	18
96	60	18
98	58	18
100	57	17
105	55	16
110	52	16
115	50	15
120	48	14
125	46	14
130	44	13
135	42	13
140	41	12
145	40	12
150	38	11
155	37	11
160	36	11
165	35	10
170	34	10
175	33	10
180	32	10
185	31	9
190	30	9
195	29	9
200	29	9
210	27	8
220	26	8
230	25	7
240	24	7
250	23	7
260	22	7
270	21	6
280	20	6
290	20	6
300	19	6

$$R1 = \frac{\text{Arc length (ft)}}{.017453 \times \text{Angle (}^\circ\text{)}}$$

$$R2 = \frac{\text{Arc Length (m)}}{.017453 \times \text{Angle (}^\circ\text{)}}$$

**Conversion from common inch sizes to millimeters**

<b>Fraction</b>	<b>Dec. Equiv.</b>	<b>mm</b>	<b>Fraction</b>	<b>Dec. Equiv.</b>	<b>mm</b>
1/64	0.015625	0.397	33/64	0.515625	13.097
1/32	0.031250	0.794	17/32	0.531250	13.494
3/64	0.046875	1.191	35/64	0.546875	13.891
1/16	0.062500	1.588	9/16	0.562500	14.288
5/64	0.078125	1.984	37/64	0.578125	14.684
3/32	0.093750	2.381	19/32	0.593750	15.081
7/64	0.109375	2.778	39/64	0.609375	15.478
1/8	0.125000	3.175	5/8	0.625000	15.875
9/64	0.140625	3.572	41/64	0.640625	16.272
5/32	0.156250	3.969	21/32	0.656250	16.669
11/64	0.171875	4.366	43/64	0.671875	17.066
3/16	0.187500	4.763	11/16	0.687500	17.463
13/64	0.203125	5.159	45/64	0.703125	17.859
7/32	0.218750	5.556	23/32	0.718750	18.256
15/64	0.234375	5.953	47/64	0.734375	18.653
1/4	0.250000	6.350	3/4	0.750000	19.050
17/64	0.265625	6.747	49/64	0.765625	19.447
9/32	0.281250	7.144	25/32	0.781250	19.844
19/64	0.296875	7.541	51/64	0.796875	20.241
5/16	0.312500	7.938	13/16	0.812500	20.638
21/64	0.328125	8.334	53/64	0.828125	21.034
11/32	0.343750	8.731	27/32	0.843750	21.431
23/64	0.359375	9.128	55/64	0.859375	21.828
3/8	0.375000	9.525	7/8	0.875000	22.225
25/64	0.390625	9.922	57/64	0.890625	22.622
13/32	0.406250	10.319	29/32	0.906250	23.019
27/64	0.421875	10.716	59/64	0.921875	23.416
7/16	0.437500	11.113	15/16	0.937500	23.813
29/64	0.453125	11.509	61/64	0.953125	24.209
13/32	0.406250	10.319	31/32	0.968750	24.606
31/64	0.484375	12.303	63/64	0.984375	25.003
1/2	0.500000	12.700	1	1.000000	25.400

## Conversion Factors

From	multiply by	To
acre	43560	ft <sup>2</sup>
acre	0.001562	mi <sup>2</sup>
acre	4046.9	m <sup>2</sup>
atm	33.94	ft of water
atm	1.013x10 <sup>-5</sup>	pascals
atm	14.6959	lb/in <sup>2</sup>
atm	1.033	kg/cm <sup>2</sup>
bar	14.504	psi
bbbl	0.1589	m <sup>3</sup>
bbbl	4.211	ft <sup>3</sup>
bbbl	31.5	gal (U.S.)
bbbl	5.78	ft <sup>3</sup>
bbbl	0.1637	m <sup>3</sup>
bbbl	36	gal (British)
bbbl	170.6	kg
bbbl	376	lb (cement)
bbbl	42	gal (U.S.)
bbbl/min	42	gal/min
bbbl/min	0.1589	m <sup>3</sup> /min
bbbl/day	0.02917	gal/min
cm	0.3937	in
cm <sup>2</sup>	0.155	in <sup>2</sup>
cm <sup>3</sup>	0.06102	in <sup>3</sup>
cm <sup>3</sup>	3.531x10 <sup>-5</sup>	ft <sup>3</sup>
daN	2.248	lbf
deg	60	min
deg	0.01745	rad
deg	3600	s
deg/s	0.1667	rpm
deg/s	2.778x10 <sup>-3</sup>	rev/s
ft/sec	0.3048	m/sec
ft	12	in
ft	0.3048	m
ft	1.89394x10 <sup>-4</sup>	mi
ft-lb	1.355818	N.m
ft-lb	0.00135582	kN.m
ft-lb	0.1383	kg-m
ft-lb	1.35583	J
ft-lb	1.286x10 <sup>-3</sup>	Btu
ft-lb/min	0.01667	ft-lb/s
ft-lb/min	2.26x10 <sup>-5</sup>	kW
ft-lb/s	1.356x10 <sup>-3</sup>	kW

<b>From</b>	<b>multiply by</b>	<b>To</b>
ft-lb/s	$1.818 \times 10^{-3}$	hp
ft/min	0.508	cm/s
ft/min	0.01667	ft/sec
ft/min	0.01829	km/hr
ft/min	0.3048	m/min
ft/min	0.01136	mi/hr
ft <sup>2</sup>	0.0929	m <sup>2</sup>
ft <sup>3</sup>	0.02832	m <sup>3</sup>
ft <sup>3</sup>	28.32	L
ft <sup>3</sup>	1728	in <sup>3</sup>
ft <sup>3</sup>	7.481	gal (U.S.)
ft <sup>3</sup> of water	62.37	lb
ft <sup>3</sup> /min	$4.72 \times 10^{-4}$	m <sup>3</sup> /s
ft <sup>3</sup> /min	0.1247	gal/s
ft <sup>3</sup> /min	0.472	litres/s
ft <sup>3</sup> /s	448.83	gal/min
ft <sup>3</sup> -atm	2116.3	ft-lb
g	0.001	kg
g-cm <sup>2</sup>	$3.4172 \times 10^{-4}$	lb-in <sup>2</sup>
g/cm <sup>3</sup>	8.34585	lbs/gal
gal	1.20094	gal (U.S.)
gal	3785	cm <sup>3</sup>
gal	0.1337	ft <sup>3</sup>
gal	231	in <sup>3</sup>
gal	3.785	L
gal	0.003785	m <sup>3</sup>
gpm	3.785	lpm
gpm	$2.228 \times 10^{-3}$	ft <sup>3</sup> /s
hp	0.7457	kW
in	2.54	cm
in	25.4	mm
in <sup>2</sup>	6.452	cm <sup>2</sup>
in <sup>2</sup>	645.2	mm <sup>2</sup>
in <sup>2</sup>	$6.944 \times 10^{-3}$	ft <sup>2</sup>
in <sup>3</sup>	16387	mm <sup>3</sup>
in <sup>3</sup>	16.387	cm <sup>3</sup>
in <sup>3</sup>	$1.639 \times 10^{-5}$	m <sup>3</sup>
in <sup>3</sup>	$5.787 \times 10^{-4}$	ft <sup>3</sup>
in <sup>3</sup>	$4.329 \times 10^{-3}$	gal
in <sup>3</sup>	0.01639	L
J	0.737557	ft-lb
kgf	9.807	N

## Conversion Factors

From	multiply by	To
kg	2.204	lb
kg-m	7.233	ft-lbs
kgf/cm <sup>2</sup>	14.2234	lb/in <sup>2</sup>
kg/m <sup>3</sup>	0.06243	lb/ft <sup>3</sup>
kg/m <sup>3</sup>	0.00835	lb/gal
kg/m <sup>3</sup>	0.351	lb/bbl
kg/m	0.672	lb/ft
kPa	0.145	psi
kPa/m	0.04421	lb/in <sup>2</sup> /ft
km	0.6215	mi
km/hr	0.6215	mi/hr
kN	224.82014	lbf
kN.m	737.561	ft-lbs
kW	1.341	hp
kW	44250	lb-ft/min
kW-hr	2.655x10 <sup>6</sup>	ft-lb
L	0.2642	gal
L	0.03531	ft <sup>3</sup>
L	0.001	m <sup>3</sup>
lb	0.4536	kg
lb	4.45x10 <sup>5</sup>	dynes
lb	4.448	N
lb	4.535x10 <sup>-4</sup>	tons
lbf	4.4482	N
lbf	0.004448	kN
lbf	0.4448	daN
lb/gal	119.83	kg/m <sup>3</sup>
lb/gal	0.11982	g/cm <sup>3</sup>
lb/bbl	2.85	kg/m <sup>3</sup>
lbf/ft	14.594	N/m
lb/in <sup>2</sup>	0.06895	bar
lb/in <sup>2</sup>	6.895	kPa
lb/in <sup>2</sup>	0.006895	Mpa
lb/in <sup>2</sup>	0.0703067	kgf/cm <sup>2</sup>
lb/in <sup>2</sup>	0.006895	N/mm <sup>2</sup>
lb/in <sup>2</sup>	0.0680462	atm
lb/in <sup>2</sup> /ft	22.62	kPa/m
lb/in <sup>3</sup>	27679.7	kg/m <sup>3</sup>
lb/in <sup>3</sup>	27.6797	g/cm <sup>3</sup>
lb/ft <sup>2</sup>	4.882	kg/m <sup>2</sup>
lb/ft <sup>2</sup>	6.945x10 <sup>-3</sup>	lb/in <sup>2</sup>
lb/ft <sup>3</sup>	16.02	kg/m <sup>3</sup>

<b>From</b>	<b>multiply by</b>	<b>To</b>
lb/ft <sup>3</sup>	5.787x10 <sup>-4</sup>	lb/in <sup>3</sup>
lb/gal	7.48	lb/ft <sup>3</sup>
lb/gal	0.12	specific grav.
lb/gal	0.1198	g/cm <sup>3</sup>
lpm	0.2642	gpm
m/sec	3.28084	ft/sec
m	3.28084	ft
m <sup>2</sup>	0.0002471	acre
m <sup>2</sup>	10.764	ft <sup>2</sup>
m <sup>3</sup>	6.29327	bbl
m <sup>3</sup>	35.315	ft <sup>3</sup>
m <sup>3</sup>	264.2	gal
m <sup>3</sup>	1000	L
m <sup>3</sup> /min	264.20079	gpm
m <sup>3</sup> /min	6.29327	bbl/min
mm	0.03937	in
mm <sup>2</sup>	0.00155	in <sup>2</sup>
mm <sup>3</sup>	0.00006102	in <sup>3</sup>
m <sup>3</sup> /s	15850	gal/min
m <sup>3</sup> /s	60000	l/min
mi	1.609	km
mi <sup>2</sup>	2.788x10 <sup>7</sup>	ft <sup>2</sup>
mi <sup>2</sup>	2.59	km <sup>2</sup>
mi/hr	1.609	km/hr
Mpa	145.03263	lb/in <sup>2</sup>
N	0.22481	lbf
N	0.102	kgf
N.m	0.737561	ft-lb
N/mm <sup>2</sup>	145.03263	lb/in <sup>2</sup>
N/m	0.06852	lbf/ft
rad	57.3	deg
rad/s	0.1592	rev/s
rad/s	9.549	rpm
tons	1000	kg
watts	0.7376	ft-lb/s
watts	1.341x10 <sup>-3</sup>	hp
yds	3	ft
yds	0.9144	m
°C	1.5 * °C + 32	°F
°F	(°F - 32) / 1.8	°C

# Nozzle Flow Area Chart (in<sup>2</sup>)

Size	1	2	3	4	5	6	7	8	9	10
7	0.038	0.075	0.113	0.150	0.188	0.225	0.263	0.301	0.338	0.376
8	0.049	0.098	0.147	0.196	0.245	0.295	0.344	0.393	0.442	0.491
9	0.062	0.124	0.186	0.249	0.311	0.373	0.432	0.497	0.559	0.621
10	0.077	0.153	0.230	0.307	0.383	0.460	0.537	0.614	0.690	0.767
11	0.093	0.186	0.278	0.371	0.464	0.557	0.650	0.742	0.835	0.928
12	0.110	0.221	0.331	0.442	0.552	0.663	0.773	0.884	0.994	1.104
13	0.130	0.259	0.389	0.518	0.648	0.778	0.907	1.037	1.167	1.296
14	0.150	0.301	0.451	0.601	0.752	0.902	1.052	1.203	1.353	1.503
15	0.173	0.345	0.518	0.690	0.863	1.035	1.208	1.381	1.553	1.726
16	0.196	0.393	0.589	0.785	0.982	1.177	1.374	1.571	1.767	1.963
17	0.222	0.443	0.665	0.887	1.108	1.330	1.552	1.773	1.995	2.217
18	0.249	0.497	0.746	0.994	1.243	1.491	1.740	1.988	2.237	2.485
20	0.307	0.614	0.920	1.227	1.534	1.841	2.148	2.545	2.761	3.068
22	0.371	0.742	1.114	1.485	1.856	2.227	2.559	2.970	3.341	3.712
24	0.442	0.884	1.325	1.767	2.209	2.651	3.093	3.534	3.976	4.418
26	0.519	1.037	1.557	-	-	-	-	-	-	-
28	0.601	1.203	-	-	-	-	-	-	-	-
30	0.690	1.381	-	-	-	-	-	-	-	-
1"	0.785	1.571	-	-	-	-	-	-	-	-
1 1/8"	0.994	-	-	-	-	-	-	-	-	-
1 1/4"	1.227	-	-	-	-	-	-	-	-	-

## Example:

Total Area for:

$$\begin{aligned} 5 \text{ of } \#14 \text{ nozzles} &= \\ 0.752 \text{ in}^2 & \end{aligned}$$

$$\begin{aligned} 3 \text{ of } \#7 \text{ nozzles} + 2 \text{ of } \#8 \text{ nozzles} &= \\ 0.113 + 0.098 &= \\ 0.211 \text{ in}^2 & \end{aligned}$$