Little Secret about Big Harnesses

This article is more about capacity ratings on all fall protection equipment, not just harnesses, but I liked the title. A common issue is a harness labeled "capacity:130-310 lbs." and people needing to use the harness over or under the label limit. People are concerned with the use of the harness thinking it's either illegal or dangerous because it's clearly against the manufacturers' label. In regards to the performance of the harness, the capacity (weight of the person), isn't a critical factor. The little secret about big harnesses is a harness approved for use at 400-pounds is the same harness approved for use at 80-pounds, just more webbing. User weight is important, but not in regards to the harness. Harness fit, location of straps, and correct application of D-rings are more important than user weight. User weight is one of the three variables that determine the force on the body, which we want to keep as low as possible, but the harness isn't part of that equation. I'll do my best to summarize.

The first point to discuss is **energy**. The weight of the user affects the amount of energy in the fall arrest system. The heavier the person, the more energy involved; pretty straightforward. A 400-pound person falling the same distance as a 300-pound person will have more energy to address. There are only three ways to reduce energy during fall arrest. 1) Decrease the distance of the fall (free fall), 2) increase the braking (deceleration) distance, or 3) reduce the weight. Since people come in all sizes, an employer has very little control over the weight. Weight is fixed for each person; they are going to weigh what they weigh. The point to be made is the harness does not have any influence on the variables that affect forces; weight, free fall distance, and deceleration distance. Harnesses have an ultimate breaking strength; they should not have a capacity. Harnesses will hold whoever is in it until forces get into the breaking strength of the harness, which is above 3600 pounds. If anyone uses a fall arrest system that reaches the breaking strength of a harness, there are several other significant issues.

To keep people "*safe*", arresting forces must be controlled so the highest force experienced (maximum arrest force) is still low enough that the user will not be injured. The harness is part of the system, but it isn't the harness that determines the force on a person when they come to a stop. The connecting equipment between the harness and anchor does this part. The harness is certainly an important part of the system, but it has no influence on free fall or deceleration distances. The harness' job is to be strong enough to hold, contain the worker, and connect to the rest of the equipment. The connecting equipment and where it's anchored determines how far someone falls and what slows them down, not the harness they have on. Before any of the techie people chime in that D-ring slide, deploying harness indicators, elastic harnesses, and the compressing of the harness around the body accounts for some deceleration, I agree, however, the amount of deceleration is inconsequential and cannot be relied upon. The energy absorbing component of the connecting means is where reliable deceleration occurs, not in the harness.

A person will fall a distance before the equipment catches (free fall distance). Once the equipment catches, it will stretch, clutch, or deploy its' brakes (deceleration). It's important with connecting equipment to align the fall distance, deceleration distance, and user weight to keep arresting forces to an acceptable level. These three variables, and manipulation of these three variables, determine how hard someone comes to a stop. Again, stopping forces can only be lowered by (1) reducing weight, (2) reducing free fall distance, and (3) increasing deceleration distance. So, the secret is a harness approved for use for a 400-pound person is the exact same harness as the one manufactured for a 130-pound person (other than the lengths of webbing of course). It has the same buckles, d-rings, webbing, pads, and construction methods. All harnesses have a breaking strength above 3600 pounds. The breaking strength for the 85-pound person harness is the same breaking strength for the 400-pound person harness. The only difference is the use limitations put on it.

To safely use a harness for a 400-pound person, extra limitations on the connecting equipment to reduce free fall and increase deceleration must be considered. To be really outrageous, but accurate, we could use a harness for

a 600-pound person. We just have to put extra limitations on the connecting equipment to control free fall and deceleration distance. We'd have to question our morality of putting a person this size into fall arrest equipment, how to rescue them, and what other health issues are associated with the increased weight, but the harness still has the same breaking strength and, if forces are controlled, will work.

The second point to discuss is the **harness objective**. A harness has two critical performance objectives. The first is the containment of the body and the second is connecting to the system. Neither of these is influenced by the user's weight. A harness has no impact (pardon the pun) on the arresting forces that a person realizes during fall arrest. It must contain the person, so they do not fall out of it and be strong enough to remain connected to the rest of the system. We can make a much longer list of harness objectives like keeping a worker upright, directing forces to the pelvis, adjusting for size variations, hi-vis, fireproof, holding accessories, waiting for rescue, looking cool, cupholders, etc., but these are secondary to containment and connections. From a performance point of view, the harness has the same purpose as an anchor; just be strong enough to hold, which all ANSI (and CSA, and EN, etc.) harnesses will do.

Follow this link to research studies and reports regarding fall arrest systems, acceptable forces on the human body, harness design, and several other topics. https://wahmember.com/page-18204

The third point to discuss is the **label**. It's the label that causes most of the issues. People think the harness will fail if a person is over the weight limit or it's illegal if the person is outside the printed range. In some respects, printing the user-weight on the harness (and anchorage connectors) isn't the right spot for it. It needs to be on the connecting equipment (which it is for ANSI compliant products) along with acceptable free fall distances. Fall protection equipment that directly affects free fall and deceleration is where the capacity label (user weight) is best suited. Most products produced in the US follow ANSI Z359 standards, whose scope is for products between 130-310 pounds. History and OSHA regulations are the main reasons this weight is being used. The legacy of 130-310 pounds being printed on all labels has been carried over for decades. Obviously, there are people outside of this weight range that still work at height, so the equipment has to be modified accordingly. OSHA allows for this variation (link provided below) so every manufacturer looks closely at their product line and determines what is the lowest (below 130) and highest (above 310) that the associated connecting equipment can handle, run the appropriate tests, and label the harness accordingly (remember it's the same harness). Unfortunately, there are all kinds of labeling conflicts being created with different PPE having different capacities.

Link to OSHA's direction for fall arrest systems used with capacities over 310-pounds.
https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.502

I completely understand the issues that are created when a label says one thing and we do another. I know I can't just discount the capacity printed on the label, even if it's irrelevant to the performance of the harness. It's printed on the product, have to follow it, I get it. It's going to take a few more years to straighten out labeling requirements, in the meantime, focus on the connecting equipment and system capacity. Harnesses don't fail if a person is over the harness label capacity; systems fail if the forces are too high…. and the harness isn't involved in that part.

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