

MARINE SOURCES

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Index

Advanced Air Guns

G. GUN 150	p. 6
G. GUN 250	p. 8
G. GUN Parallel Cluster	p. 10

Low Frequency G. GUNs

G. GUN 380	p. 12
G. GUN 520	p. 12

Mini G. GUN	p. 14
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Controlled Bubble Air Guns

GI GUN	p. 16
Mini GI	p. 24

Watergun	p. 26
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MARINE SOURCES

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Sercel offers a wide range of powerful, reliable and compact sources to cover the entire range of surveys in any environment.

Our product line includes three separate families of guns allow the users to tune the source to their needs.

These widely used marine seismic sources were developed in the research and testing facilities of Soderia and Seismic Systems Inc., both well-known players in the marine seismic source industry with more than 30 years of design and manufacturing expertise.

Both companies - and their products - are now part of the Sercel organization. We're proud to offer our customers the latest in air and Watergun technology.



THE G. GUN

The G. GUN is easy-to-use and reliable, proven in applications all over the globe. Its compact size, strong performance and easy adaptability make it perfect for marine seismic acquisitions, crustal studies and VSP surveys.

Special features include:

- Wide range of volumes. Each gun can easily change from 25 in³ to 150 in³ by means of inexpensive plastic inserts called "Volume Reducers," then from 150 in³ to 520 in³ by changing the external body, thus retaining the same simple mechanism for the entire range.
- More power from a single gun. The G. GUN is designed to operate continuously at up to 3,000 psi (210 bars).
- High degree of repeatability. Over years of field use, the main pulse has proven steady within ± 0.30 ms.
- Inexpensive and easy to maintain.
- Safer to handle. The G. GUN can be deployed and retrieved without any air pressure.

Two main remarks can be made about the above unique features:

- The same G. GUN mechanism can be used to build any array. Since only one kind of spare has to be stored, maintenance of the array is highly simplified.
- When the air pressure is increased from 2,000 to 3,000 psi for the same gun volume, the peak-to-peak output increases by 27% while the low frequency content of the spectrum is boosted by more than 6 dB.

Higher pressure can be used to increase the array output without changing the array configuration or increasing the number of guns.

THE GI GUN

Sercel developed the GI GUN to reduce or suppress the bubble oscillations of a single air gun.

When the bubble created by the air gun reaches its maximum volume, air is injected. Depending on the characteristics of the injection, the bubble oscillations can be reshaped and reduced, or totally suppressed.

A GI GUN comprises:

- One Generator to generate the acoustic pulse;
- and one Injector to reduce / suppress the bubble oscillations created by the Generator.

The volume of the Generator can be easily changed from 25 in³ to 250 in³, and the Injector from 25 in³ to 105 in³.

Working pressure is up to 3,000 psi (210 bars).

The GI GUN is used in a wide range of applications. For example:

- One single unit - hazard surveys and high-resolution surveys.
- Small arrays of 1 to 6 GI GUN - shallow water and transition zones, arctic and antarctic surveys.
- Large arrays of 14 to 20 GI GUN - conventional and 3D deep seismic surveys.
- VSP and walkaway VSP.

The GI GUN arrays are also used:

- To generate shear waves in marine surveys;
- and for crustal studies (Monobulle Technique).

THE WATERGUN

The S15 Watergun is capable of delivering a high-frequency, bubble-free acoustic pulse perfectly suitable for very high resolution applications. Compressed air is used to propel a water jet, which creates a vacuum cavity. When the vacuum cavity implodes from the surrounding hydrostatic pressure, it emits a strong bubble-free, high-frequency signal.

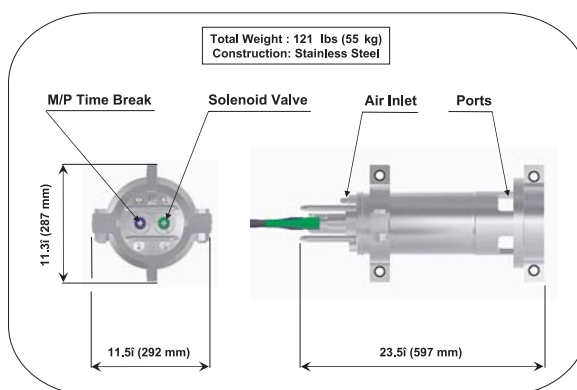
G. GUN 150

AN OPTIMIZED DESIGN

ADVANTAGES

- Smaller and lighter.
- Fewer parts - 40% less than the simplest available air gun.
- Assembly / Disassembly within minutes without special tooling or torque bench.
- A single gun allows a wide range of volumes from 25 up to 150 in³.
- SAFER - the G. GUN can be deployed and retrieved without air pressure.
- More powerful - the G. GUN is designed and built to operate continuously up to 3,000 psi (210 bars) air pressure.
- Higher degree of pulse repeatability - 50 μ s standard deviation.
- External time break and solenoid valve for easy service.

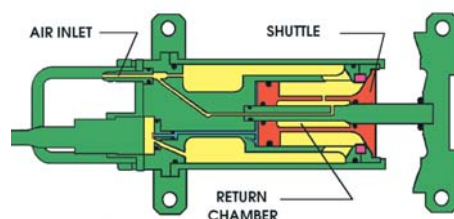
And... NO RECOIL ...



OPERATION

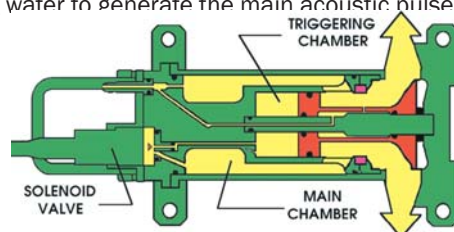
PREFIRED

Compressed air fills up the return chamber in the hollow shuttle to close and seal the main chamber. At the same time, the main chamber located between the casing and the shuttle is pressurized.



FIRED

When the solenoid valve is energized, the triggering chamber is pressurized, allowing the shuttle to unseal and the shuttle larger area to be pressurized. The lightweight shuttle quickly acquires a high velocity before uncovering the ports. High-pressure air is then explosively released into the surrounding water to generate the main acoustic pulse.

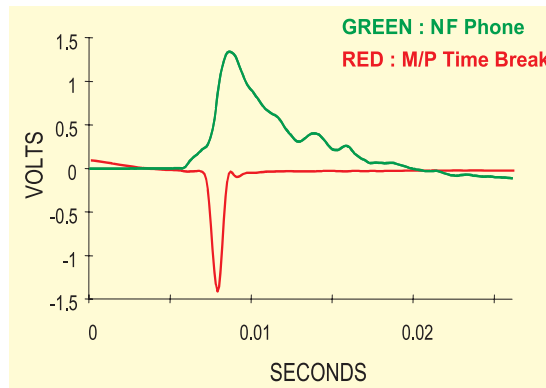


RETURN

When the pressure within the main chamber drops, the still fully pressurized return chamber returns the shuttle to its pre-fired position.

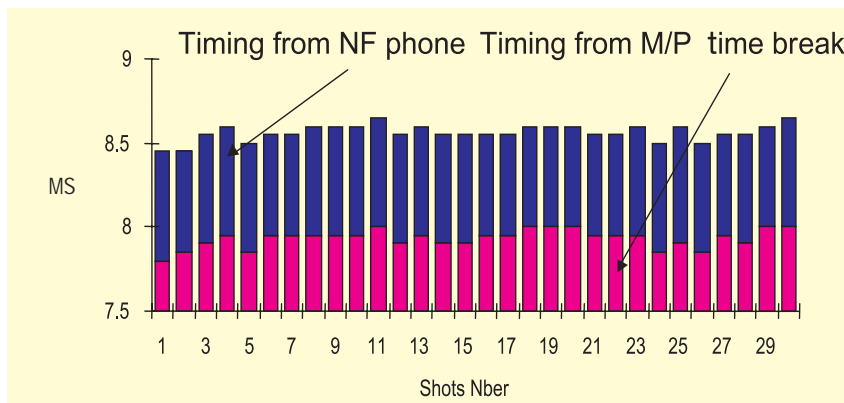
A HIGH DEGREE OF STABILITY

- Clean, consistent time break pulse easy to process
- Tightly correlated to the Near Field phone



REPEATABILITY OF PRIMARY PULSE

Standard Deviation = 50 μ s



SIZES

The volume of the G. GUN 150 can easily change from 25 in³ to 150 in³ by using volume reducers. If a larger volume is needed, then the casing has to be replaced (see G. GUN 250), but all other parts remain strictly identical. Therefore, only one type of gun is needed even for large arrays.

SAFETY

The G. GUN is deployed and retrieved without being pressurized at all. A special design allows the water that could have entered the gun to be expelled when the gun is fired.

PRESSURES

The G. GUN has been designed and tested for continuous operation at pressures up to 3,000 psi. When fired at 3,000 psi, the G. GUN will generate 50 percent more acoustic energy than when fired at the standard pressure of 2,000 psi. This gain in energy is achieved in the low frequencies of the spectrum. In other words, the total energy of a given G. GUN array can increase by 50 percent without increasing the number of guns, and/or their volume.

TIME BREAK - REPEATABILITY

An external coil, located on the gun top, generates the time break signal when the gun is actually fired. To simplify and save time, the time break assembly can be serviced without removing the G. GUN from the array. The time break accurately follows the primary pressure pulse generated by the gun, as measured on a near field hydrophone.

For instance, in a series of tests with the 150 in³ G. GUN at 2,000 psi, we recorded the following results:

- Primary on NF phone: Dispersion = ± 0.12 ms
- Standard deviation = 0.054 ms

To be compared with :

- Time break signal: Dispersion = ± 0.15 ms
- Standard deviation = 0.050 ms

Those results are typical and show the excellent repeatability of the G. GUN even over a long period of time.

RELIABILITY

The reliability of the G. GUN can be estimated at well over 250,000 shots, even at air pressures of 3,000 psi.

The gun has reached more than a half-million shots without needing service.

RECOIL

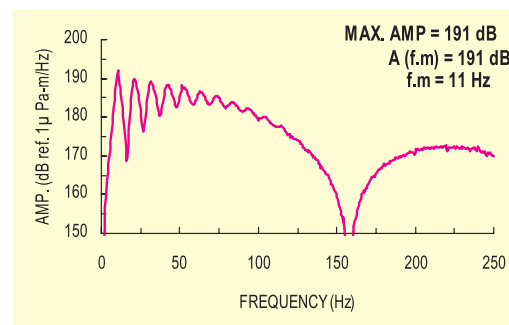
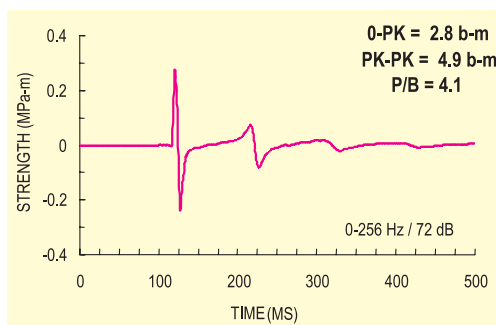
It is well known that existing Air Guns, like BOLT or SLEEVE GUN, experience powerful recoil when fired, especially when large volumes are used. Those recoils are damaging to the towing system, the umbilical connecting the guns to the vessel and to the harness which is designed to maintain the position of the gun's position. A special design allows the G. GUN to be recoilless when fired, which increases the life of the peripherals and avoids costly breakdowns.

SPECIFICATIONS

Physical G. GUN 150

- Weight : 55 kg (121 lbs.)
- Length : 597 mm (23.5 in.)
- Width : 292 mm (11.5 in.)
- Diameter : 287 mm (11.3 in.)

FAR FIELD SIGNATURE AND SPECTRUM



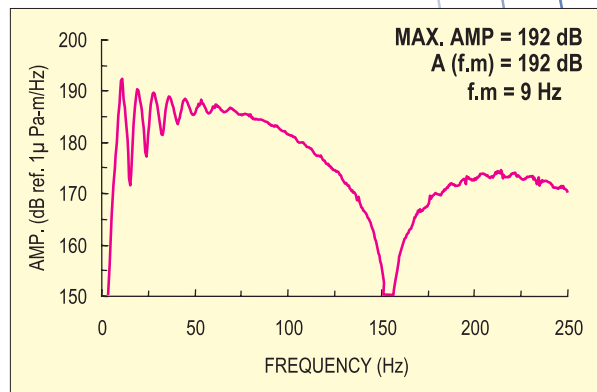
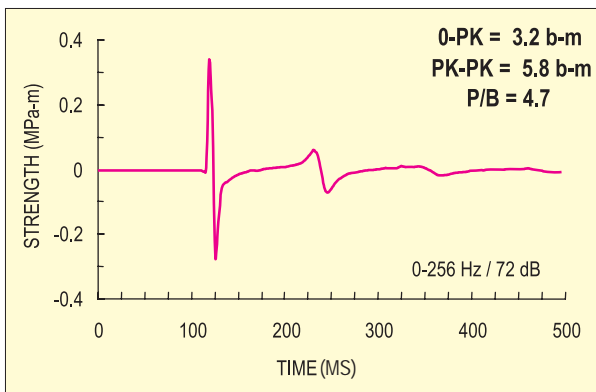
1 * G. GUN 150 in³
Pressure = 2,000 psi
Depth = 5.0 m

G. GUN 250

Just by changing the gun casing, any G. GUN can be easily retrofitted to 250 in³. Therefore, the same simple mechanism can be used on all G. GUN from 25 in³ up to 250 in³, retaining its one-of-a-kind, field-proven repeatability and reliability.

Both the peak-to-peak output and the low frequency content of the spectrum of a given air gun array, can be increased without changing the general configuration of the array or its handling / towing arrangement.

FAR FIELD SIGNATURE AND SPECTRUM



1 * G. GUN 250 in³
Pressure = 2,000 psi
Depth = 5.0 m



SPECIFICATIONS

Physical G. GUN 250

- Weight : 65 kg (143 lbs.)
- Length : 597 mm (23.5 in.)
- Width : 292 mm (11.5 in.)
- Diameter : 287 mm (11.3 in.)

G. GUN PARALLEL CLUSTER

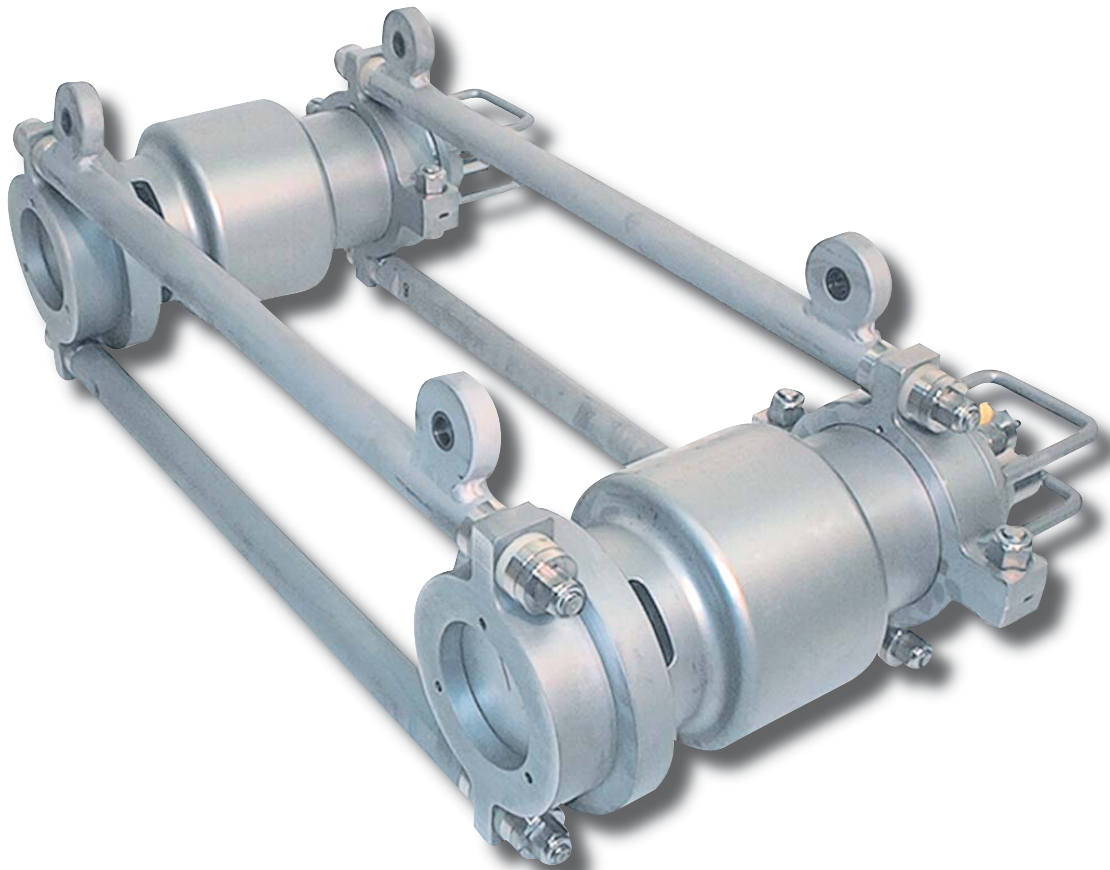
The Parallel Cluster* has been specially designed for the G. GUN to overcome the problems currently encountered by air gun cluster users, resulting in a tremendous increase in the reliability of the full array.

By maintaining the guns at a fixed predetermined separation, the Parallel Cluster guarantees the consistency of the cluster signature shot after shot. It overcomes most of the gun downtime due to broken peripherals such as air and sensor lines. It reduces wear on chain links and shackles as well as eliminates the shocks between the guns, leading to an overall drastic improvement of the array reliability.

Three gun clusters can be advantageously replaced by two G. GUN in a Parallel Cluster of the same total volume.

This has proven to be more efficient, easier to deploy and less expensive to maintain.

* U.S Patents: 5,980,148 and 6,364,569

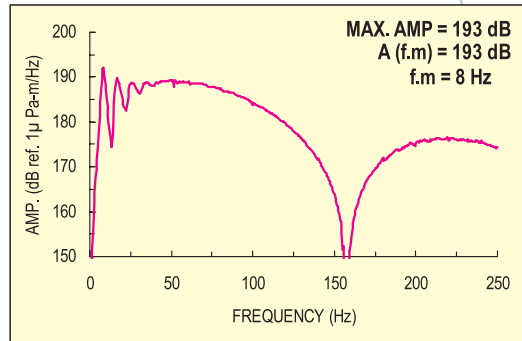
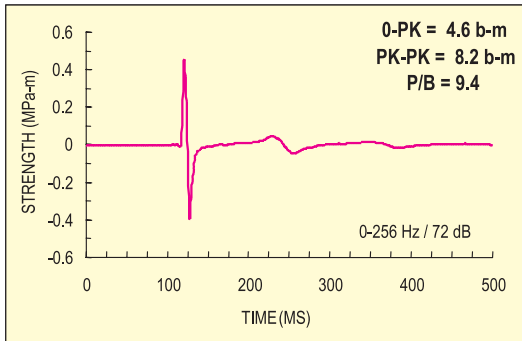


SPECIFICATIONS

Physical

- **Weight of Parallel Cluster alone** : **45 kg (99 lbs.)**
- **Lengths available** : **0.60, 0.70, 0.80, 0.90, 1.00 m**

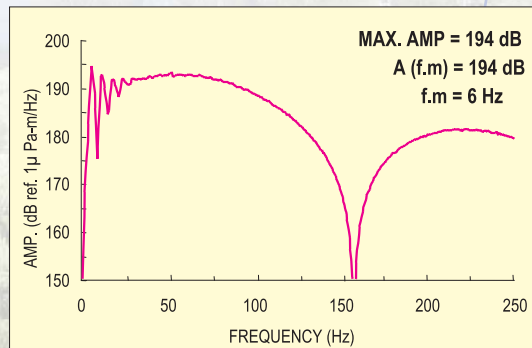
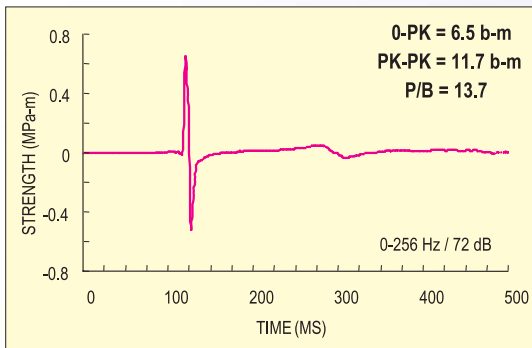
FAR FIELD SIGNATURE AND SPECTRUM



2 * G. GUN in Parallel Cluster / 300 in³

(2* 150 in³)
Pressure = 2,000 psi
Depth = 5.0 m

FAR FIELD SIGNATURE AND SPECTRUM



2 * G. GUN in Parallel Cluster / 500 in³

(2* 250 in³)
Pressure = 3,000 psi
Depth = 5.0 m

LOW FREQUENCY G. GUNS

G. GUN 380 & G. GUN 520

The renewed interest for very deep seismic and/or crustal studies has increased the demand for higher amplitude spectrum of the low frequencies - below 10 Hz - generated by the seismic sources.

This requirement points to the use of air guns with larger volumes and higher pressure.

At the same time, to avoid the lowest frequencies generated by the source to be cut off by the surface reflection or "ghost," the source should be located deep enough - between 9 m (30 ft.) and 18 m (60 ft.), for example.

For obvious practical reasons, the number of elementary sources - single air gun or cluster of guns - should be reduced to a minimum.

Based on the above considerations, the range of volumes of the G. GUN has been extended to 380 in³ (6.2 l) and 520 in³ (8.5 l).

The internal parts are the same as for the standard G. GUN, so the replacement of some standard G. GUN by large guns is straight forward: only the casings are different.

The reliability and repeatability, as well as other key features of the G. GUN remain unchanged.

The G. GUN 380 & G. GUN 520 can be used in Parallel Cluster.

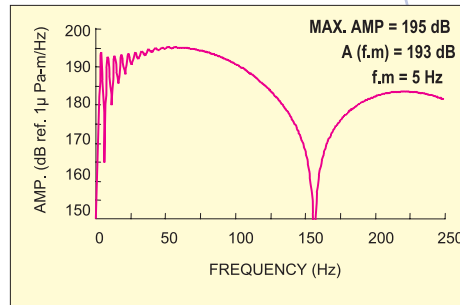
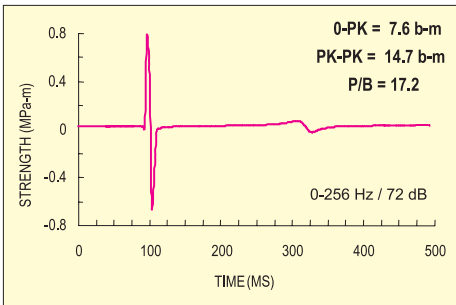


SPECIFICATIONS

Physical G. GUN 380

- Weight : 85 kg (187 lbs.)
- Length : 597 mm (23.5 in.)
- Width : 292 mm (11.5 in.)
- Diameter : 287 mm (11.3 in.)

FAR FIELD SIGNATURE AND SPECTRUM



2 * G. GUN in Parallel Cluster / 760 in³

(2*380 in³)

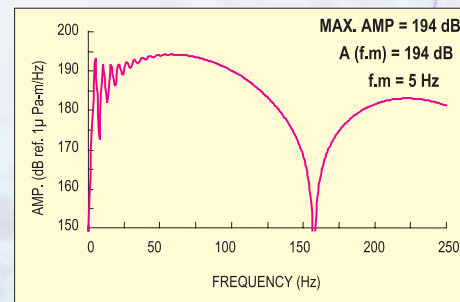
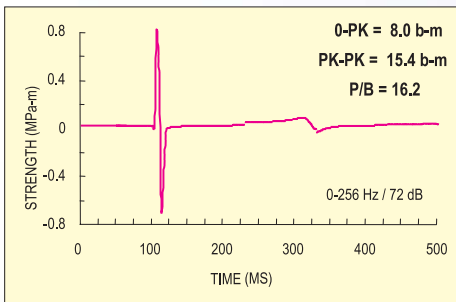
Pressure = 3,000 psi

Depth = 5.0 m

Physical G. GUN 520

- Weight : 90 kg (198 lbs.)
- Length : 597 mm (23.5 in.)
- Width : 292 mm (11.5 in.)
- Diameter : 287 mm (11.3 in.)

FAR FIELD SIGNATURE AND SPECTRUM



2 * G. GUN in Parallel Cluster / 1,040 in³

(2*520 in³)

Pressure = 3,000 psi

Depth = 5.0 meters

MINI G. GUN

Scaled down model from the already compact G. GUN, and widely used on major flag ships, the Mini G. GUN retains the same advantages as its larger counterparts, but with even simpler technology.

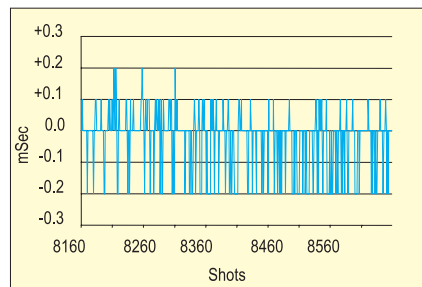
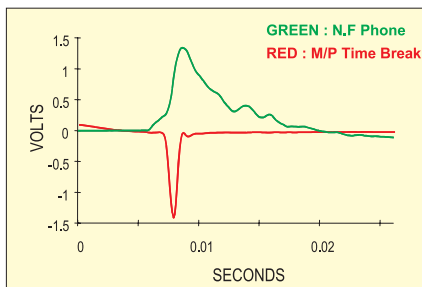
The G. GUN simplicity and reliability is now available for high-resolution, shallow-water, and transition zones surveys with the introduction of the Mini G. GUN.

The same solenoid and M/P time break ensure excellent timing with a standard deviation of 0.096 ms over 500 shots (see example below).

- One size gun for a complete range of volumes
- No RECOIL at any volume and pressure

0 to Peak of Mini G. GUN

Volume (in ³)	0-1000 Hz (b-m)	0-256 Hz (b-m)	0-1000 Hz (b-m)	0-256 Hz (b-m)
	Pressure = 2,000 psi		Pressure = 3,000 psi	
12	1.40	0.80	1.80	1.10
24	1.70	1.10	2.30	1.40
40	2.00	1.30	2.60	1.70
60	2.20	1.60	2.90	2.10



SPECIFICATIONS

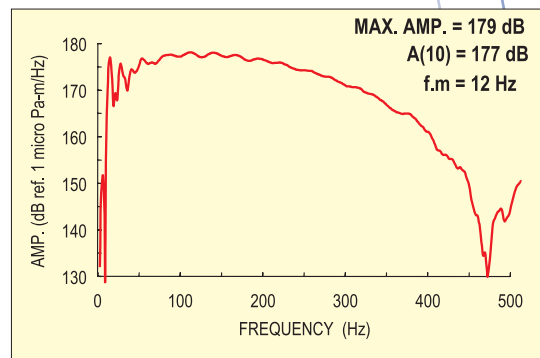
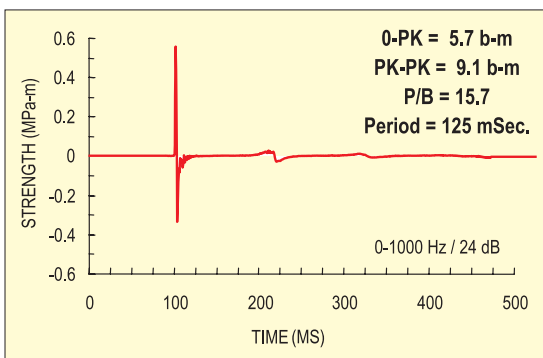
Physical Mini G. Gun

- Weight : 25 kg (55 lbs.)
- Length : 380 mm (15.0 in.)
- Width : 200 mm (7.9 in.)

Range

- Volumes : 12, 20, 24, 40 and 60 in³
- Pressure : from 1,000 to 3,000 psi

FAR FIELD SIGNATURE AND SPECTRUM



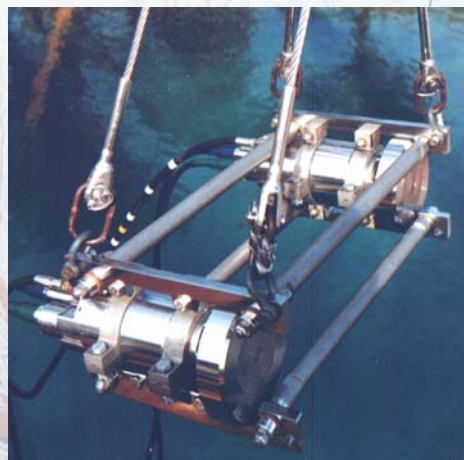
2 * Mini G. GUN in Parallel Cluster / 120 in³

(2* 60 in³)
 Pressure = 3,000 psi
 Depth = 1.5 m



Mini G.GUN

G.GUN 150



Mini G.GUN in Parallel Cluster

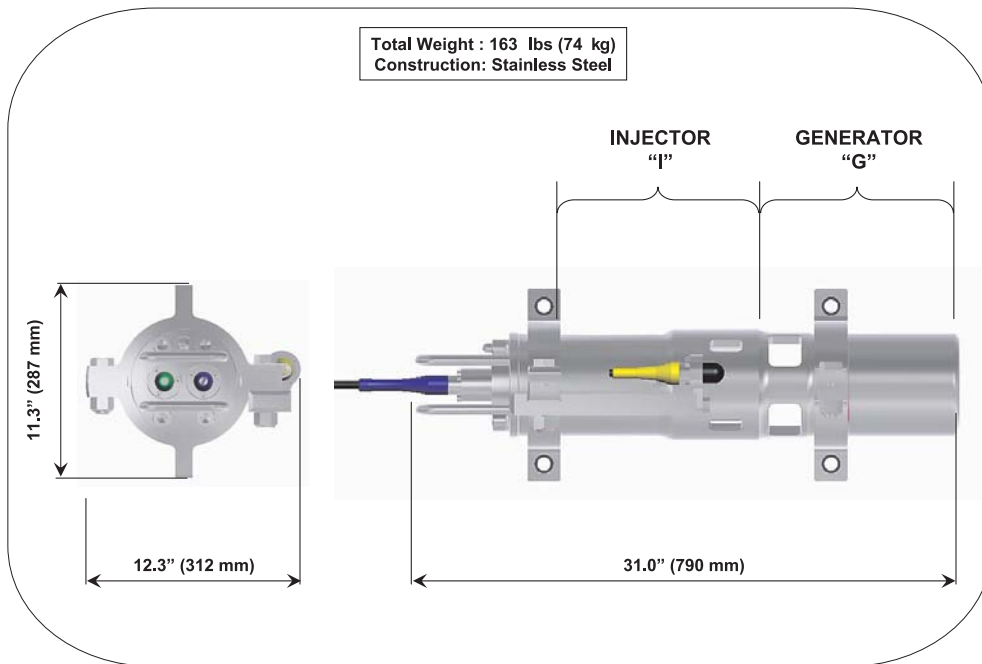
CONTROLLED BUBBLE AIR GUNS

GI GUN

The GI GUN is a pneumatic seismic source, made up of two independent air guns within the same casing, used to control and reduce bubble oscillations. The first air gun is called the Generator, as it generates the primary pulse and creates the bubbles. The second one is called the Injector, as it injects air inside the bubble.

Each gun has its own reservoir, its own shuttle, its own set of exhaust ports, and its own solenoid valve.

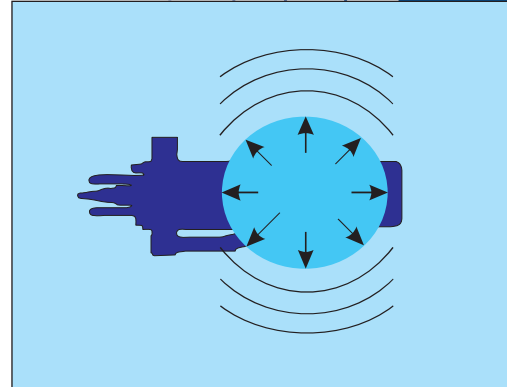
A common hydrophone provides both the time break and the shape of the near field signal. This gun phone is located inside the bubble and responds to the actual air blast of the GI GUN, without being affected by the neighboring guns.



HOW IT WORKS

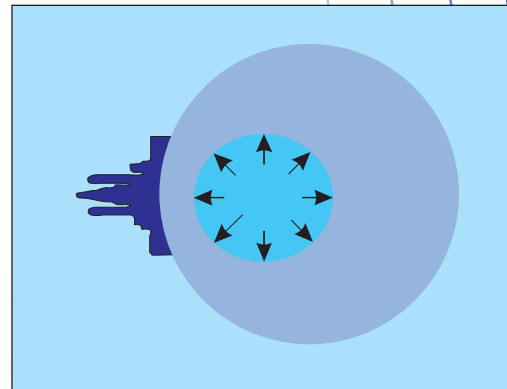
Phase 1 :

The Generator ("g") is fired. The blast of compressed air produces the primary pulse and the bubble starts to expand.



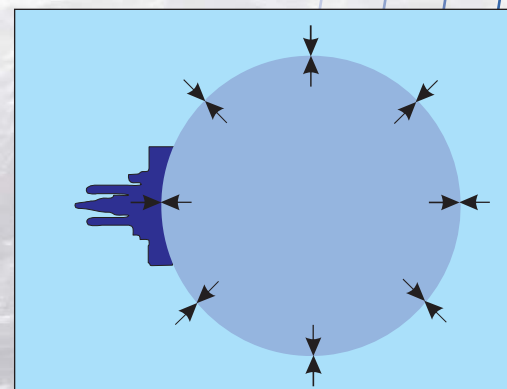
Phase 2 :

When the bubble approaches its maximum size, it encompasses the Injector ports, and its internal pressure is far below the outside hydrostatic pressure. At this time, the Injector ("I") is fired, injecting air directly inside the bubble. Due to the quasi-static state of the bubble, the timing of the Injector is not critical.



Phase 3 :

The volume of air released by the Injector increases the internal pressure of the bubble, and prevents its violent collapse. The oscillations of the bubble and the resulting secondary pressure pulses are reduced and re-shaped.



CONTROLLED BUBBLE AIR GUNS

The signature of a single GI GUN can be shaped virtually at will by adjusting:

- The volume of the Generator from 25 to 250 in³. This is achieved by means of plastic volume reducers for volumes ranging from 25 to 105 in³, and by changing the reservoir for volumes 150 and 250 in³.
- The volume of the Injector from 25 to 105 in³. This is achieved by means of plastic volume reducers.
- The time when the injection starts. This adjustment is conveniently done at the instrument room.
- The duration of the injection by means of exhaust ports reducers.

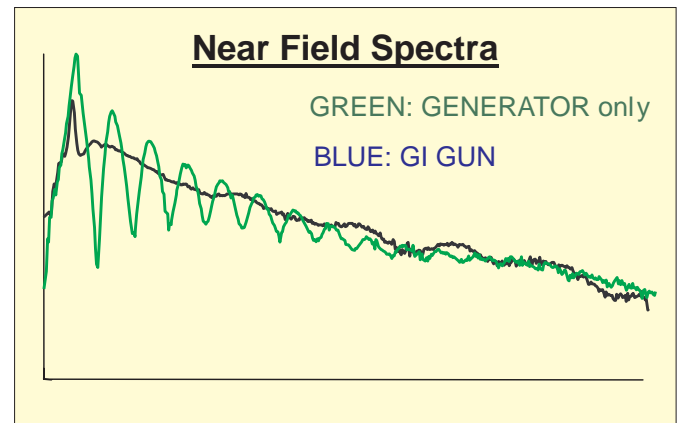
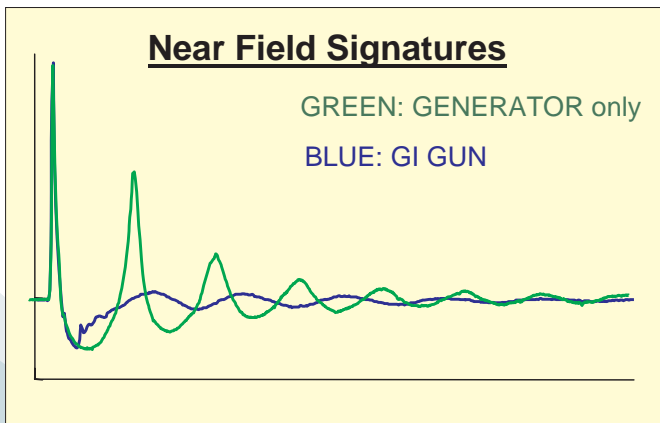
The figures below show how the near field signature and spectrum of the Generator alone (green line) is re-shaped by an optimally tuned injection (blue line). This type of setting is called “true GI mode” and results in an almost total bubble suppression of the bubble oscillation.

VERSATILITY

While the G. GUN is totally interchangeable with existing air guns in an air gun array, it can also transform easily into a GI GUN.

The shuttle assembly is the same on the G. GUN as on the GI GUN. Overall, the G. GUN and the GI GUN share 90 percent of their components. For instance, starting from two G. GUN, it is possible to build one GI GUN within minutes. The GI kit needed to transform the two G. GUN into one GI GUN includes only six parts specific to the GI GUN.

Near Field signatures and spectra comparison
(Green line : Generator alone - Blue line : true GI mode)



The graphs below illustrate the Far Field signatures generated by two different GI GUN configurations using the same volume of air (150 in³), compared to the signature of an air gun of the same volume.

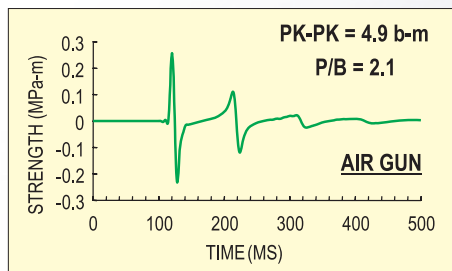
Left (a) : Typical signature of an air gun with a volume of 150 in³. The peak-to-peak output is maximum, but the primary-to-bubble ratio is poor.

Middle (b) : Signature generated by a single GI GUN where the Generator and the Injector have the same volume (75 in³), and the firing of the Injector has been delayed from the firing of the Generator by approximately half the period of the Generator fired alone. This configuration is called: “HARMONIC MODE.” Compared to the air gun, the peak-to-peak output has been reduced by 24 percent, but the primary-to-bubble ratio has been multiplied by four.

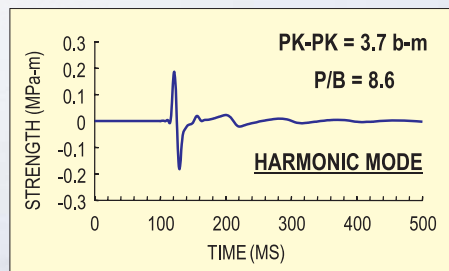
Right (c) : Signature generated by a single GI GUN used in the “true GI mode.” The Generator has a volume of 45 in³ and the Injector has a volume of 105 in³. Here too, the firing of the Injector has been delayed by about half the time of the Generator fired alone.

Compared to the air gun, the peak-to-peak output has been reduced by 40 percent, but the primary-to-bubble ratio has been multiplied by nearly seven, thus reaching almost 14 with one single gun.

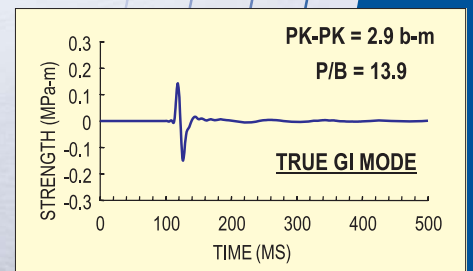
a) AIR GUN
Volume = 150 in³



b) GI GUN “HARMONIC MODE”
Generator = 75 in³
Injector = 75 in³ - Delayed



c) GI GUN “TRUE GI MODE”
Generator = 45 in³
Injector = 105 in³ - Delayed



FAR FIELD SIGNATURE COMPARISON WITH SAME TOTAL VOLUME (150 in³)
Pressure = 2,000 psi - Depth = 6.0 m - Filtered DFS 0 -256 Hz 72 dB/o

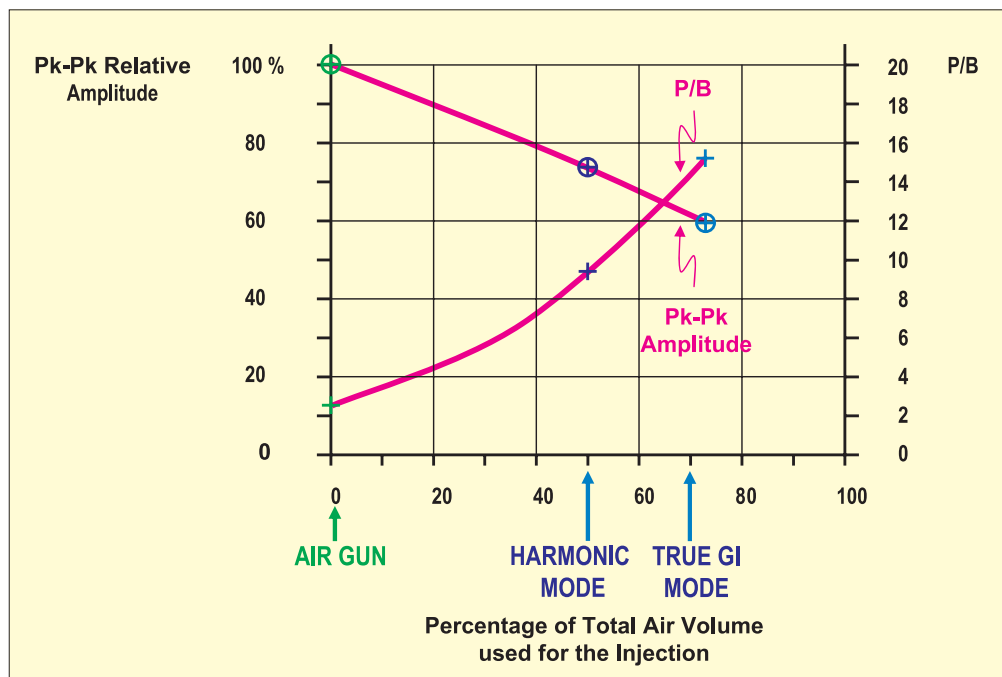
CONTROLLED BUBBLE AIR GUNS

The following figure, demonstrates the variations of both the peak-to-peak output and the primary-to-bubble ratio when the percentage of the total volume used for the injection increases (the total volume being constant - 150 in³).

The peak-to-peak amplitude is plotted as a percentage of its maximum value, when all the air is used in the Generator and no injection is made (air gun). The results given in the previous pages are plotted on the curve.

Again, the results have been obtained using a single GI GUN, and demonstrate the great flexibility (versatility) of the GI GUN, allowing the user to select the characteristics of the signature without having to change the source.

Variations of peak-to-peak
relative amplitude and P/B ratio versus
the percentage of total volume used for the injection



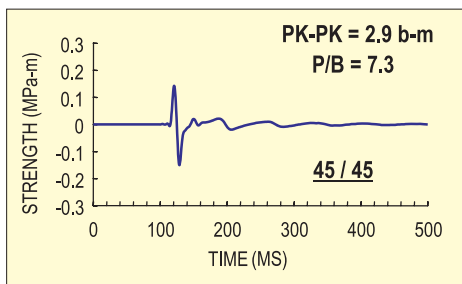
When the Injector has about the same volume as the Generator, the oscillation of the bubble created:

- is re-shaped into a smooth quasi-harmonic oscillation;
- its amplitude is reduced, and the primary-to-bubble increases between seven and 10 or more.

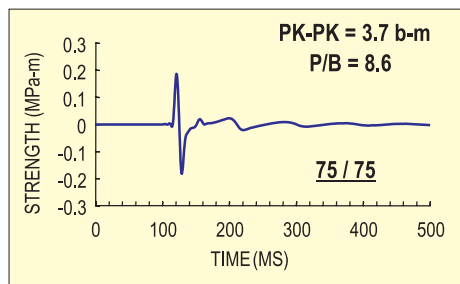
Below are three different harmonic mode far field signatures from a single GI GUN using three different volumes: 90 in³, 150 in³ and 210 in³.

GI GUN HARMONIC MODE - 3 BASIC VOLUMES

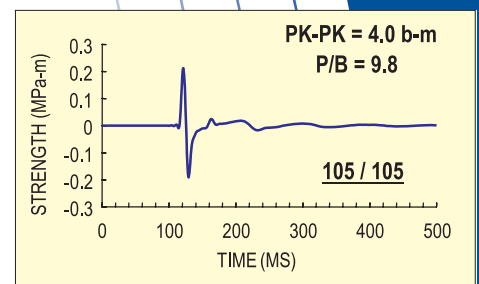
Pressure = 2,000 psi - Depth = 6.0 m - Filtered DFS 0-256 Hz 72 dB/o



GI GUN 90 in³
G = 45 in³
I = 45 in³ - Delayed



GI GUN 150 in³
G = 75 in³
I = 75 in³ - Delayed



GI GUN 210 in³
G = 105 in³
I = 105 in³ - Delayed

The signature of a single GI GUN in harmonic mode is similar to the signature generated by a two air gun cluster, so that two independent and identical GI GUN compare favorably with a two air gun cluster of the same total volume.

For instance, a two air gun cluster with a total volume of 300 in³ (2 * 150 in³) gives an output peak-to-peak (DFS 0-128 Hz) = 6.9 bar-meter and a primary-to-bubble ratio of 7.7. While two independent GI GUN in harmonic mode, 150 in³ each, give an output peak-to-peak (DFS 0-128 Hz) = 7.4 bar-meter and a primary-to-bubble ratio of 8.6.

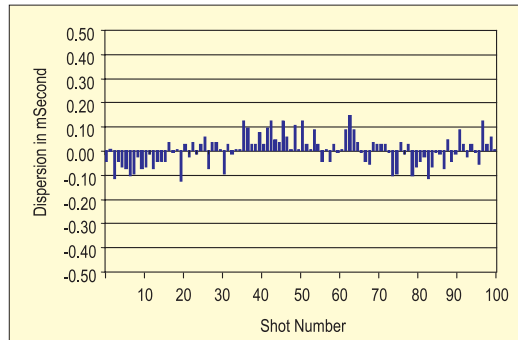
But, unlike the air gun cluster, the signature produced by the two GI GUN, is not sensitive to its separation or actual firing depths, so that in operation, the signature stability is far better.

In addition, the smooth harmonic oscillation allows a sub-array of just two GI GUN with different volumes, so that the primaries add up. And, the final oscillation is further reduced by destructive interference and therefore, the primary-to-bubble ratio can reach a value of 14 with only two guns. This can be seen when adding the signature of one GI GUN 90 in³ (left) with the signature of one GI GUN 210 in³ (right). This leads to a two GI GUN 300 in³ sub-array that will be described next, and that could be the building block for larger, more powerful arrays.

REPEATABILITY

The figure below shows the timing dispersion of 100 consecutive shots emitted by the Generator of the GI GUN with a volume of 45 in³, recorded through a near field hydrophone located one meter below the gun.

- The dispersion of ± 0.14 ms has been confirmed in operation involving a large number of guns
- Repeatability on Generator 45 in³ of GI GUN - 100 SHOTS



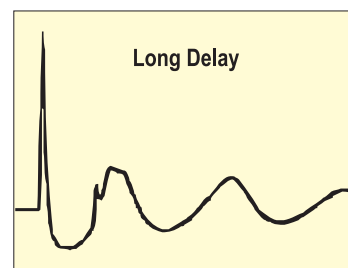
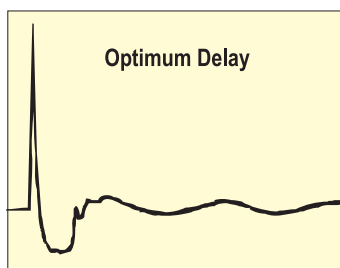
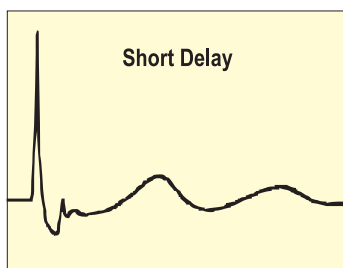
SIGNATURE QC

A time break hydrophone mounted on the GI GUN and located inside the bubble (as soon as the Generator has been fired), displays the signature of the GI GUN without being influenced by the neighboring gun.

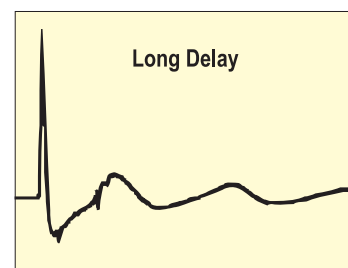
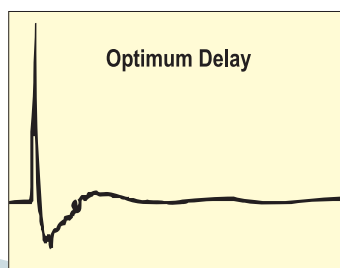
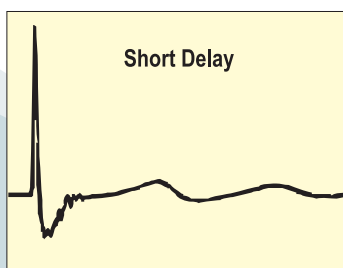
The graphs below compare the signals given by a near field hydrophone (top) with the signals given by the time break hydrophone (TB) located inside the bubble (bottom), for three different delays between the Generator and the Injector.

As illustrated, the shapes of the signals given by both hydrophones are similar and the optimized tuning of the gun can be achieved using the time break signal, which can be used also for the signature QC emitted by each individual gun at every shot.

Near Field Hydrophone



Time Break Hydrophone



SPECIFICATIONS

Physical GI GUN 210

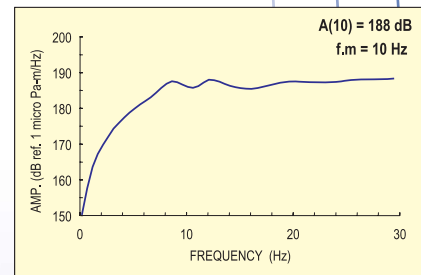
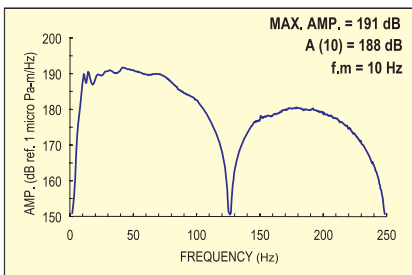
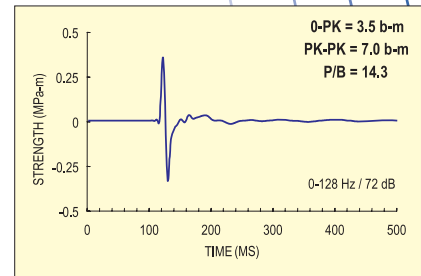
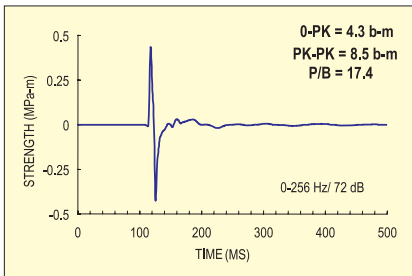
- Weight : 74 kg (163 lbs.)
- Length : 790 mm (31.0 in.)
- Width : 312 mm (12.3 in.)

FAR FIELD SIGNATURE AND SPECTRUM

2 * GI GUN 300 in³ Sub-Array

(G45 / I45) + (G105 / I105)

Pressure = 2,000 psi; Depth = 6.0 m

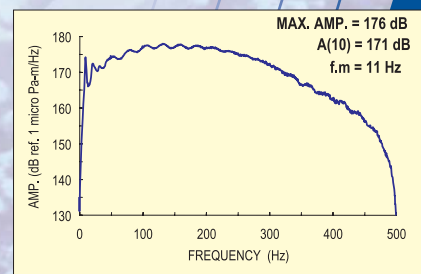
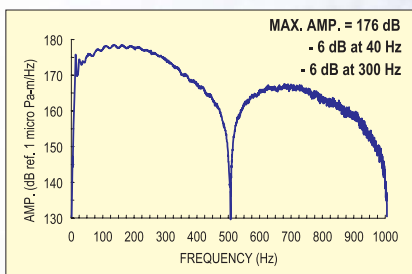
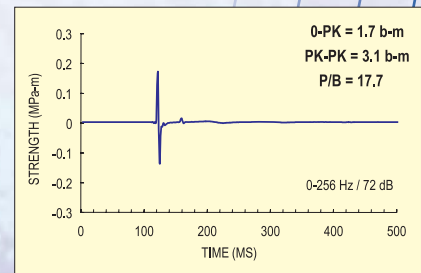
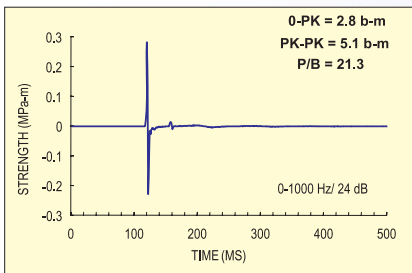


FAR FIELD SIGNATURE AND SPECTRUM

1 * GI GUN / 90 in³ High Frequency

(G45 / I45)

Pressure = 2,000 psi; Depth = 1.5 mm



MINI GI GUN

MINI GI

This new gun is a scaled down model of the well-known, appreciated and field-proven GI GUN. The Mini GI is primarily intended to advantageously replace the small air guns with wave shape kit or Watergun, normally used for high-resolution/well-site surveys.

The good quality signal allows the user to design simple and efficient arrays always using the same element, giving to the outgoing signature a high degree of stability.

The higher frequency content of the Mini GI spectrum permits a tremendous saving in air consumption when compared to the standard GI GUN.

Indeed, the spectra of the Mini GI 40 (G20 / I20) and the standard GI GUN 90 Hf (G45 / I45) are identical from 200 Hz up, while the air consumption is divided by more than two.

As for the standard GI GUN, the Mini GI volumes can be adjusted easily by means of inexpensive plastic inserts.

The available volumes for each chamber are: 15, 20 and 30 in³.

The standard mode of operation for both Generator and Injector volumes is identical (harmonic). However, for special applications where the resolution is the most important factor, the Mini GI can be used in “true GI mode” where the Generator is 15 in³ and the Injector is 30 in³. In this case, the P/B ratio jumps five points over the previous mode of operation to reach almost 23 to 1 (DFS 0-256 Hz).

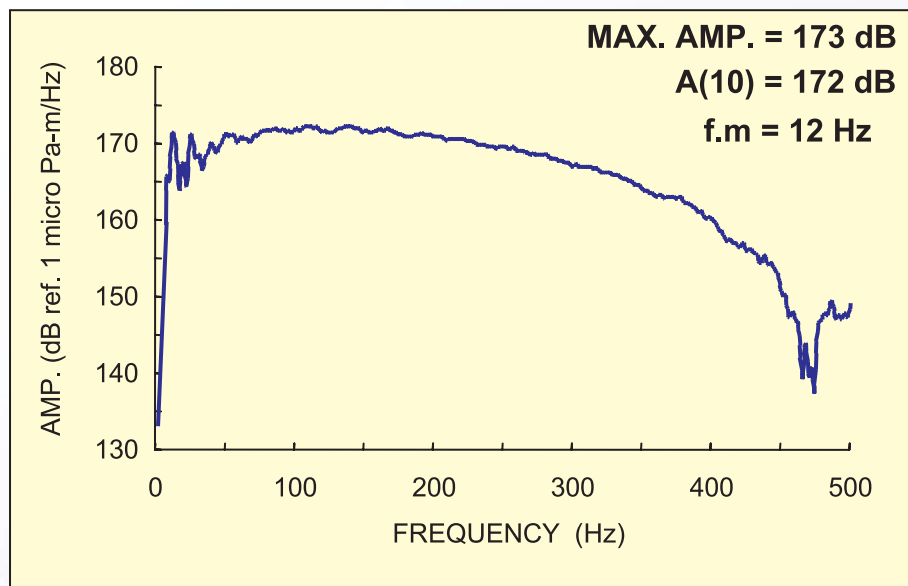
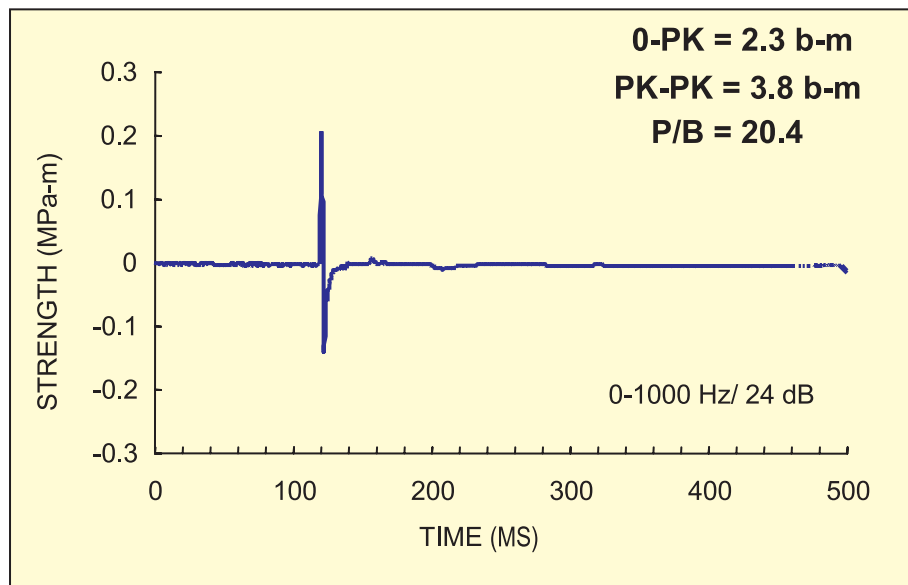


SPECIFICATIONS

Physical Mini GI

- Weight : 29 kg (64 lbs.)
- Length : 566 mm (22.3 in.)
- Width : 200 mm (7.9 in.)

FAR FIELD SIGNATURE AND SPECTRUM



1 * Mini GI 60 in³
(G30 / I30)
Pressure = 2,000 psi
Depth = 1.5 m

WATERGUN

S15 WATERGUN

The S15 Watergun is a pneumatic seismic source using compressed air similar to air guns.

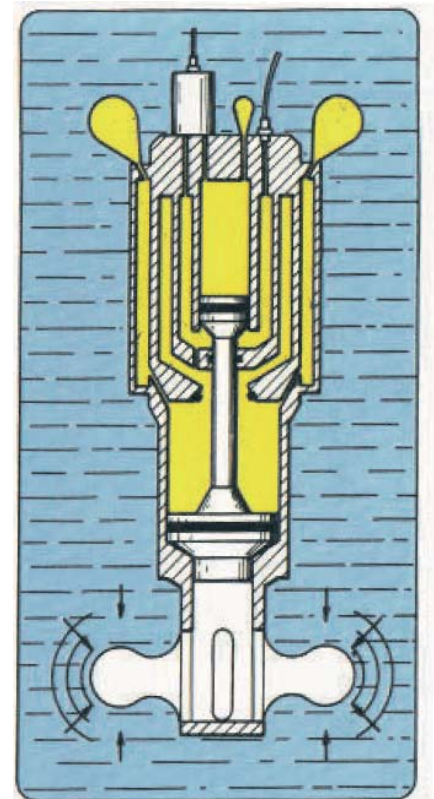
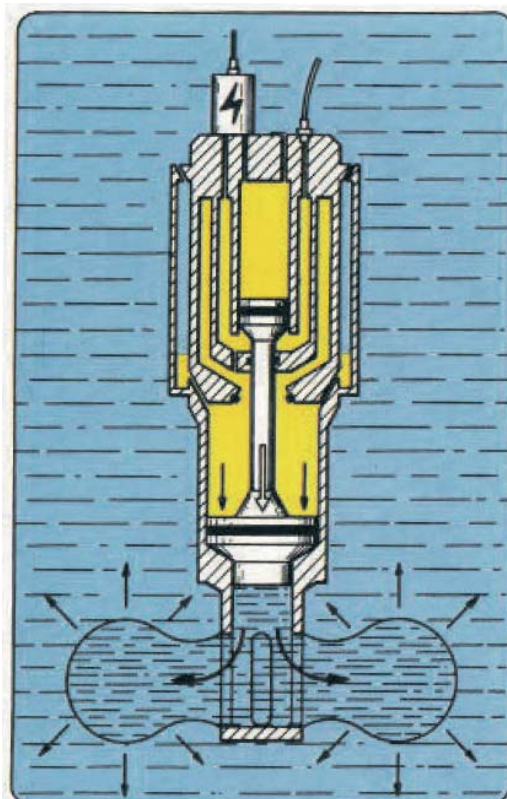
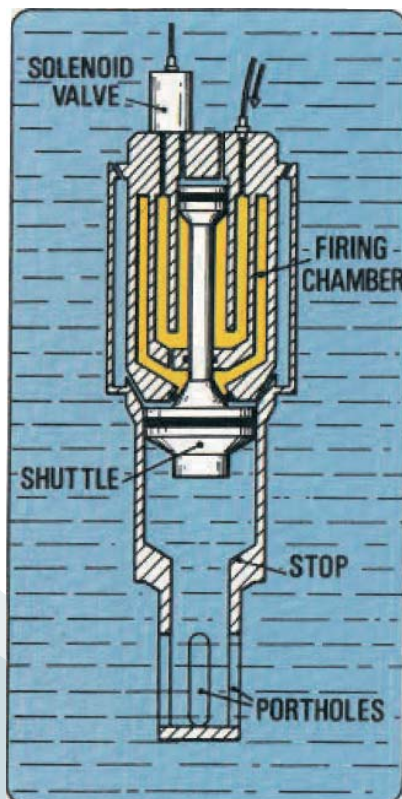
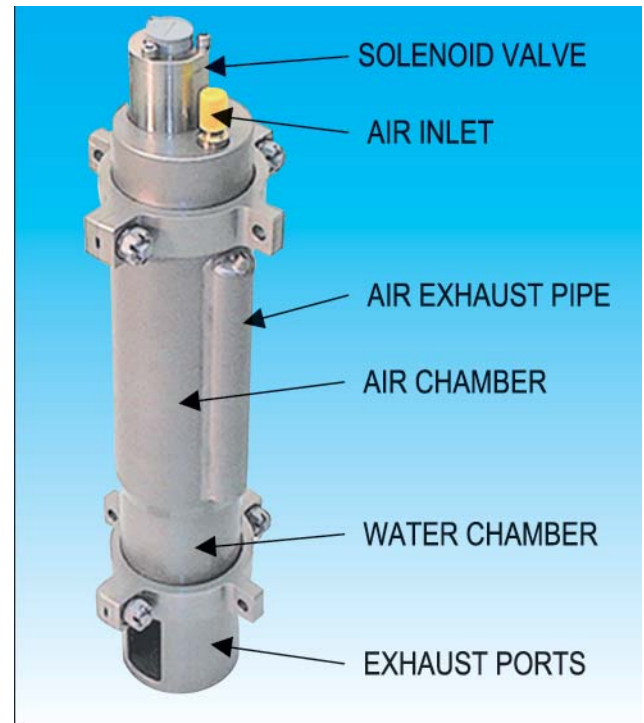
The S15 can also be interfaced with the same peripheral equipment as the Air gun.

The S15 is an implosive source creating an acoustic pulse which:

- is free of bubble oscillations;
- has a broad spectrum extending to the high frequency (up to 2,500 Hz);
- is highly repeatable both in shape and amplitude.

The S15 is a versatile source that can be used offshore, in marsh areas, on land or for downhole shooting, both as a stand alone source or in array.

S15 Watergun Operation



SPECIFICATIONS

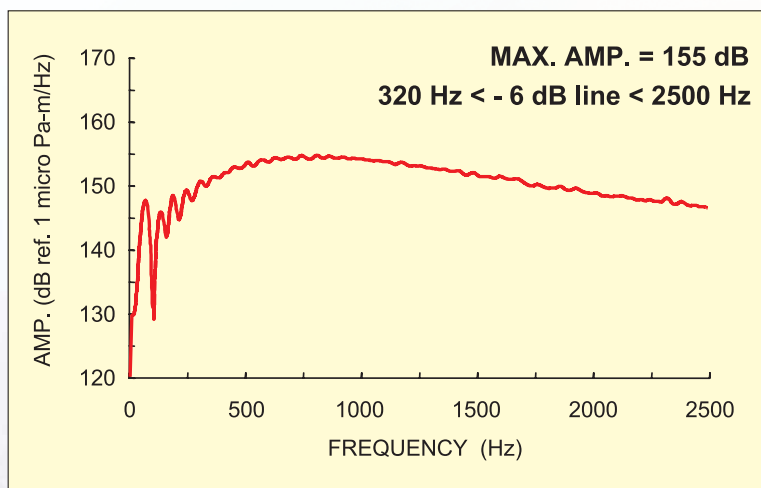
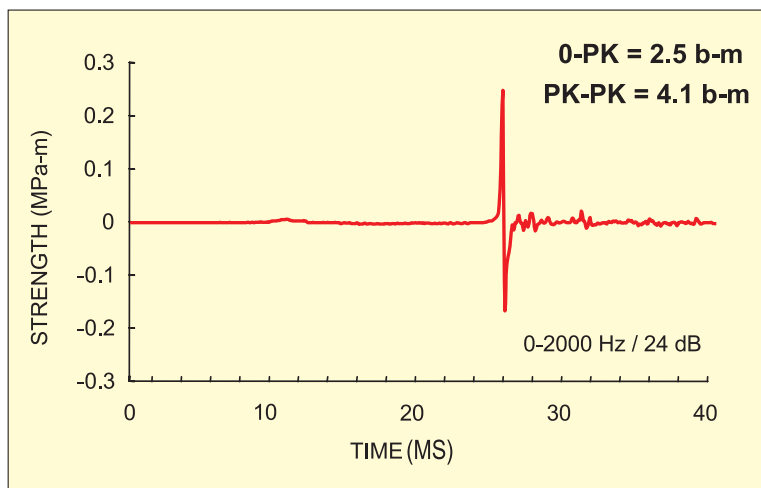
Physical S15 Watergun

- Weight : 13 kg (29 lbs.)
- Length : 546 mm (21.5 in.)
- Width : 152 mm (6.0 in.)

Operational

- Air Pressure : from 140 psi (10 bars) to 3,000 psi (210 bars)
- Air Requirement : 10 in³ (0.16 liter) per shot
- Firing Cycle : 0.5 s (0.25 s upon request)
- Compressor Requirement : 50 scfm (87 Nm³/h)
(2,000 psi/s)
- Minimum firing depths :
 - Horizontal 9 in. (0.22 m)
 - Vertical 1 ft. (0.30 m)
- Maximum firing depth : 1,800 ft. (600 m)

FAR FIELD SIGNATURE AND SPECTRUM



1 * S15 Watergun
Pressure = 2,000 psi
Depth = 0.22 m

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