# Total Flow Area

## Reference

| Nozzle Total Flow Area (TFA) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| # of Nozzles<br>Nozzle Size | M | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 8 | 0.0490 | 0.0981 | 0.1472 | 0.1963 | 0.2454 | 0.2945 | 0.3436 | 0.3926 | 0.4417 | 0.4908 |
| 9 | 0.0621 | 0.1242 | 0.1863 | 0.2485 | 0.3106 | 0.3727 | 0.4348 | 0.4970 | 0.5591 | 0.6212 |
| 10 | 0.0766 | 0.1533 | 0.2300 | 0.3067 | 0.3854 | 0.4601 | 0.5368 | 0.6135 | 0.6902 | 0.7669 |
| 11 | 0.0928 | 0.1856 | 0.2784 | 0.3712 | 0.4640 | 0.5568 | 0.6496 | 0.7424 | 0.8352 | 0.9280 |
| 12 | 0.1104 | 0.2208 | 0.3313 | 0.4417 | 0.5522 | 0.6626 | 0.7731 | 0.8835 | 0.9940 | 1.1044 |
| 13 | 0.1296 | 0.2592 | 0.3888 | 0.5184 | 0.6481 | 0.7777 | 0.9073 | 1.0369 | 1.1665 | 1.2962 |
| 14 | 0.1503 | 0.3006 | 0.4509 | 0.6013 | 0.7516 | 0.9019 | 1.0523 | 1.2026 | 1.3529 | 1.5032 |
| 15 | 0.1725 | 0.3451 | 0.5177 | 0.6902 | 0.8628 | 1.0354 | 1.2080 | 1.3805 | 1.5531 | 1.7257 |
| 16 | 0.1963 | 0.3926 | 0.5890 | 0.7853 | 0.9817 | 1.1780 | 1.3744 | 1.5707 | 1.7671 | 1.9634 |
| 18 | 0.2485 | 0.4970 | 0.7455 | 0.9940 | 1.2425 | 1.4910 | 1.7395 | 1.9880 | 2.2365 | 2.4850 |
| 20 | 0.3067 | 0.6135 | 0.9203 | 1.2271 | 1.5339 | 1.8407 | 2.1475 | 2.4543 | 2.7611 | 3.0679 |
| 22 | 0.3712 | 0.7424 | 1.1136 | 1.4848 | 1.8561 | 2.2273 | 2.5985 | 2.9697 | 3.3410 | 3.7122 |
| 24 | 0.4417 | 0.8835 | 1.3253 | 1.7671 | 2.2089 | 2.6507 | 3.0925 | 3.5342 | 3.9760 | 4.4178 |

Total Flow Area (TFA) is summation of nozzle areas which fluid can pass through. When you consider about the TFA, you need to count all nozzles that you have in a bit or a reamer.
Basically, you can determine flow area with a simple circle area formula.

Flow Area = $(\pi \times D^2)/4$

Where;
Area in square inch
π is a constant which approximately equates to 3.14159.
D is diameter in inch

Let's make it easier for our life. Normally, a diameter of nozzle is reported in xx/32 inch. For example, a bit has 3 nozzles and each one of them has size of 20/32 inch.
The formula above can be simplified like this.

Flow Area = $(N^2) / 1303.8$

Where;
Area in square inch
N is nozzle size in number/32 inch.

For instant, you use a bit that has a total of 5 nozzles. Three nozzles have a diameter of 10/32 inch and other 2 nozzles are 12/32 inch diameter. Determine the total flow area (TFA) of the bit.

By the definition, you must sum every nozzle together in order to get the TFA; therefore, you can apply the formula above into this form.

Total Flow Area = $(10^2 + 10^2 + 10^2 + 12^2 + 12^2) / 1303.8 = 0.451$ inch$^2$

Total flow area = 0.451 square inch

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