

# Tools, components, and industry usage

*Brent Kirschner, Owen Oil Tools*

The StimGun family of products currently consists of three unique tool configurations – the StimGun™ assembly, the StimTube™ tool and the Well Stimulation Tool (WST). These three products allow for maximum stimulation design flexibility for a wide range of well configurations. With each of these products, production/injection enhancement is accomplished through perforation breakdown and near-wellbore stimulation.

The StimGun technology is best understood as an engineered job design process that integrates the use of the products with PulsFrac™ computer modeling and data acquisition using the high-speed gauge. Unlike approaches used by others, the StimGun technology takes into account well fluids, well mechanicals, and rock properties to select the optimum tool for each specific application.

## StimGun family of products



**StimGun™ assembly**



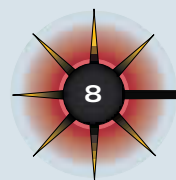
**StimTube™ tool**



**Well stimulation tool (WST) and hardware**



**High-speed/high-shock downhole memory gauge**





## The StimGun™ assembly

The StimGun™ assembly has two major components – a conventional hollow steel perforating gun and a sleeve of special propellant material surrounding the gun. The perforating gun is fired in the wellbore as normal, and as a result of the perforating process the sleeve is ignited. The sleeve, which is a proprietary oxidizer, and binder combination burns quickly and produces a burst of high-pressure gas. This high-pressure gas enters the perforation and creates fractures resulting in an improved flow path from the formation to the wellbore. The sleeves are available for hollow carrier

perforating gun systems from 2 $\frac{3}{8}$  in. (60.3 mm) through 7 in. (177.8 mm) outer diameter (OD). The StimGun™ assembly can be lowered into the well on wireline, tubing or drill pipe, or with coiled tubing.

## Industry Usage

As of December 2001, over 30,000 ft (9140 m) of the StimGun™ assembly have been run. This represents thousands of successful completions. These include onshore-offshore oil, gas, and injector wells around the world. The StimGun™ assembly is a field-proven method of perforating and stimulating in one run.

## StimGun™ assembly components



**Propellant sleeve** – Cast tube of a proprietary oxidizer/resin binder material, similar in appearance to plastic pipe, that simply slides over the perforating guns. The “propellant-like” material (actually classified as an oxidizer) is ignited by the perforating events. Usually a minimum of four shots per foot is required to adequately ignite the sleeve. However, 6 spf (20 spm) are generally recommended. Maximum temperature rating is 330°F (160°C). The sleeves are impervious to all current well fluids.



**Centralizing rings** – Used to position and secure the sleeves to the outside of the perforating gun. In addition to securing the sleeves, the rings are available over-sized (typically sleeve OD +  $\frac{1}{4}$ "/6.4 mm) to protect the sleeves from contact with the casing.

**Finned tandem/bull nose subs** – Subs centralize the assembly and protect the sleeves – while resulting in minimum flow restriction. Typically gun OD +  $\frac{1}{2}$ " (12.7 mm)



**Perforating guns** – Typically hollow steel carrier guns are recommended. Sleeves are currently available for the following gun OD sizes: 2 $\frac{3}{8}$ ", 2 $\frac{1}{2}$ ", 2 $\frac{3}{4}$ ", 2 $\frac{7}{8}$ ", 3", 3 $\frac{1}{8}$ ", 3 $\frac{1}{2}$ ", 4", 4 $\frac{1}{2}$ ", 4 $\frac{7}{8}$ ", 5 $\frac{1}{8}$ ", & 7" (60.3 mm, 63.5 mm, 69.9 mm, 73 mm, 79.4 mm, 85.7 mm, 101.6 mm, 130.2 mm & 177.8 mm).



**High-speed/high-shock downhole memory gauge** – Data acquisition at rates up to 100,000 points per second (user programmable for high, intermediate, and low speeds). Sensors available include pressure, temperature, acceleration – high-G for shock measurement and acceleration, low-G for tool velocity calculation. Maximum memory = one million data points. Sizes available (OD) = 1 $\frac{1}{16}$ " & 2" (42.9 mm & 50.8 mm). Maximum temperature rate = 255°F (125°C).



## The StimTube™ tool

The StimTube™ tool consists of a molded cylinder of propellant-like oxidizing material surrounding an internal steel support tube containing detonating cord. The StimTube™ tool provides efficient, cost effective remediation to existing perforated or open-hole intervals. The StimTube™ tool is available in a variety of sizes including 1½ in., 1⅞ in., 2 in., 2½ in., and 3 in. (38.1 mm, 42.9 mm, 50.8 mm, 63.5 mm and 76.2 mm). The StimTube™ tool is run into the wellbore, typically on wireline, and positioned across existing perforations. The conventional detonating

cord is then initiated causing the oxidizer to ignite. Similar to the StimGun™, the StimTube's proprietary propellant burns quickly and produces a burst of high-pressure gas.

## Industry Usage

As of December 2001, over 12,000 ft (3660 m) of the StimTube™ assembly have been run. Applications are primarily through-tubing pre-hydraulic fracture treatment and stimulation of damaged wells, where wellbore restrictions do not allow for the use of the StimGun™ assembly.

## StimTube™ tool components



**The StimTube™** – A cast cylindrical rod of proprietary oxidizer/resin material with an embedded steel support tube, ignited with 40 grain detonating cord. Available sizes – Outside Diameters – 1½", 1⅞", 2", 2½", and 3" (38.1 mm, 42.9 mm, 50.8 mm and 76.2 mm); lengths – 1', 2', 3', and 4' (.3 m, .6 m, .9 m and 1.2 m). Maximum temperature rating = 340°F (170°C). Impervious to all well fluids.



**Firing head** – Used to connect the detonator to the detonating cord and to connect the tools to the wireline or coiled tubing.



**Connecting subs** – Used to assemble multiple StimTube™ tools and to minimize tool contact with the casing. Generally, maximum recommended total length per run of StimTube™ tool for wireline applications is 15' (4.6 m). Longer lengths can be run on continuous tubing.



**Bull nose sub** – Used to terminate the assembly and protect the propellant and detonating cord end seal.



**High-speed/high-shock downhole memory gauge** – Typically run just below the wireline cable head.



## Well Stimulation Tool (WST)

The WST is a “stick” tool consisting of a cast cylindrical rod of a proprietary oxidizer/resin material with a central ignition system. It is primarily used in perforated or open hole wells with no inner diameter restrictions.

## Industry Usage

As of December 2001, over 15,000 ft (4570 m) of the WST has been run. This product has an extremely reliable ignition system and a verified burn repeatability. The WST is primarily used as a perforation breakdown tool and as a horizontal well stimulation tool.

## Well Stimulation Tool components



**WST available sizes** – ODs 1½", 1⅞", 2 in., 2½ in., and 3 in. (38.1 mm, 42.9 mm, 50.8 mm, 63.5 mm and 76.2 mm); lengths – 1', 2 ft, 3 ft, and 4 ft (.3 m, .6 m, .9 m and 1.2 m). It is ignited with 40, 60, or 80 grain detonating cord, however 40 is typically recommended. Maximum temperature rating – 250°F (120°C). Impervious to all well fluids except methanol.



**Steel carriers** – Similar to a spent perforating gun except with typically 24-1" holes per foot. It is available in several ODs depending the specific WST used.



**Connecting subs** – Used to assembly multiple WSTs. Generally, maximum recommended total length per run of WST for wire line applications is 12 ft (3.7 m). Lengths of over 1000 ft (305 m) can run on tubing.

**Bull nose sub** – Used to terminate the assembly.

**Firing head** – Used to connect the detonator to the detonating cord, and to connect the tools to the wire line or tubing.



**High-speed/high-shock downhole memory gauge** – Typically connected below the bull nose sub.