NOZZLE SIZE	NUMBER OF NOZZLES and Total Flow Area – in^2									
IN.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
7/32	0.0376	0.0752	0.1127	0.1503	0.1879	0.2255	0.2631	0.3007	0.3382	0.3758
8/32	0.0491	0.0982	0.1473	0.1963	0.2454	0.2945	0.3436	0.3927	0.4418	0.4909
9/32	0.0621	0.1243	0.1864	0.2485	0.3106	0.3728	0.4349	0.4970	0.5591	0.6213
10/32	0.0767	0.1534	0.2301	0.3068	0.3835	0.4602	0.5369	0.6136	0.6903	0.7670
11/32	0.0928	0.1856	0.2784	0.3712	0.4640	0.5568	0.6496	0.7424	0.8353	0.9281
12/32	0.1104	0.2209	0.3313	0.4418	0.5522	0.6627	0.7731	0.8836	0.9940	1.1045
13/32	0.1296	0.2592	0.3889	0.5185	0.6481	0.7777	0.9073	1.0370	1.1666	1.2962
14/32	0.1503	0.3007	0.4510	0.6013	0.7517	0.9020	1.0523	1.2026	1.3530	1.5033
15/32	0.1726	0.3451	0.5177	0.6903	0.8629	1.0354	1.2080	1.3806	1.5532	1.7257
16/32	0.1963	0.3927	0.5890	0.7854	0.9817	1.1781	1.3744	1.5708	1.7671	1.9635
17/32	0.2217	0.4433	0.6650	0.8866	1.1083	1.3300	1.5516	1.7733	1.9949	2.2166
18/32	0.2485	0.4970	0.7455	0.9940	1.2425	1.4910	1.7395	1.9880	2.2365	2.4850
19/32	0.2769	0.5538	0.8307	1.1075	1.3844	1.6613	1.9382	2.2151	2.4920	2.7688
20/32	0.3068	0.6136	0.9204	1.2272	1.5340	1.8408	2.1476	2.4544	2.7612	3.0680
21/32	0.3382	0.6765	1.0147	1.3530	1.6912	2.0295	2.3677	2.7059	3.0442	3.3824
22/32	0.3712	0.7424	1.1137	1.4849	1.8561	2.2273	2.5986	2.9698	3.3410	3.7122
24/32	0.4418	0.8836	1.3254	1.7671	2.2089	2.6507	3.0925	3.5343	3.9761	4.4179
26/32	0.5185	1.0370	1.5555	2.0739	2.5924	3.1109	3.6294	4.1479	4.6664	5.1849
28/32	0.6013	1.2026	1.8040	2.4053	3.0066	3.6079	4.2092	4.8106	5.4119	6.0132

Drill bit Hydraulic Formulae

Hydraulic Calculations:

Annular Velocity:

$$V_A = \frac{24.5\ Q}{d_h^2 - d_s^2}$$

Surface Equipment Pressure Losses:

$$\Delta P = c\rho \times (Q/100)^{1.86}$$

Drill Stem Bore Pressure Losses:

$$\Delta P = \frac{6.1 \times 10^{-5}\ \rho L Q^{1.86}}{d_i^{4.86}}$$

Jet Nozzle Pressure Losses:

$$\Delta P = \frac{\rho Q^2}{10858\ A_N}$$

Annular Pressure Losses:

$$\Delta P = \frac{(1.4327 \times 10^7)\rho L V^2}{d_h - d_s}$$

Jet Velocity:

$$V_N = \frac{0.32086\ Q}{A_N}$$

Jet Impact Force:

$$I_N = 5.16 \times 10^{-4}\ \rho Q V_N$$

Hydraulic Horsepower:

$$H_{hp} = \frac{PQ}{1714}$$

Nomenclature:

V_A ... Annular Velocity [ft / min]
Q ... Circulation Rate [gpm]
d_h ... Borehole Diameter [in]
d_s ... Drill String Outer Diameter [in]
d_i ... Drill Stem Inner Diameter [in]
ρ ... Mud Weight [lb / gal]
c ... Friction Factor
P ... Pressure [psi]
ΔP ... Pressure Drop [psi]
L ... Length [ft]
A_N ... Nozzle Area [in^2]
V_N ... Jet Velocity [ft / sec]
I_N ... Jet Impact Force [lbf]
H_{hp} ... Hydraulic Horsepower [hp]