Nozzle & Choke Comparison

Quick Calculation Method

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Total Flow Area

- The amount of flow through the bit is dependant on the total flow area (TFA)
- The TFA is the sum of the individual cross-sectional areas of the bit nozzles
- The TFA is $\sum(\pi r^2)_1+(\pi r^2)_2 \ldots+(\pi r^2)_n$ where r is the radius of each nozzle and n is the total number of nozzles

Nozzle & Choke Measurement

- Bit Nozzles are measured in 1/32 of an inch, i.e. a 20 nozzle is 20/32 inch in diameter
- Chokes are measured in 1/64 of an inch, i.e. a 32 choke is 32/64 inch in diameter
- The same flow comparison calculations apply to both

Derivation

- Flow is directly proportional to total flow area
- The flow area of Nozzle A compared to Nozzle B is expressed as:
  - $\pi(.5D_A)^2/\pi(.5D_B)^2$
  - Simplifying yields D_A^2/ D_B^2
  - Since the denominators for both nozzles are the same, they cancel out

Conclusion

- The square of the nominal diameter of a single nozzle is proportional to the square of the nominal diameter of a second nozzle
- Comparison of predicated flow change is good only for the case of all nozzles of the same nominal diameter, otherwise TFA must be figured in the normal manner

Example

- A bit dressed with three 22 jets replaces a bit with three 20 jets. How much more flow can be expected?
- $22^2/20^2=1.21$
- 21% more flow can be expected from the 22 jets with the same standpipe pressure
- Of course, pump SPM must be raised accordingly

Example 2

- A bit dressed with six 12 jets is replaced by a bit with six 10 jets
- $10^2/12^2=.69$
- The TFA of the second bit is 69% that of the first bit

Example 3

- The same comparison is true for positive chokes
- A well is flowing through a 32/64 choke. What choke should be used to cut the flow down by about half?
- $x^2/32^2=.50$
- So $x=\sqrt{(.50*32^2)}$
- And x=22.6
- Use a 22/64 choke