

# Measuring Shaped Charge Gun Performance Update – July 2004

## Target Consistency – Does 19B Pass or Fail?

In June 2003, Titan released a “white paper” reviewing target consistency issues that have been raised by a major shaped charge manufacturer on the API SC 19 Subcommittee on Perforating. The API Workgroup investigating the matter is currently reviewing the issues raised, and has not yet drawn conclusions or issued a report. While the issue is still under investigation by the Workgroup, an oil company concrete specialist has stated during API meetings that “we are doing everything wrong” and that the 19B concrete specification allowed too much variation. The 19B target was intended to improve target consistency and accuracy over the earlier API RP-43 Fifth Edition Section 1 target. Titan has analyzed 19B Registered data available on the API website. That analysis revealed what appear to be significant consistency problems with the 19B target (such as penetration decreasing from the top to the bottom of the target, and large compressive strength variations in the targets), increasing our concern about the issues raised in API Subcommittee. Others have done similar analysis. Some agree with our conclusions, and some do not. At this time there is no consensus.

Target to Target Penetration Comparison		
	Max. difference	Average difference
Titan 19B to 19B	29%	9%
Titan 5 <sup>th</sup> to 5 <sup>th</sup>	4%	2%
Titan 19B to 5 <sup>th</sup>	38% loss	24% loss
SC Mfg. 19B to 5 <sup>th</sup>	24% loss	18% loss
API Subcommittee Test Program 19B to 5 <sup>th</sup>	13% loss to 7% gain (23% range)	4% loss

Titan has also analyzed data from over 50 Titan 19B tests. We have experienced large target to target penetration variations that are indicative of target consistency problems (see Table above). Results of similar comparisons in RP-43 5<sup>th</sup> Edition targets yielded very consistent results. Titan tests comparing penetration in 19B targets to 5<sup>th</sup> Edition targets revealed a number of instances in which penetration losses were significantly larger than predicted by the original API Subcommittee Test Program. Comparable data provided to Titan by another major shaped charge manufacturer showed variations similar to Titan’s. Obviously to make up for this unexpectedly large loss of penetration, shaped charge manufacturers would have to redesign their shaped charges to optimize them in this unrealistically soft target. Potentially, this would sacrifice performance in true downhole conditions.

### **Time to Move On to a More Representative Target**

Even if the consistency questions are resolved, Titan remains concerned about the overall applicability of 19B data. Whether they believe that 19B data is valid or not, most in the industry agree that 19B data is not representative of results in downhole conditions. With widespread lack of confidence in the usefulness of the data in the real downhole world, we wonder if the data actually misleads more than it helps.

Titan has maintained its policy of not Registering or releasing 19B data. We strongly support those who believe that 19B is not representative of any actual formation or downhole condition. We agree that shaped charges designed in 19B targets yield misleading results, producing unrealistically large numbers that have no scientific basis and are only useful for marketing purposes. Instead, we have maintained our RP 43 Fifth Edition data, while increasing our effort to develop targetry that is representative of the real downhole world.



## ***The Ideal Target***

For a target and test configuration to be useful for evaluation of perforating systems, it needs to meet seven key criteria.

1. The test must evaluate the entire gun system, not just a single shaped charge.
2. The target must be simple, and easy to characterize.
3. The target and test must provide consistent, repeatable performance results anywhere in the world at any time of the year.
4. The target and test must provide results that are representative of real downhole formations. Evaluation should be equivalent to testing in mid-range formation strength, not very soft or very hard.
5. The procedure must address production quality, and make it easy to tie production performance to API certified performance as well as performance in the downhole environment.
6. The procedure must provide an easy, quick and believable means for customers to audit either production performance or API certified performance.
7. The target and test must be cost effective, and affordable for routine use.

Within the industry, perforator evaluation has been done in steel, concrete, rock, synthetic rock and aluminum. Steel has been deemed by the industry as not representative of real downhole formations because it is too hard. Similarly, concrete is too soft to be representative. Rock can be representative, but is difficult to characterize, generally inconsistent, and difficult to use in a shaped charge production environment. While these complicated problems can be addressed, it would still be difficult to use in an audit environment, and is not affordable for routine use. Synthetic rock has not been proven to be consistent. In studying the options, aluminum has the best potential for providing a target that meets the required criteria. Aluminum has been used to some extent by nearly all shaped charge manufacturers at some time. Recently, a technical paper proposed it for use as an alternate API target (SPE 67955, Bell et al, *Measuring Shaped Charge Gun Performance — an Alternate API Section 1 Target*, available on the Titan website at [www.titanspecialties.com](http://www.titanspecialties.com)). Of the available options, aluminum appears to be the only one with the potential to meet all of the criteria.

## ***The Ideal Target – Finding a Solution***

While continuing perforator certification in API RP-43 Fifth Edition targets and using concrete sonotube targets for production quality control, Titan is continuing its search for targets that meet the criteria of the “Ideal Target.” Of targets available to the industry, clearly aluminum appears to have the best potential. The above referenced technical paper provides strong scientific basis for use of the target. Titan is in the midst of a test program designed to expand the target’s scientific basis. This testing will refine the manufacturing quality control technique, as well as the tie of daily manufacturing performance to performance in real downhole rock. While focusing our effort on the target with the best potential (aluminum), we are not locked into one target or idea. Our goal is to provide meaningful performance data at an affordable cost.

## ***Contact Us For More Information***

Titan is very interested in discussing API RP 19B, and performance evaluation in general, with any interested party. We have a Power Point presentation with more detailed data. If you would like to discuss these issues further, please contact either Girven Kissell (800-320-5110) or Tim Golian (713-870-1760), or visit the Titan website at [www.titanspecialties.com](http://www.titanspecialties.com).

