TecsPak® General Product Sizing Guidelines

The following are guidelines that can be used to size TecsPak General Products. TecsPak General Products have been developed to specific energy capacities. However, every application is unique and the bumpers will perform differently based upon the inputs. The guidelines presented are intended to direct you toward a bumper that will be acceptable in the application, but should be proved out to verify that it provides the necessary cushion and life expectancy. The goal of these guidelines is to recommend a bumper(s) that will absorb the energy impacts with a consistent response and with a goal of a one million cycle life.

General Sizing Considerations:

Based upon the calculated energy input, it is recommended that bumpers be selected that have the required energy capacity (We) with a bumper travel of between 50 and 90% of rated stroke. Bumpers with a stroke of greater than 90% will tend to take an excessive amount of compression set and may not provide a sufficient life expectancy. The life can further be affected by the limiting factors discussed below. Bumpers which have a stroke at the energy input of less than 50% of maximum stroke are over rated and lose some of their cost effectiveness.

It should also be pointed out that part of the energy calculation is the effect of a propelling force. A propelling force is any force that acts on the bumper throughout its stroke. For horizontal applications, this can be a device such as an electric motor that is moving (propelling) the object into the bumper. For vertical applications, this will be the weight of the object. The energy from the propelling force is equal to this force (weight) times the deflection of the bumper. This is influenced by the bumper selected as different bumpers will deflect different amounts based upon the energy (potential or kinetic) input.

Limiting Factors:

The ideal application for a bumper is at room temperature with a cycle rate of less than one per minute. However, in the real world, this is seldom the case and we must take these factors into consideration when selecting a bumper that will provide an acceptable life and performance. The method used to account for these factors is to oversize the bumper. By oversizing, we increase the energy input so that a larger bumper is required to meet the standards.

Temperature:

TecsPak bumpers are rated from -40° to 120°F (49°C) for normal operation. While the bumpers will be stiffer at the colder temperatures (see Temperature Effects document), they will warm up with use because TecsPak does absorb some of the energy (Wa) and converts that energy to heat. At elevated temperatures, this can be a problem because as more heat is added, the bumper becomes even warmer and can fail due to melting. For this reason, we modify the energy input by increasing the energy input by 2% for every degree of ambient temperature over 100°F (38°C). This holds true up to 150°F (65°C). Above this temperature, it is recommended that the factory be contacted to determine if there is any bumper we can recommend.

Cycle Rate:

Ideally, the bumper should be cycled no more than one time per minute. However, we realize that in many applications, this is not the situation. As mentioned above, TecsPak takes some of the energy input (We) and converts it to heat (Wa). The remaining energy is put back into the system. If a bumper is cycled at a quick rate and too a significant amount of travel, the bumper will heat up due to the hysteresis (absorbed energy Wa). If the bumper is not allowed to dissipate this energy to the environment in a timely manner, it will continue to heat up with detrimental effects. Because the bumper is warm, it will deflect more to absorb the same amount of energy. The more it deflects, the warmer it gets. Eventually, the bumper may actually start to melt.

To avoid this from occurring, we recommend that the energy be modified per the following schedule. Any bumper that is cycled between 1 and 2 time per minute, should have the energy doubled (multiplied by 2). Any time the bumper is cycled between 2 and 4 times per minute, the energy should be tripled (multiplied by 3). We do not recommend that axial bumpers be cycled any faster than 4 times minute. For applications where the bumper is cycled between 4 and 60 times per minute, we recommend that only radial designs be used.

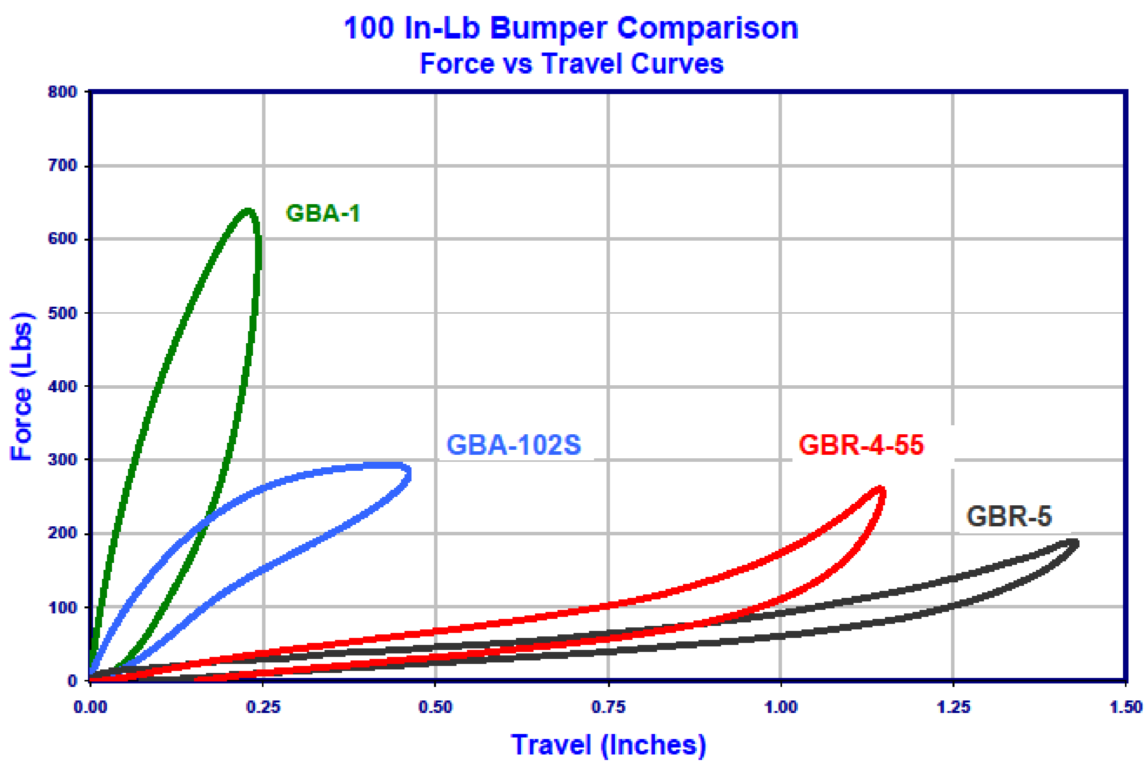
Basic Sizing Procedure:

The basic procedure we would recommend is to first, calculate the input energy – either potential or kinetic. Next, modify this energy by any of the Limiting Factors discussed above. Based upon this calculation, select bumpers that are rated at 25% greater than the calculated value. This should get you to bumpers that qualify for the 50 – 90% of travel at rated energy recommendation. In viewing the dynamic charts, find the rated energy on the energy curve (single line) and drop down to the horizontal axis. This will provide the height of the bumper at this energy input. Calculate to see if the travel (height minus free height) is in the acceptable range.

Next, calculate the amount of increased energy for a propelling force, if any. This may become an iterative process because the added energy may place the bumper travel outside of the recommended range. If so, you will need to go the next bumper and redo all of the calculations. Continue until there is a bumper that meets the recommendations.

Final Selection Considerations:

It is possible and most likely that several bumpers will meet your requirements. At this point, a selection can be made based upon factors such as size, end force, travel and other factors. In fact, it is quite common for bumpers of different configurations and types to overlap based upon rated energy capacity as is shown below.



As can be seen, all four bumpers are rated at a similar energy, but have significantly different performance curves. If there is limited space and end force is not critical, the GBA-1 might be the best choice. If longer travel with a softer initial spring rate and lower end force is important, the GBR-455 or GBR-5 would be a better selection. Finally, a compromise between all of the considerations would be the GBA-102S which is midrange in both travel and end force.