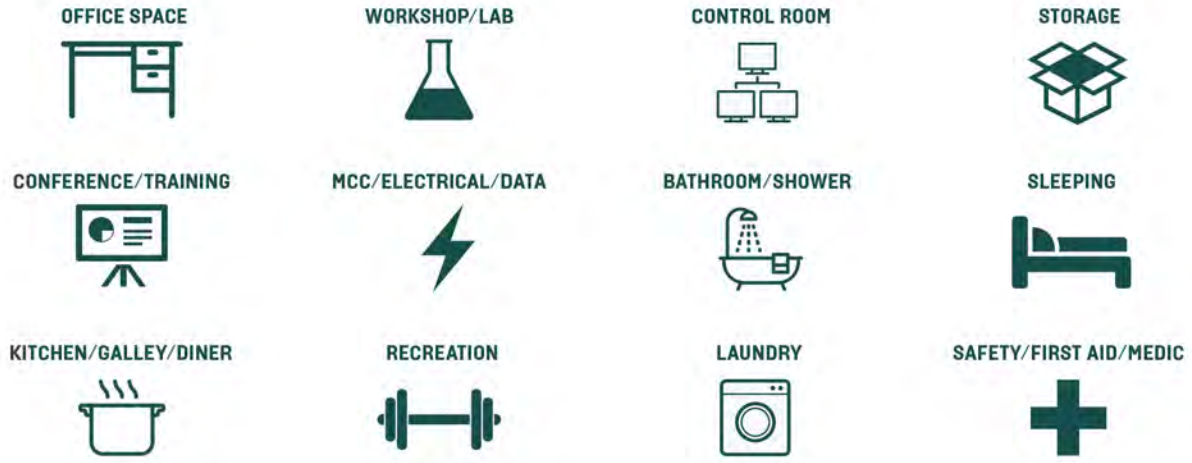
5 CONSIDERATIONS WHEN CHOOSING BLAST RATED MODULES

There's no cookie cutter approach to Blast Resistant Modules. It's one thing to market and promote "Blast Resistant Modules", but every environment, scenario, and project presents its own unique set of variables and requirements. HB Rentals' in-house engineering can support your project team and help design a custom module specific to your blast requirements, or identify a suitable asset from our existing rental fleet.

Here's a quick checklist to consider and ask when requesting a blast resistant, modular solution:

BUILDING USE

The function of the blast rated module to be deployed has to be considered when developing blast criteria for your project. It's important to understand the building requirements and features that are necessary to have a fully functional blast rated module. No generic module will allow you to maximize productivity if your operations are impacted or limited by the equipment that you're required to use.



POSSIBLE BUILDING FUNCTIONS

A partner like HB Rentals will inquire to each of the blast rated modules use and will offer a versatile fleet that be customized for your specific application.

DAMAGE RESPONSE LEVEL (ASCE)

The damage response level references various thresholds to aid in estimating the level of repairs and reuse a building will require after it has been subjected to a blast event. The most commonly referenced damage response level is the one developed by the American Society of Civil Engineers (ASCE). ASCE categorizes damage/response to three levels:

LOW RESPONSE

Localized building/component damage. Building can be used; however repairs are required to restore integrity of structural envelope.

MEDIUM RESPONSE

Widespread building component damage. Building cannot be used until repaired. Total cost of repairs is significant.

HIGH RESPONSE

Key building components have lost structural integrity and may collapse due to environmental conditions (i.e. wind, snow, rain). Total cost of repairs approach replacement cost of building.

All levels will protect personnel in event of a blast. Response levels deal with the usability of a module post blast. Typically, low response modules have a higher cost as they allow the least amount of structural deformity. Modules that contain sensitive and critical equipment are often designed to be low response - however, the response level is dictated by the client's requirement. A good partner will work with the end user, evaluate proper project factors to provide guidance on what response level is acceptable for their unique project.

SEVERITY OF BLAST

The severity of the blast is determined by overpressure. In layman's terms, overpressure is the air pressure or shockwave created by the blast or explosion, which is greater than the surrounding atmospheric pressure. In determining the forces that a module will experience, there are several types of overpressure factors taken into consideration:

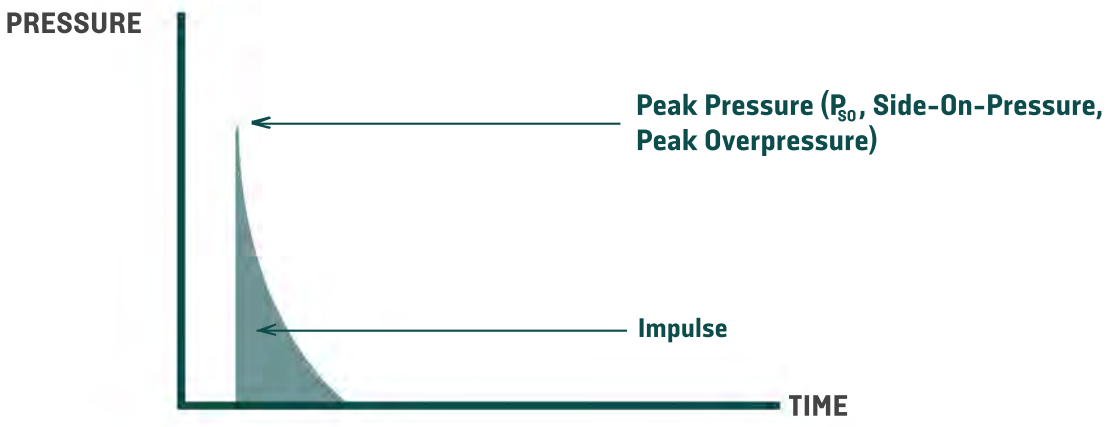


Figure 1

PEAK PRESSURE - the peak value of the blast/explosion. This is also known as the **side-on-pressure** or **peak overpressure.** It is represented by the highest point of the curve in Figure 1.

IMPULSE - relates to the total force per unit area that is applied on a module in a blast. It can be considered even more important than the peak pressure when it comes to designing the blast rated module. It is represented by the shaded area under the curve in Figure 1.

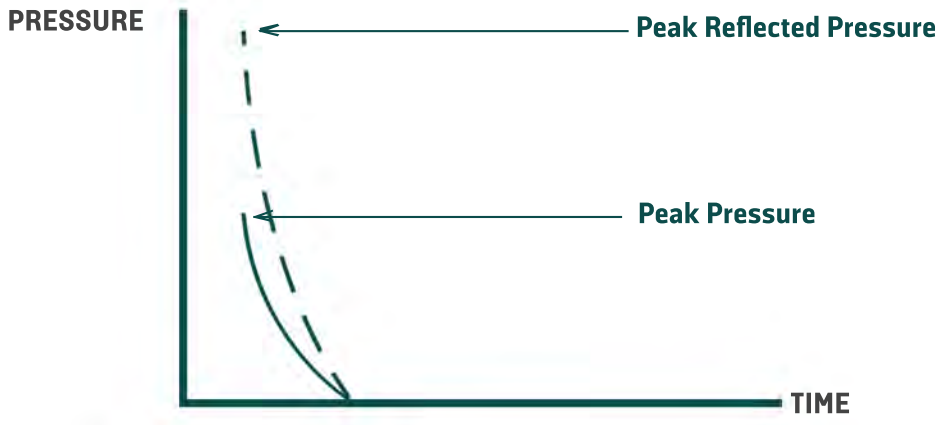


Figure 2

REFLECTED PRESSURE - when the blast wave comes in contact with a hard surface, the pressure is reflected. It is important to note that the reflected pressure is always greater than the initial pressure. It can be several times larger. Figure 2 illustrates the reflected pressure curve vs. the original pressure curve.

In order to further determine the peak pressure, at least two other factors must be accounted for. While there may be a myriad of factors, these two elements always come into play. First is the distance of the module from the blast. The second is the type of blast.

Distance plays a straighfoward, but critical role for blast loading. As one might assume, the peak pressures exerted on the module rapidly degenerate as the distance between the detonation point and target module increases. When it comes to the type of blast, this guide categorizes detonations into three basic types.

FREE AIR BURST - The blast occurs in the air, the blast waves travel outwards and interact directly onto the module without prior interaction with other obstacles or the ground.

AIR BURST - The blast occurs in the air, the blast waves travel outwards and interact onto the structure after having interacted with the ground.

SURFACE BURST - The blast occurs almost at ground surface, immediately interacting with the ground and then travels outward and interacts with the structure.

Understanding the basic physics involved during the blast event, and identifying the proper blast loading has a significant impact on the type of blast resistant module that's suitable for your project.

BLAST DURATION

When developing a blast resistant solution, duration defines the period of time in which the modular building will be impacted in the event of a blast or explosion. Blast durations are typically measured in milliseconds, and this information needs to be taken into consideration when running the blast analysis or calculation for the end users' specific scenario.

When discussing blasts, every fraction of a millisecond counts. If you were to recall how blast impulse is defined in the previous section, it is the area underneath the blast pressure curve. The difference of even one millisecond to the blast duration can easily double the impulse load that the modular structure will have to withstand. (Figure 3)

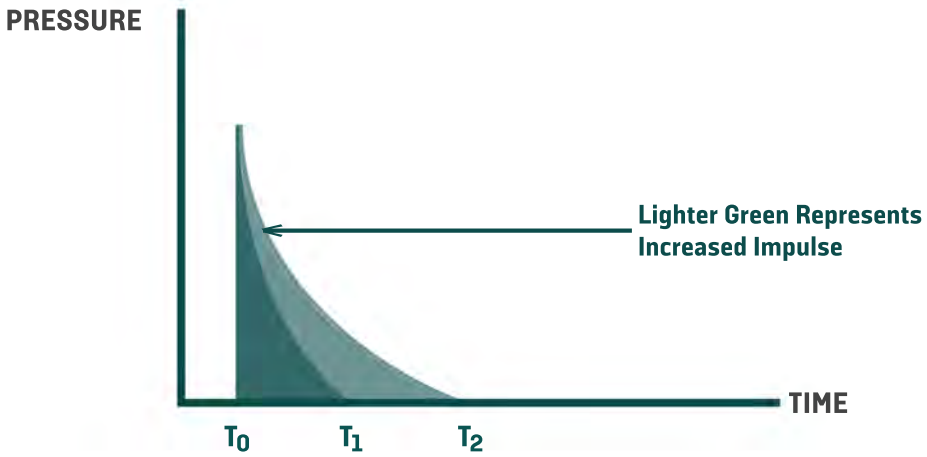


Figure 3

MODULE ANCHORING

Often overlooked with modular solutions, but just as crucial as the overall fabrication of the building, is the application that will be used for securing the foundation of the building.

The decisions made regarding anchoring the modules to the foundation, or not, play a significant role in the environmental criteria that is used to run the blast analysis. The end user will ultimately determine if they want to bolt, lock, or weld the modules in place, or allow the building to rest freely onsite and slide.

EFFECTS OF SPACE LIMITATIONS

It's important to note that sometimes space limitations on a project will restrict anchoring methods. For example, it's rather difficult to implement a slide anchor on an offshore platform.

ABOUT HB RENTALS

We work to simplify the management of your onsite workforce housing needs to ensure you have all the necessary essentials to live and work productively in remote locations. From accommodations to utility services to communications, our custom-tailored end-to-end solutions, specialized expertise and solid execution will help you prevent delays, avoid issues and maximize productivity.

With our core business in the supply and servicing of rental onsite accommodations and the operating essentials necessary to sustain daily workforce living and working needs, we've grown our rental fleet to serving offshore and land projects across six continents. As a leader in both offshore and land accommodation solutions, HB Rentals offers the industry's most diverse fleet of accommodation assets for global, regional as well as local businesses.

HB Rentals
A SUPERIOR ENERGY SERVICES COMPANY

Onsite Accommodation and Operating Essentials

www.hbrentals.com