



(((ECHOMETER)))

Your Artificial Lift Experts

Gun-Microphone Assemblies

For the use with Acoustic Liquid Instruments



Echometer Gun-Microphone Assemblies

A Gun-Microphone assembly consists of a gun and a microphone together. A gun generates a pressure pulse. A microphone converts acoustic pressure pulses into an electrical signal. The gun and microphone are normally supplied together as a unit. The gun generates a single pressure pulse which travels down the casing annulus and is reflected by collars and the liquid level. The reflected pressure waves deflect the microphone and generate an electrical signal. The electrical signal is fed either to the computerized Well Analyzer which automatically processes the signal or to an amplifier-recorder which amplifies, filters and records the signals on a strip chart, or in the case of the Model H, displays the data on a digital screen.

Two important factors must be considered when selecting the type of gas gun.

1. The gun should generate a pressure pulse that results in the collars being counted as far down the well as possible.
2. The gun must generate a pressure pulse of sufficient strength to cause the reflected pressure wave from the liquid level to be readily distinguishable. The reflected liquid level pressure wave is larger when the volume or pressure of gas discharged into the casing annulus is increased. On deep, slim hole, low pressure wells, the liquid level response may be weak unless a large initial pressure pulse is used.

Manually Operated Gas Guns



Compact Gas Gun



5000 PSI Gas Gun

The Compact Gas Gun and the 5000 PSI Gas Gun are manually operated in either the explosion mode or the implosion mode. On low-pressure wells (less than 200 PSI), the gas gun is used in the explosion mode. The gas gun volume chamber is pressurized above the casing pressure. Opening the gas valve results in a positive compression pressure wave being generated which travels down the casing annulus. On wells having over 200 PSI casing pressure, the gas gun can be operated in the implosion mode. Gas is rapidly released from the well into the gas gun volume chamber to generate a negative rarefaction pressure pulse. A compressed gas source is not needed in the implosion mode. Operating the Compact Gas Gun in the implosion mode is not recommended if pressurized gas is available at a pressure greater than the casing annulus pressure. The 5000 PSI Gas Gun is normally used only in the implosion mode. The 5000 PSI Gas Gun has an excellent noise canceling microphone and generates a good pressure pulse when the $\frac{1}{2}$ " ball valve is rapidly rotated 180 degrees and the well pressure exceeds 200 PSI. When the 5000 PSI Gas Gun becomes dirty due to debris, the volume chamber and microphone assembly can be flushed with a solvent to remove the debris. The 5000 PSI Gas Gun requires very little maintenance. It is excellent for gas lift, flowing, and high-pressure shut-in wells.

Remote Fire Gas Gun



A Remote Fire Gas Gun utilizes a high performance microphone having an excellent signal-to-noise ratio along with a 12 cubic inch volume chamber. A solenoid valve releases gas from the gas gun volume chamber into the well.

The solenoid is operated from the Well Analyzer system or from a conventional 12 volt car-type battery. The Remote Fire Gas Gun cannot be operated in the implosion mode. The Remote Fire Gas Gun is required for unattended pressure transient data acquisition.

The Remote Fire Gas Gun is normally supplied with a 1500 PSI pressure gauge and 1500 PSI pressure transducer. Thus, in this configuration, the Remote Fire Gas Gun is limited to 1500 PSI working pressure. For single shot analysis on a well exceeding 1500 PSI, a 5000 PSI implosion gun is recommended.

A High Pressure Gas Gun will operate up to 15,000 PSI with a test pressure of 30,000 PSI. The 15,000 PSI Gas Gun operates in the implosion mode only. The volume chamber in the gas gun is bled to a pressure less than the pressure existing on the well. The valve is manually opened to release gas from the well into the gas gun volume chamber to generate the pressure pulse. The microphone is not as sensitive or noise canceling as the microphone on the Compact Gas Gun, the Remote Fire Gas Gun or the 5000 PSI Gas Gun.

Best performance will be obtained when the 15,000 PSI Gas Gun is used at pressure exceeding 1500 PSI but not exceeding 15,000 PSI. The gas gun is useful in determining liquid levels, bottomhole pressures, locating the liquid level of corrosion inhibitors, and locating other anomalies. Excellent results have been obtained at pressure above 1500 PSI (100 ATM) through 1/8" orifice needle valves which are standard on most high pressure wells. Minimum expense and trouble are involved in the use of this High Pressure Gas Gun.

1500 PSI Gas Gun



Gas Gun Specifications and General Information

| | Compact Gas Gun | Remote Fire Gas Gun | 5000 PSI Gas Gun | 15000 PSI Gas Gun |
|---|---------------------------|---------------------------|--|---------------------------|
| Volume Chamber Size, In | 10 | 12 | 7 | 1 |
| Working Pressure PSI (ATM) | 1500 (100) | 1500 (100) | 500 (333) | 15,000 (1000) |
| Best Operating Pressure PSI (ATM) Min/Max | 0-1500 (0-100) | 0-1500 (0-100) | 0-200 (0-13) EXP 200-5000 (13-333) IMP | 1500-15,000 (100-1000) |
| Mode of Operation | Explosion/Implosion | Explosion Only | Explosion/Implosion | Implosion |
| Type of Operation | Manual | Automatic/Solenoid | Manual | Manual |
| Dimensions | 3" x 4 ½" x 12" Long | 4-½" x 8-½" x 14-½" Long | 2" Square x 16" Long | 2-¾" Square x 8" Long |
| Weight | 8 lbs | 12 lbs | 10 lbs | 10 lbs |
| Microphone | Dual Disc Noise Canceling | Dual Disc Noise Canceling | Dual Disc Noise Canceling | Single Disc |

All gas guns are constructed from 316 stainless steel and are suitable for H₂S and corrosive service.

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Filling the Volume Chamber

Carbon dioxide or nitrogen gas is normally used with gas guns when operating in the explosion mode. Carbon dioxide is obtained from welding supply firms, fire extinguisher firms and soft drink preparation firms. The Compact Gas Gun and Remote Fire Gas Gun can be recharged from a CO₂ cylinder furnished with the guns. A 5 lb or 2 ½ lb CO₂ cylinder is available with a hose and quick connector to pressure up the guns. The bottles are generally filled from a stationary 50 lb siphon-type bottle located at a field office. Approximately 5000 tests can be obtained from the 50 lb bottle. A large amount of CO₂ gas can be contained in relatively small cylinders. Carbon dioxide gas is commonly supplied in approved CO₂ cylinders with the pressure in the cylinder being the vapor pressure of the carbon dioxide gas at the particular temperature of the carbon dioxide cylinder. The critical temperature is 88°F and the pressure in the bottle (if gas and liquid exist in the bottle) at 88°F will be 1070 PSIA. If the bottle contains liquid, the pressure is 650 PSI at 50°F, 300 PSI at 0°F, and 120 PSI at -50°F. As long as the temperature of the CO₂ gas is high enough that the vapor pressure exceeds the well pressure, carbon dioxide gas is the most convenient gas to use for acoustic testing. If the well pressure exceeds the vapor pressure of carbon dioxide, then nitrogen gas is the most common gas to use for acoustic testing. Generally, nitrogen gas is supplied at 2200 PSI and the pressure is in excess of the needed pressure to charge the gas gun. A pressure regulator is commonly used to reduce the nitrogen pressure to charge the gas gun. A pressure regulator is commonly used to reduce the nitrogen pressure to a pressure satisfactory for charging the gas gun volume chamber. For example, if the maximum pressure on the wells to be tested is 500 PSI, the pressure regulator might be set for 750 PSI. When performing pressure transient testing, the well pressures are increasing. At night, the temperature may become cold and the vapor pressure of carbon dioxide gas may be below well pressure. This requires the use of nitrogen gas or some other gas, which has a pressure in excess of well pressure. An operator may prefer to use carbon dioxide for conventional well testing and use nitrogen bottles with a regulator when performing pressure transient testing.

General Information

5 lb CO₂ gas cylinders are constructed of aluminum, have a test pressure of 3000 PSI, and a service pressure of 1800 PSI. Dimensions are 20" long by 5.25" O.D. Empty weight is 7.6 lbs. The gas valve has 0.965-14 NGO R.H. external thread. The 2 ½ lb cylinders are 14" long by 4.375" O.D. Empty weight is 4.6 lbs.

Nitrogen bottles are constructed of aluminum and have a test pressure of 3694 PSI and a service pressure of 2216 PSI. Dimensions are 42" long by 8" O.D. Weight is 43 lbs. Capacity is 115 cu. Ft. of N₂ gas at 2216 PSI. The gas valve has 0.965114 NGO R.H. internal thread.

Pressure Regulators

A pressure regulator is available for use with the nitrogen gas cylinder, which will reduce the pressure to a preset level that can be set by the operator ranging from 50 to 1500 PSI. This can be used during single shot or pressure transient data acquisition.

PATENTS 5,285,388 5,406,482 5,464,058 5,589,633 Canadian 2084951 Approved and others pending. These patent numbers are presented for your information. Some are current. Others are expired so the patent rights for the claims no longer exist. Please refer to the particular patents for additional information.

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