

## Chapter III – Bodywear

### 3.1 Full Body Harness



A “full body harness” is a type of personal protective equipment (PPE) worn by the worker to provide support from different “D-Rings” during the activities of fall restraint, positioning, and fall arrest.

#### Wearing it Correctly

The full body harness (FBH) will only fully protect the worker if it is worn correctly. Workers are often seen wearing harnesses that are way too loose that will become quite dangerous in a fall.

Significant injury can happen when a loose harness rides up on its user in a fall, imparting high forces on parts of the body other than the major muscles and bones of the thighs.

The first step to the entire process of “donning” (putting on) of a harness is realizing that they are not “one size fits all;” there are 4 different sizes. MSA’s sizing chart uses the factors of (1) height and (2) weight of the worker.



**Harness Size Chart for V-SERIES Harnesses**

ft. (m)	110 (50)	130 (59)	150 (68)	170 (77)	190 (86)	210 (95)	230 (105)	250 (114)	270 (123)	290 (132)	310 (141)	330 (150)	400 (181)
6'-6" (2.0)													
6'-4" (1.9)													
6'-2" (1.9)													
6'-0" (1.8)													
5'-10" (1.8)													
5'-8" (1.7)													
5'-6" (1.7)													
5'-4" (1.6)													
5'-2" (1.6)													
5'-0" (1.5)													

## 3.2 Harness Basics

Full body harnesses replaced body belts as the only approved form of “bodywear” permitted by OSHA for *use in fall arrest* situations starting in January of 1998 due to their ability to more safely focus fall forces into the legs and hips, away from the abdominal region.

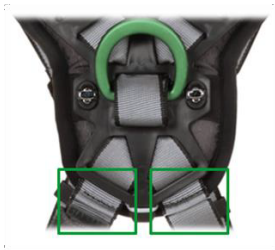


The full body harness is a much more complex piece of equipment that has many parts and pieces that bear discussion at this point. There are 4 main parts to any harness; they include:

### 3.2.1 Webbing Parts / Inspection


The webbing consists of the grey and black straps that can be seen on this V-FLEX harness. In some cases, it is covered by padding, as is the case here with the shoulder straps.

- Thigh Straps – These distribute forces to the muscles and bones of the thighs.
- Sub-Pelvic Strap – Many harnesses will have a strap that joins both sets of leg straps on the back side of the harness below the wearer’s buttocks. This strap is designed to transmit forces applied during fall arrest and post-fall suspension to the pelvic area.
- Torso & Shoulder Straps – The rest of the straps on the harness are used to encapsulate the top part of the worker’s torso. On the front of the harness, adjusters allow harness tightness to loosened or snugged down. Shoulder straps pass by on either side of the neck and will hold the harness on the wearer in a head-first fall.
- Load Indicator – Another webbing feature that will be found on a harness is what is known as the “fall arrest load indicator” (pictured to the left). This is a fold of webbing that has been sewn into place by a single, straight stitch with the purpose to rip free when fall forces are applied.



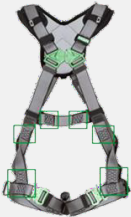
When “deployed” it will expose a tag underneath to tell the inspector to immediately remove the harness from any further service permanently.

Note: This will often be referred to as a “tattletale.”

Web Inspection Points	
<ul style="list-style-type: none"> <li>Cuts, tears, &amp; frays that weaken the webbing.</li> <li>Permanent discoloration, which is an indication of chemical or UV radiation deterioration.</li> <li>Burns or melted spots from “hot work” activities.</li> <li>Writing on webbing must be done with a “non-toxic” <b>ASTM D 4236</b> Marker.</li> </ul>	


### 3.2.2 Stitching / Inspection

Stitching unites different straps of the harness together. Usually it will come in the form of a “box” or a “honeycomb” style, and its purpose is to unite the various of lengths of webbing that come together to form the full body harness.

Stitching Inspection Points	
<ul style="list-style-type: none"> <li>There should not be any broken threads in the stitch itself.           <ul style="list-style-type: none"> <li>Note: The end of a stitch, known as its “tail,” may look like a broken thread.</li> </ul> </li> <li>Check straps to ensure that they are not pulling apart, even if the stitch is intact.</li> <li>Ensure that the entire stitch is in-place, not coming undone. The entire “box” or “honeycomb” stitch needs to be in-place and not unraveling.</li> </ul>	

### 3.2.3 Tags / Inspection

The tag is a very important source of information that will tell about many important features of the harness such as when it was manufactured, its capacity as well as size, and what its designated uses are.

Tag Inspection Points	
<ul style="list-style-type: none"> <li>Is the tag <b>present</b> and completely <b>legible</b>?</li> <li>Harness Capacity - Make sure the user weight with all tools doesn’t surpass what is listed.</li> <li>Service Life - Tritech states that its fall protection equipment does not have a “service life” of a specified number of years (5 was a common number in the past) if it passes regular <b>pre-use</b> and <b>competent person</b> inspections.</li> </ul>	

### 3.2.4 Hardware (D-Rings & Buckles) / Inspection

#### 3.2.4.1 D-Rings

One of the most visible types of “hardware” on a harness is the “D-ring.”



Harnesses can have a variety of different D-shaped rings that serve a number of purposes. The most important is the fall arrest attachment known as the “dorsal D-ring.” This dorsal (back) ring serves as the fall arrest attachment point for the worker’s connection device and must be located where the rear shoulder straps cross between the shoulder blades.

The location of the back D-ring is important because it affects one’s body orientation after a fall and influences the motion of the body, and distribution of forces upon it, during fall arrest.

- If the back D-ring is positioned between the worker’s shoulder blades, they will be suspended at **an angle less than 30 degrees** from vertical, a requirement by law.
- If the back D-ring is positioned too **low on the worker’s** back they will be suspended in a more horizontal position after their fall is arrested, causing significant distress.

Besides the dorsal “D,” a harness may have a variety of other rings that serve other purposes. The symbols that follow will be found on any equipment meeting the requirements of the Canadian Standards Association (CSA), a non-governmental, standards development body that oversees equipment design.



#### CLASS A: FALL ARREST –

A Class A harness is designed to support the body during and after the arrest of a fall. This is the most basic form of full body harness and is denoted by the back or “Dorsal D-Ring.”



#### CLASS D: SUSPENSION & CONTROLLED DESCENT –

Class D harnesses are designed for suspension or controlled descent from heights. In addition to having the Class A connector, they will have one or more rings at waist level used for rappelling type activities.



**CLASS E: LIMITED ACCESS -**

Class E harnesses are designed to support the user in a position that “reduces the worker’s profile” during passage into a confined space. This type of harness must have a connector on each of the shoulder straps. The D-rings on the shoulder straps are connected to a “spreader bar” so that the worker can be lowered into a tight space.



**CLASS L: LADDER CLIMBING -**

This type of a harness carries a D-ring on its front for attachment to *permanent* vertical lifeline systems (ladder safety systems) of the sort discussed in anchorage connectors.



**CLASS P: WORK POSITIONING -**

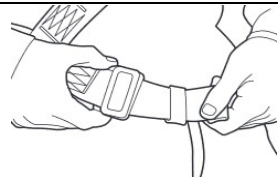
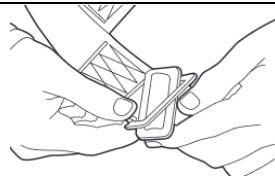
Class P harnesses are used to perform work positioning (one of the three applications of the Personal Fall Protection System). The worker has a D-ring on either side of their harness into which they connect a positioning lanyard which is used to connect out in front of them so that they can work hands-free in a vertical position; the lanyard at their waist becomes the “third point of contact.”



**3.2.4.2 Buckles**

Hardware sometimes is in-place to (1) connect straps together or to (2) make adjustments in harness fit.

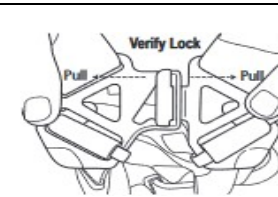
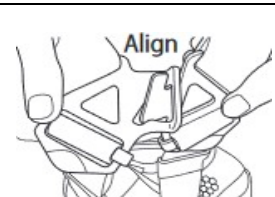
**Mating Buckles -**



These buckles, called the “Qwik-Fit”, are the most basic of those that can be found on a harness. There are a “male” and a “female” side to this connector.

To buckle, slide the male side of the buckle through the slots that can be seen in the right side of the photograph.

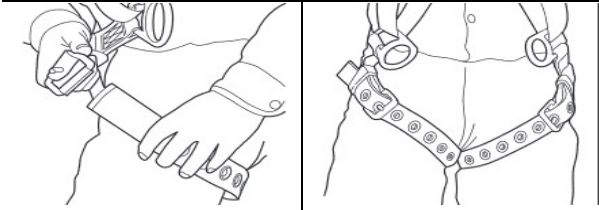
**RaceForm Buckle -**



This buckle works on a similar concept to that of the mating buckle above (with a male and a female side).

Here the main difference is that the entire chest strap (a traditional feature on most harnesses) has been eliminated in favor of this buckle, which leads to a much more snug fit.

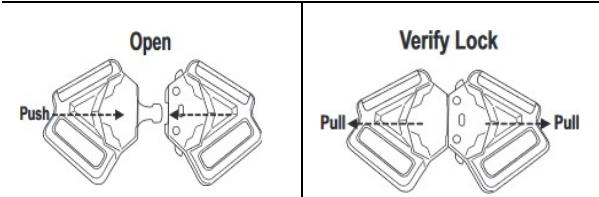
**Tongue Buckle -**



This very popular buckle works much like a belt for each leg on the bottom of the harness.


One end of the strap has a buckle with a roller and a “tongue” and the other strap that connects into it has various holes along its length known as “grommets” through which the tongue is passed to hold the strap.

**Quick Connect -**



The quick connect, with this version being known as “RaceFlex”, locks like a car seatbelt. The user simply slides the two ends together until they click into place.

To unlock, the wearer must press on two ears on either side of the female buckle at the same time, pulling apart.

Hardware Inspection Points	
<ul style="list-style-type: none"> <li>Any cracks, bends, or breaks in the metal itself.</li> <li>Corrosion, which can show up as red rust or flaking of metal off the hardware, or pitting (which shows up as small holes down in the metal).</li> <li>Sharp edges where the metal has been worn down below its initial thickness or diameter.</li> <li>Check the webbing <i>below hardware</i>, where possible, for damage or staining.</li> </ul>	

**3.3 Specialty Harnesses**



- Meant for tower climbers.
- Incorporate a seat for suspended positioning

V-FIT Tower Harness w/ Seat



- Designed for situations of potential arc flash.
- 40 cal / cm<sup>2</sup> rating

EVOTECH Arc-Rated Harness





- Kevlar webbing
- Hot work activities, harsh work conditions that could cut a normal harness

Gravity® Welder



- Easy-to-clean coating on web
- Built for dirty environments or where clean PPE is critical

Gravity® Urethane-Coated



- Wide assortment of D-rings for varied activities
- Designed to be a rescuer's harness

Gravity® Suspension



This final specialty harness takes care of a need on *many* workers' minds: that of self-rescue. The "PRD," as it is known, comes with spool of thin rope up to 65' in length that sits compactly on the worker's back in a pouch. During a fall, it will bring the worker to a stop. The worker can then pull a cord that initiates play-out of the line, beginning a controlled descent to the ground.

An important additional feature is a rescue pole that can be purchased separately to activate the descent feature of an unconscious worker who has fallen and who is completely unable to further help themselves; with the pole, a rescuer can activate their system.

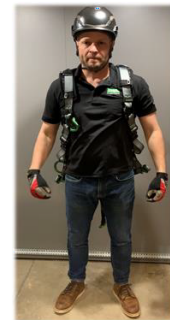
Personal Rescue Device (PRD)

### 3.4 Harness Donning

#### Step 1

After having loosened the straps through the adjustment, undo all buckles and shake the harness while lifting it by the back D-ring. Straighten any twisted webbing.

With the sub-pelvic strap behind you, hang the harness on your shoulders, letting it drape down. Ensure that the sub-pelvic strap is properly located. Fall arrest systems must transmit force primarily to the pelvic and upper thigh regions of the skeletal system. These are the strongest parts of the body, and they're best located for distributing force away from the vulnerable organs of the midsection and the spinal column. Center the back D-ring between the shoulder blades, adjusting as necessary to ensure proper placement.



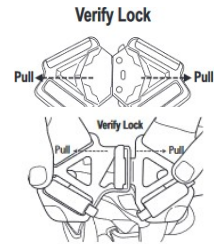
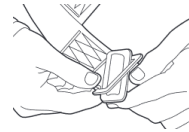
### Step 2

Begin by fastening the chest strap. As mentioned previously, this strap holds the shoulder straps in-place and must remain tight enough to retain the harness over the shoulders in a fall.



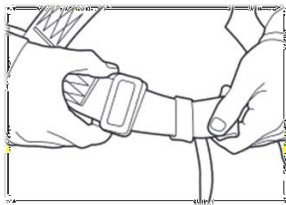
For the quick-connect buckle, push together, ensuring that both sides are fully connected and both locking pawls (“ears”) are engaged. Pull on the shoulder straps to verify sides are locked.

For Qwik-Fit™ or RaceForm buckles, connect the male and female sides of the buckle.

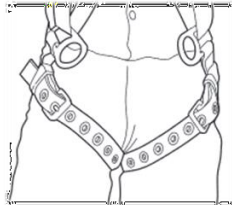


### Step 3

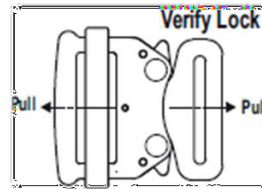
Leg strap connectors could be any of the following styles. Regardless of type, pull one strap at a time between your legs, ensuring that it is not twisted before connecting.



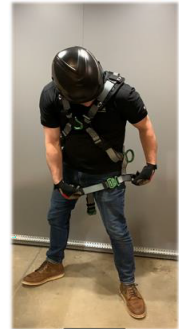
Mating Buckle



Tongue & Grommet



Quick Connect



### Step 4



Adjust the torso / shoulder straps for a snug, comfortable fit by pulling down on the torso webbing ends, as is being demonstrated in the picture to the left. By pulling down on the webbing through the friction buckles, not only will the shoulder straps be pulled tight to the shoulders, but the leg straps will also tighten down on the thighs.

This is a good time to walk around a bit in the harness to check for comfort and to ensure that the leg straps do not move up and down with movement. It is key that fall forces are properly imparted on the parts of the body able to take them in a fall:

1. the shoulders in a head-first fall &
2. the thighs in a feet-first fall. Use the web keepers to stow any excess webbing.



### 3.5 Harness Cleaning

Clean the equipment with a solution of water and mild laundry detergent. Dry hardware with a clean cloth and hang to air dry. Do not speed dry with heat. Excessive accumulation of dirt, paint, or other foreign matter may prevent proper function and, in severe cases, weaken the webbing. To clean Secure-Fit Buckles and Quick Connect Buckles remove foreign material with a cotton swab. In dusty environments, fine particles can prevent proper function of the buckle. Dip the buckle in clean water to flush fine particles. Remove excess water and allow to air dry. Questions concerning conditions and cleaning should be directed to Trittech Fall Protection.



### 3.6 Storage



Store the equipment in a cool, dry, and clean place out of direct sunlight. Avoid areas where heat, moisture, light, oil, and chemicals or their vapors or other degrading elements may be present. Equipment which is damaged or in need of maintenance should not be stored in the same area as equipment designated as unusable. Heavily soiled, wet, or otherwise contaminated equipment should be properly maintained (i.e., cleaned & dried) prior to storage. Prior to using equipment which has been stored for long periods of time, a formal inspection should be performed by a competent person. Store harnesses with the buckles connected.

### 3.7 Caution

#### Caution - 1

If any of the previously stated conditions (from the Inspection section) exist, your harness may not be safe.

**DO NOT WEAR IT!**

**ANY HARNESS SUBJECTED TO ARRESTING A FALL MUST BE REMOVED FROM SERVICE.**



#### Caution - 2

Do not use solvent base solutions to clean or identify your harness.

#### Caution - 3

It is always good practice to store your harness away by hanging it up by the dorsal D-Ring.

