

G. GUN

The Recoilless Air gun



Small



Powerful



Simple



Highly Repeatable



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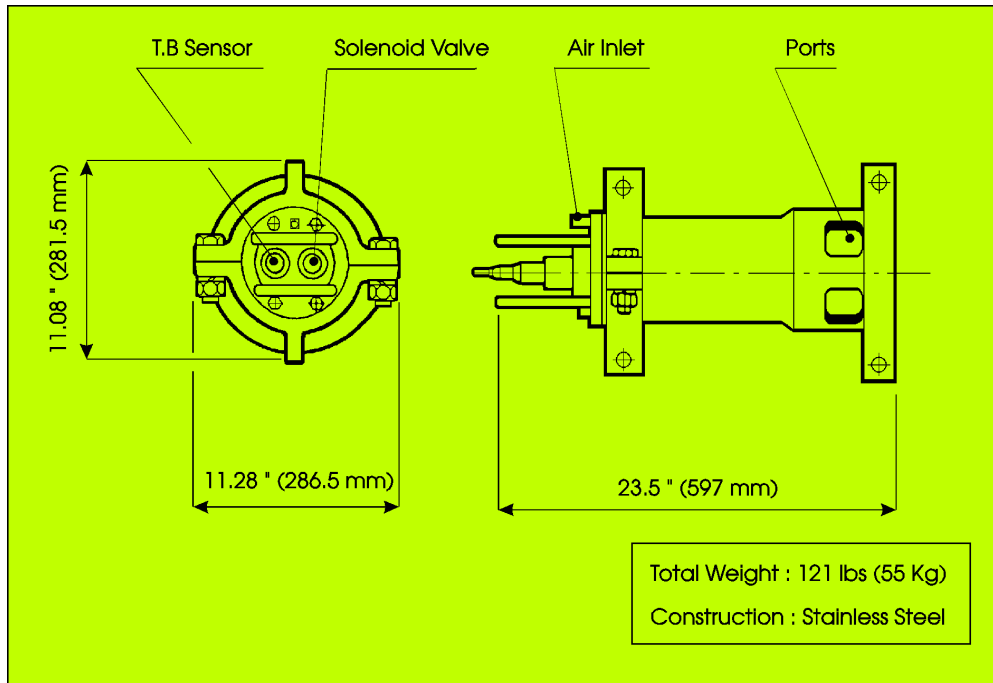
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AN OPTIMIZED DESIGN



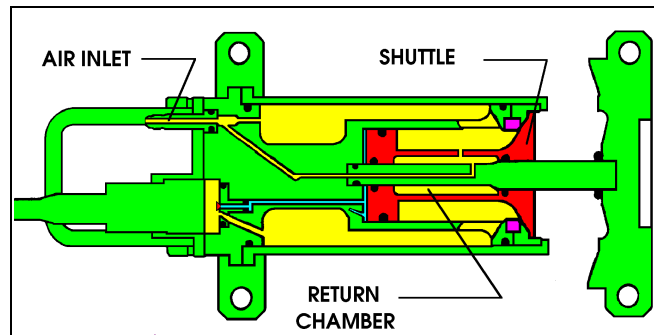
ADVANTAGES:

- SMALLER and LIGHTER WEIGHT.
- FEWER PARTS: 40% FEWER PARTS THAN THE SIMPLEST AVAILABLE AIR GUN.
- ASSEMBLY / DISASSEMBLY WITHIN MINUTES WITHOUT SPECIAL TOOLING.
- A SINGLE GUN ALLOWS A WIDE RANGE OF VOLUMES: FROM 25. UP TO 250 cu.in.
- SAFER: G. GUN IS DEPLOYED AND RETREIVED WITHOUT AIR PRESSURE.
- MORE POWERFUL: G. GUN IS DESIGNED AND BUILT TO BE OPERATED CONTINUOUSLY UNDER UP TO 3,000 psi (210 bar) AIR PRESSURE.
- HIGHER DEGREE OF PULSE REPEATABILITY: 50 μ second STANDARD DEVIATION.
- EXTERNAL TIMING COIL FOR EASY SERVICE.

AND ... NO RECOIL ...

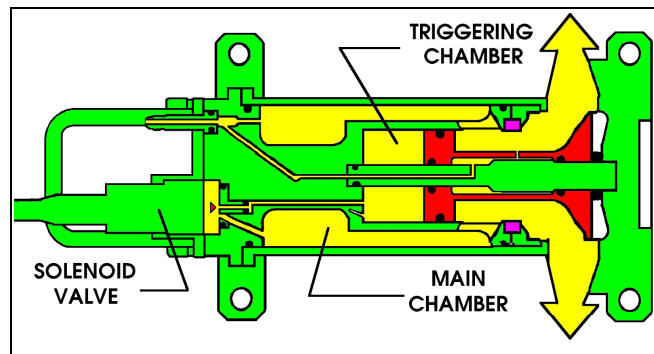


OPERATION



PREFIRED

Compressed air first fill up the Return Chamber firing the hollow Shuttle to close and seal the Main Chamber. At the same time, the Main Chamber located between the Casing and the Shuttle starts to be pressurized.



FIRED

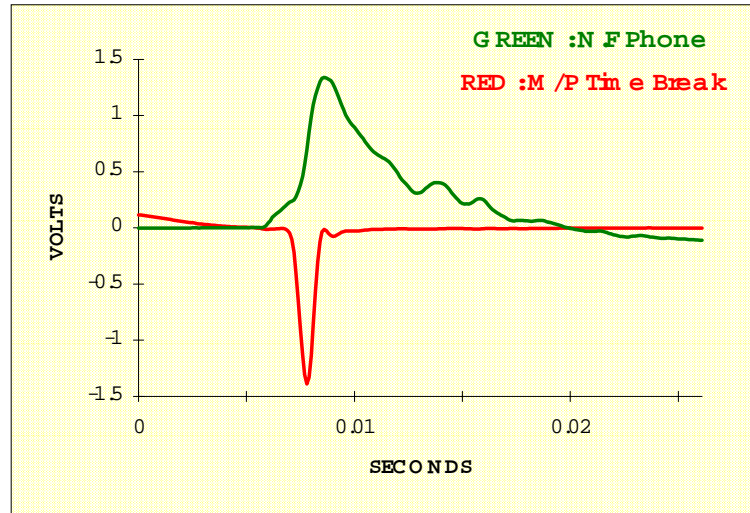
When the Solenoid Valve is energized, the Triggering Chamber is pressurized allowing the Shuttle to unseal and the Shuttle larger area to be pressurized. The light weight Shuttle quickly acquires a high velocity before uncovering the Ports. High pressure air in then explosively released into the surrounding 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 prefired position.

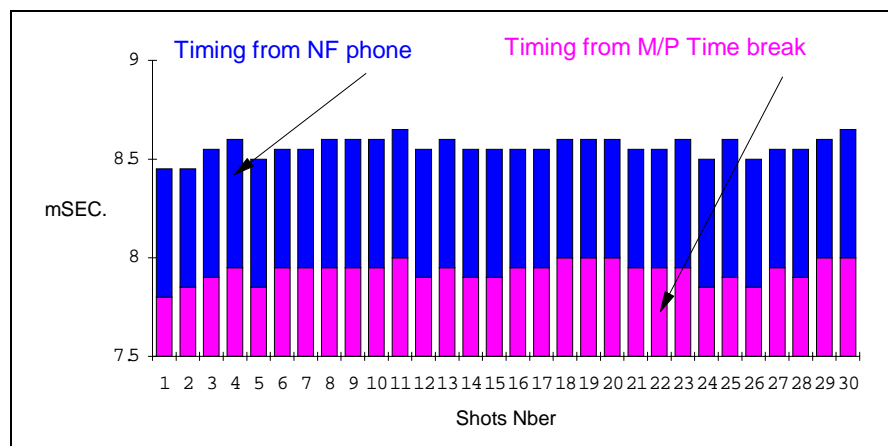


A HIGH DEGREE OF STABILITY



- Clean and Consistent pulse easy to process.
- Tightly correlated to the Near Field Phone.

REPEATABILITY OF PRIMARY PULSE



Standard Deviation = 0.05 mSEC.



INTRODUCING SSI G.GUN

The G.GUN borrows the technology of the GI GUN, the Bubble Free Air Gun, which for many years now is well known for its field proven reliability.

Basically, the G.GUN is an Air Gun made of half a GI GUN and therefore is more compact, lighter and more simple than any Air Gun actually on the market.

For instance, the G.GUN 150 cu.in. uses 40% fewer parts than the 150 cu.in. SLEEVE GUN, and does not require any expensive special tooling.

The chart hereafter shows the main features of the G.GUN compared to the SLEEVE GUN Series 2 and the BOLT 1500 c.

	G.GUN	SLEEVE GUN	BOLT 1500 C
<u>TOTAL NUMBER OF PARTS</u> (including the hanging system)	43	76	79
<u>WEIGHT</u>	55 kg (121 lbs)	88 kg (194 lbs)	84kg (185 lbs)
<u>PHYSICAL DIMENSIONS</u>			
LENGTH	60 cm (23.5 in.)	81 cm (31.9 in.)	75 cm (29.5 in.)
WIDTH	29 cm (11.3 in.)	32 cm (12.6 in.)	26 cm (10.2 in.)

150 cu.in. AIR GUN COMPARISON



SIZES

The G.GUN is currently available in two sizes, but by using simple and inexpensive plastic inserts, the volume can easily be changed from 25 cu.in. to 150 cu.in. If a larger volume is needed, then the Casing has to be replaced, but all other parts remain strictly identical. Therefore, even for large arrays only two sizes of guns are needed.

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 pressurized.

PRESSURES

The G.GUN has been designed and tested for continuous operation under up to 3,000 psi air pressure. While the G.GUN can be used with 1,000 psi up to 3,000 psi, the same gun generates 50% more acoustic energy than under 2,000 psi, and most of the gain is achieved in the low frequencies. In other words, the total energy of a given G.GUN array, for instance, can be increased by 50% without increasing the number of guns, and/or their volume.

Comparing the recorded signatures of page 16 (volume : 150 cu.in. - pressure = 2,000 psi) with the same on page 17 (volume : 150 cu.in. - pressure = 3,000 psi), it can be observed that the output 0-Peak has been increased by about 28%.

TIME BREAK - REPEATABILITY

An external coil, located on the gun top, generates the time break signal when the gun is actually fired. The time break coil can be serviced without removing the G.GUN from the array, for simplicity and time saving.

The time break follows accurately 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 cu.in. G.GUN at 2,000 psi, we recorded the following results :



Primary on N.F. phone :Dispersion = +/- 0.09 mSEC.
Standard deviation = 0.054 mSEC.

Time break signal :Dispersion = +/- 0.15 mSEC.
Standard deviation = 0.05 mSEC.

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 3,000 psi air pressure.
Over half a million shots without servicing the gun has been reached.

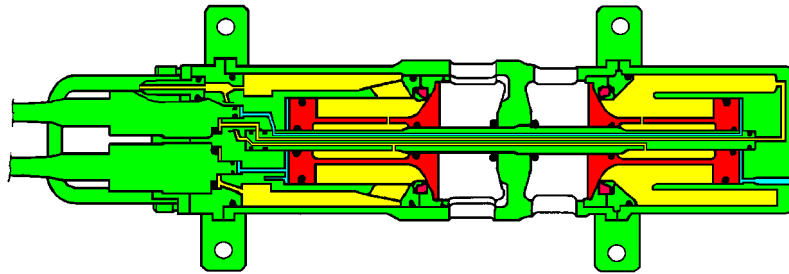
RECOIL

It is well known that existing Air Gun, like BOLT or SLEEVE GUN, experience a powerful recoil when fired, especially when large volumes and high pressures are used. Those recoils are damaging the harness designed to maintain the position of the gun as well as the towing system and the umbilical connecting the guns to the vessel.
A special design allows the G.GUN to be recoilless when fired thus avoiding costly break down and increasing the life time of the peripherals.

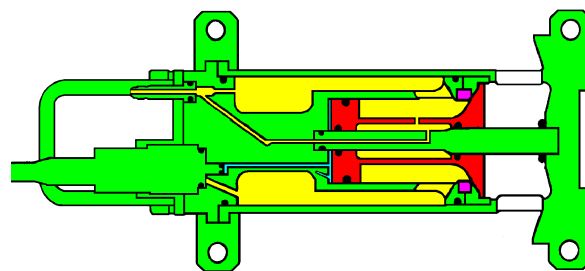
VERSATILITY

While the G.GUN is totally interchangeable with existing Air Guns in an Air Gun array, it can also be easily transformed into a GI GUN.
The shuttle assembly is the same on the G.GUN and on the GI GUN. Over all, the G.GUN and the GI GUN share 90% of their components. For instance, starting with two (2) G.GUN, it is possible to build within minutes one (1) GI GUN. The GI kit needed to transform the two (2) G.GUN into one (1) GI GUN includes only six parts specific to the GI GUN.

The figure on page 8 shows both GI GUN and G.GUN at the same scale.



GI GUN



G. GUN

GI GUN AND G.GUN COMPARISON (same scale)



OUTPUTS

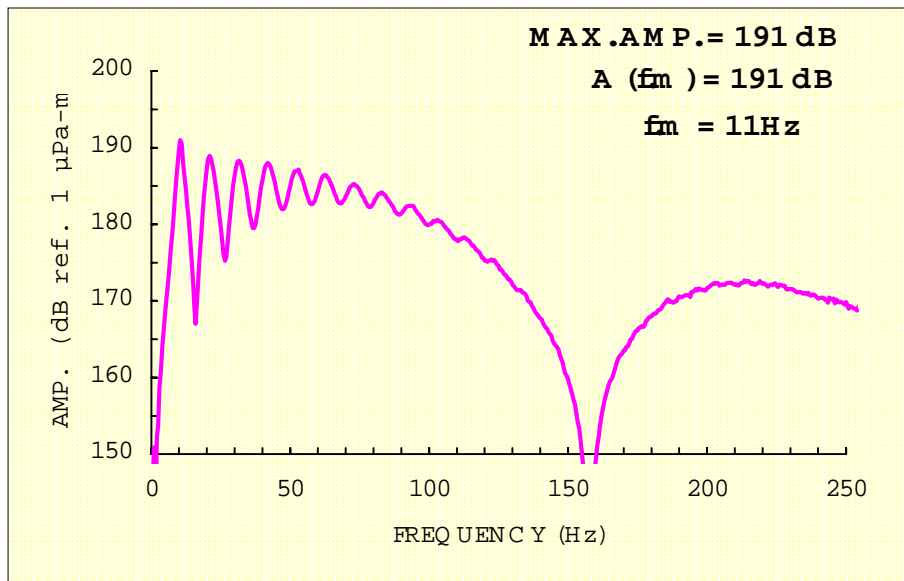
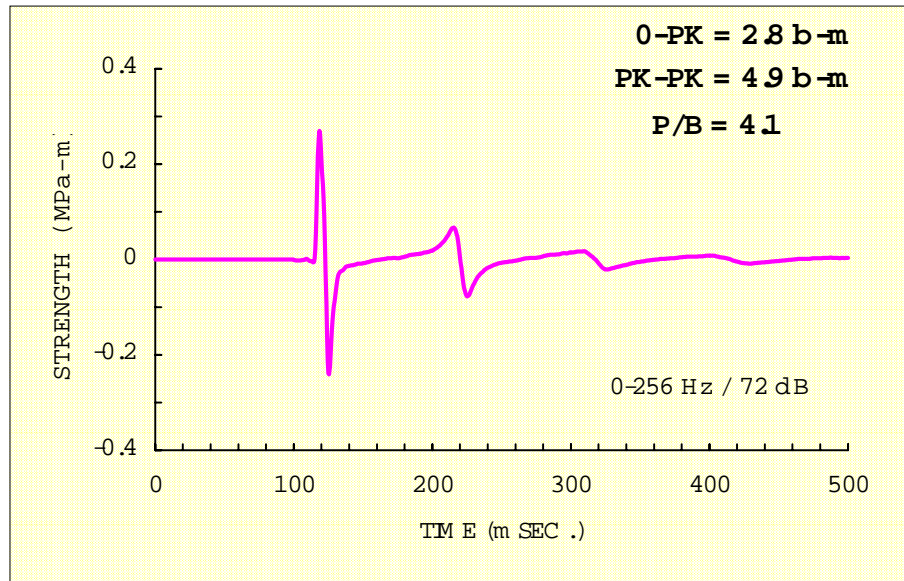
The following pages show recorded signatures and spectra from one single G.GUN, two G. GUN and three G.GUN in cluster.

For all signatures the gun depth was 5.0 meters.

All signatures filtered DFS 0-256 Hz 72 dB.

	2,000 psi		3,000 psi	
VOLUME (cu.in.)	UNFILTERED	0-128 Hz 72 dB	UNFILTERED	0-128 Hz 72 dB
45	2.5	1.5	3.3	2.0
75	3.0	2.0	3.9	2.5
105	3.4	2.2	4.4	3.0
150	3.7	2.6	4.6	3.4

OUTPUTS 0-PK FROM A SINGLE G. GUN
(in bar-meter)

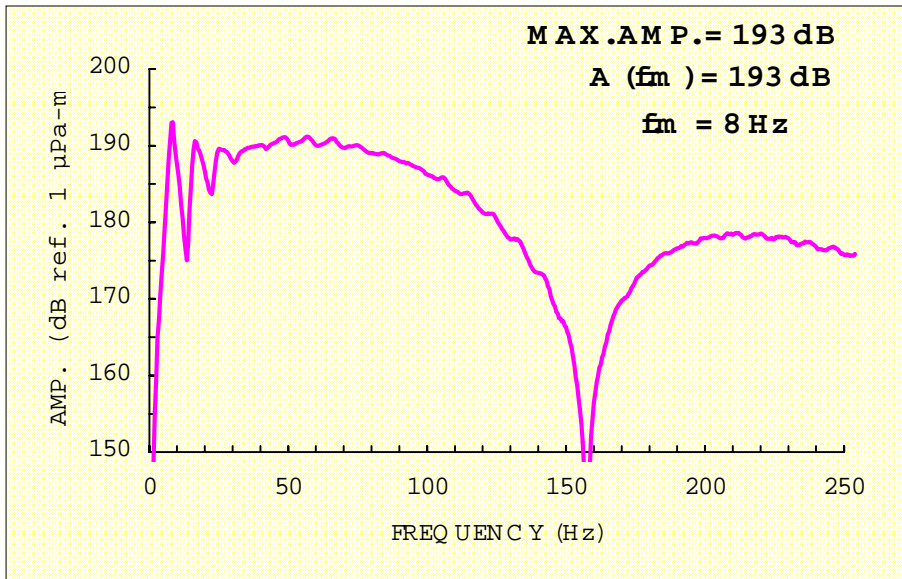
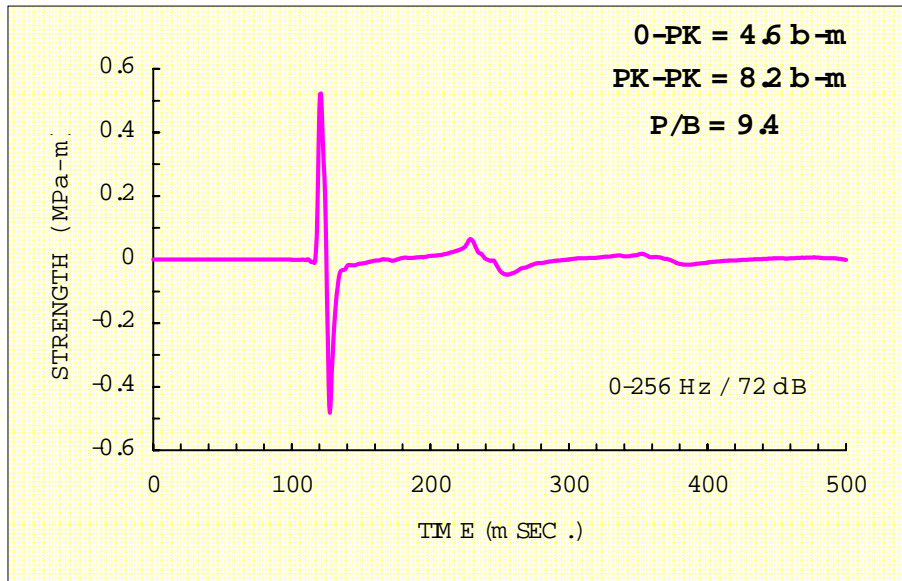


FAR FIELD SIGNATURE and SPECTRUM

1 * G. GUN / 150 cu.in.

PRESSURE = 2,000 psi

DEPTH = 5.0 meters

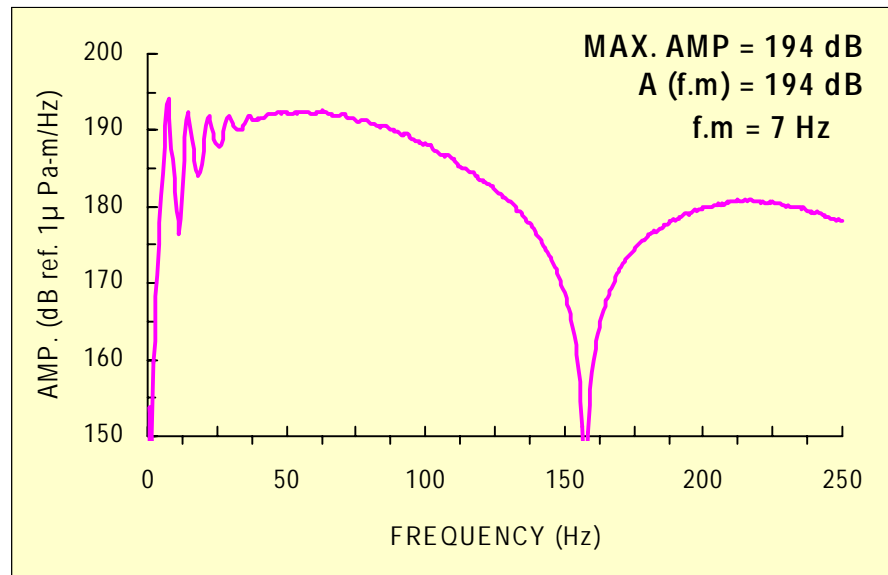
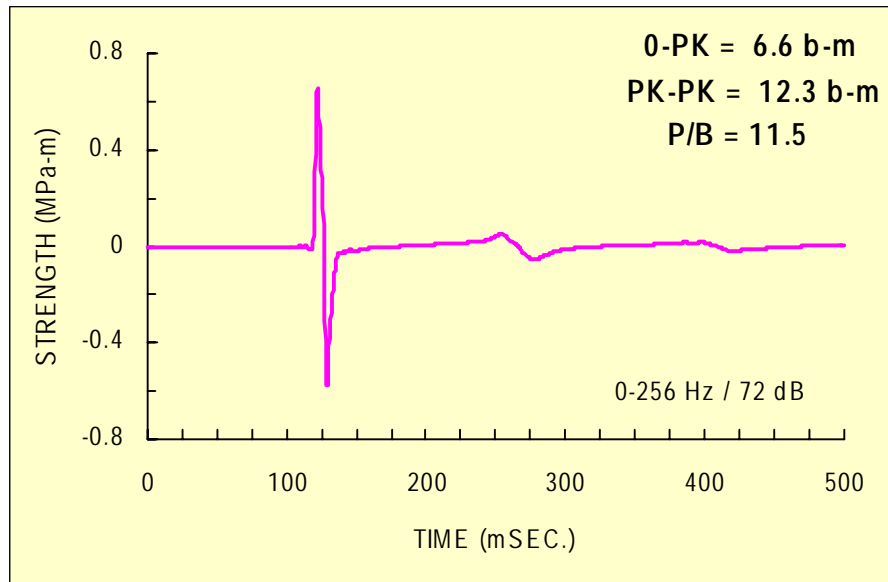


FAR FIELD SIGNATURE and SPECTRUM

2 * G. GUN Cluster / 300 cu.in.

PRESSURE = 2,000 psi

DEPTH = 5.0 meters



FAR FIELD SIGNATURE and SPECTRUM

3 * G. GUN Cluster / 450 cu.in.

PRESSURE = 2,000 psi

DEPTH = 5.0 meters



G. GUN 150 cu.in.

REPEATABILITY ON 100 SHOTS

Gun pressure = 2,000 psi

Gun depth = 1.5 meter

- LISTING DATA POINTS**

All values in mSEC.

	1	2	3	4	5	6	7	8	9	10
0	8.10	7.90	7.95	8.05	7.95	8.00	8.00	8.00	7.95	8.00
10	8.00	7.95	8.00	7.95	8.10	8.05	7.95	8.00	8.05	8.10
20	8.05	8.00	7.95	8.05	7.95	8.00	7.95	8.00	7.90	8.00
30	7.90	8.00	8.05	8.00	7.95	8.00	7.95	8.00	8.00	8.00
40	8.05	7.95	8.00	7.95	7.90	7.95	7.95	7.95	7.95	7.90
50	8.00	7.90	7.95	7.95	8.00	7.95	8.00	<u>8.15</u>	8.10	7.95
60	8.05	7.95	7.95	8.00	7.90	8.00	7.95	8.00	7.95	7.95
70	7.95	7.90	8.00	8.00	<u>7.85</u>	7.95	7.95	7.95	<u>7.85</u>	7.90
80	8.00	7.95	<u>7.85</u>	8.10	7.90	7.95	8.00	8.00	8.00	8.00
90	8.00	8.00	8.00	7.95	8.00	8.00	7.95	8.00	8.00	8.00

- RESULTS**

Minimum value = 7.85 mSEC.

Maximum value = 8.15 mSEC.

Mean value = 7.98 mSEC.

Dispersion = +/-0.15 mSEC.

Standard deviation = 0.05 mSEC.

- GRAPH DISPERSION VERSUS SHOT NUMBER**



