

# Controlling the Variables for Quality Perforations and Uniform Fracking

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The consistent quality and size of perforations play an essential role in the success of fracking operations. Consistently sized perforations that meet specified diameters provide for a uniform pressure drop throughout a stage, leading to an efficient and effective fracking process.


However, this necessary level of quality and consistent holes can only be achieved if variables that impact perforating performance are optimally controlled.

Today, SWM Technology's breakthrough PerfAlign+™ Self-Orienting Perforating System (combining the proven PerfAlign™ Self-Orienting Gun and AdvancedAlign™ self-orienting charges) is the industry's leading tool for controlling the variables associated with perforating. This proven system dominates the industry by delivering high-quality, consistently sized holes in thousands of perforating operations. The success of this system is validated by the fact that SWM has sold more than 800,000 PerfAlign guns.

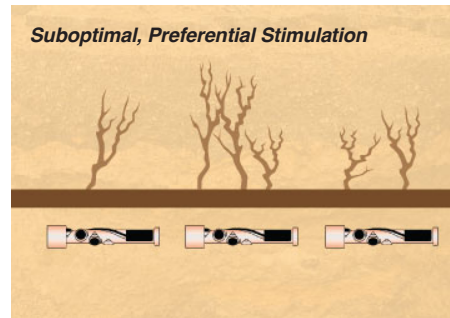
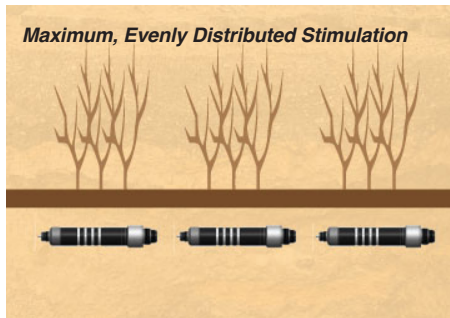
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## **Variable #1 – Hole Size**

Consistent hole diameters are a key factor contributing to uniform pressure across all perforations during fracking. The proven accuracy of the PerfAlign Self-Orienting gun provides industry-leading control of the variables that impact hole size, leading to high-value perforating.

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The left diagram below illustrates how consistent hole diameters allow fracking stimulants to be evenly distributed throughout a stage. By contrast, the presence of varying hole sizes, as illustrated in the right diagram, results in uneven distribution of fluids and proppants.



## Variable #1 – Hole Quality

SWM’s AdvancedAlign Shaped Charges, designed specifically for self-orienting perforating, provide a second level of hole quality. These charges create “burr-free” perforations, so each hole in a stage presents a consistent coefficient of friction. Maintaining this level of consistency of friction across all holes further contributes to fluids and proppants being uniformly distributed throughout a stage.



## Controlling the Variables for Even Distribution of Fluids and Proppants

The importance of consistently sized, “burr-free” perforations is further confirmed when one considers the formula for pressure drop across a stage:

$$\Delta P_p = \frac{0.2369 \times Q^2 \times \rho}{C_d^2 \times N^2 \times D^4}$$

$\Delta P_p$  = pressure drop

Q = injection rate, bbl/min

$\rho$  = fluid or slurry density, LBM/gal

$C_d$  = discharge coefficient

N = number of perforations

D = orifice or perforation diameter, in.

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The importance of consistent hole diameters. Using the formula for pressure drop above, the hole diameter, “D,” is a critical element of the denominator of this equation. Since “D’s” value is to the 4th power, the consistent or inconsistent diameter of the perforations is obviously a significant factor in the level of pressure drop across each hole in a stage, impacting the efficiency of the fracking operation. If “D” is constant, pressure from hole to hole will be similarly consistent. By contrast, an inconsistent “D” will result in wide-ranging fracking pressures in a stage.

The importance of “burr-free” holes.  $C_d$ , the discharge coefficient, is influenced by the burrs surrounding the perforation, so their impact on the consistency of perforations is significant. Since AdvancedAlign charges create “burr-free” perforations, the coefficient of friction variable remains constant over all perforations, and the fluids and proppants can be uniformly distributed throughout the stage.

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### **More Information and a Deep Dive Into This Subject**

Please let us know if you would like to discuss the science behind the information included in this whitepaper. We encourage you to join us in a discussion of hole consistency and quality.

**Please visit [www.swmtx.com](http://www.swmtx.com), call 877-665-8747, or email us at [sales@swmtx.com](mailto:sales@swmtx.com).**

