

## Common Questions and Answers

1. Vibrations caused by the use of this product

There is no vibration energy in gun propellant. Its energy source is gas expansion only. This is the primary technical physics and value proposition of the technology. As an example we supplied a project utilizing our product back in the late 1990's that required a trench to be excavated alongside an operational large diameter high pressure gas pipeline. Even hydraulic breakers were prohibited on this project due to their excessive vibration characteristics. This is one of its main market advantages.

2. Flyrock

No high velocity fly-rock. We supply a tarpaulin for safety containment but most customers don't feel the need to use even that level of safety containment. You can see the level of fly rock that is present from the video. That is typical, as propellant energy produces only rapid gas expansion. The rock peels more like an onion as opposed to a violent explosive "detonation based" reaction. This is another of its main market advantages.

3. Suitability for bedrock and hard rock and the quantity that can be effectively broken with one charge.

The technology will break any strength rock. Two operational setup factors are important. One, you must have the droll hole as you need to break the rock in tension which is it weakest structure (rock is very strong in compression and is the reason hydraulic breaking is so time consuming and costly). Two, you must have at least on free face to break. You can always create a free face by extra work up front and then continually break to that direction. The quantity broken will depend on the setup and the number of cartridges necessary for a give setup. However, if you can estimate that a single charge will effectively break one cubic meter.

4. The drill hole sizes and if any special drilling equipment is required.

The drill hole size is 1.0 to 1.5 inch (38 mm). We supply a separate ignition barrel for each size. No special equipment only our tool and the drilling equipment.

5. The weight of your equipment if it has to be carried manually to inaccessible areas.

The Magnum Buster weight is about 23 kg and the Weight Disc is about 13 kg. A safety tarp will be 2 to 3 kg. All are easily carried to remote locations. One of our biggest customers is the US Forest Service where they clear trails in remote locations.

6. Overall productivity and the cost of breaking 1 CM of rock.

You can expect to drill a single hole and break a single rock or trench face with a single cartridge every 5 minutes with a 2 man crew. You can expect to break a minimum of 1 CM of rock per shot (and often times much more). From this you can calculate how many individual Magnum Buster breaking operations you will need to schedule for any given project to meet schedule.

Budget USD 5 to break a cubic meter. This would be the averaged cartridge cost and not include the amortized portion of the equipment cost. However, on a large job the unit amortization cost would be insignificant.

7. The number of workers required to work at a specific location.

The best results will be produced with 2 workers per Magnum Buster. However, we have many operators in the US that do everything themselves.

8. Availability of accessories and charges for the equipment.

Everything is readily available.

9. Provision of Training on usage of the product for the workers.

If you would like we can set up a training program for about a week on site but that will require our travel costs to be covered. In the majority of cases to simply utilize the tool in a normal boulder breaking operation we provide a very comprehensive Operational Manual and other documentation that we have found to be more than sufficient to allow personnel start utilizing the tool safely and effectively without the extra cost of having us come on site for personal training. For additional reference a condensed version of the operational manual is in the library section of the web site.

However, given the more unique “integrated” aspect of this project, one option to consider would be to engage us directly in the design and organization of the excavation portion of the job. We are experts in all design and operational phases as well as technological approaches to rock excavation, with over 35 years of experience in the field. As such we are often asked to consult on this specialized excavation portion of larger projects through the US. We have been past presidents and board members of the International Society of Explosives Engineers. We do not advertise this as we are primarily technology developers and manufactures of our own technologies. However, there are so few people in the world with this specialty that we end up providing this service upon customer request.

10. Major projects and references on the use of this product.

Our business is original equipment based development and manufacturing where we supply of our technology to end users and the end users employ the technology on a wide variety of their own projects. We have a customer list of about 2000 entities. They range from the US Forest Service, US Military, US Department of Transportation, Every State Highway Department throughout the United States and a large number of Utility and Civil contractors that contract for projects utilizing our products in both the public and private sector.

The main physics to understand between high explosives and propellant is as follows:

1. The only energy source of propellant is rapid gas expansion.
2. With High explosives you have 3 phases.
  - a. The detonation phase that is essentially wasted energy and mostly pulverizes the rock around the drill hole. This is the largest component of the energy release, say around 75 to 80 percent.
  - b. The seismic phase which is the source that sends an amplitude wave through the insitu material and itself, if too significant, can be destructive to adjacent structures. This is generally the reason for ms delays in an explosive round.
  - c. The rapid gas expansion phase. This is only about 15% of the total energy release of a high explosive but the component that accomplishes most of the work product.
3. It is the rapid gas expansion phase that actually presses into the natural fractures and continues fracture propagation which is the process that breaks into a productive unit.
4. It is the same with propellant. Propellant is 100% rapid gas expansion so it has none of the other destructive energy phases. This is also why it is perfect for launching projectiles. Were these other energy phases present in propellant they would be bombs rather than ammunition.
5. When using propellant, as we do, we take advantage of the characteristic of propellant. We introduce it into the center of the rock and take advantage of the rapid gas expansion to press into the natural fractures and propagate the crack to some extent of completion.
6. The Rock Mechanic science originates from the 1020's Griffith Crack Theory. The theory was postulated after a growing phenomenon of metal ships breaking apart and sinking. It was determined that the welding process was leaving micro-fractures in the metal. Further investigation determined that even though it took fairly significant tensile energy to initiate the crack propagation it too progressively less energy to propagate the crack to completion. This was the mother of invention of metal welding xray. And it is the basis of how our technology fits so perfectly into breaking rock (similar to high explosives) but in a more controlled environment.
7. So as you can see there is no VOD since that is no detonation component to propellant. In fact we had a project many years ago to excavate a rock trench alongside an operation high pressure gas line. The owner was unable to use hydraulic rock breakers as the rock breakers introduced excessive seismic energy beyond the engineering factor of safety. Again our product was the technology of choice as it produced no seismic damage potential as there is no seismic component to propellant.
8. Of course we use 1CM per shot as a baseline relative to free boulders. Insitu excavation will generally be less. There will never be any method of estimating excavation productivity without some actual field experience on any give project. The variables are just too many. However, if you are unable to use high explosives for any reason our technology is the next closest on the Specific Energy curve than any of the other competing technologies. And until the physical laws of nature become repealed relative positioning of rock breaking technologies on the Specific Energy curve will always be the predetermine relative cost to benefit relationship as the basic decision point to start with. You simply need to gain some experience with this technique.