



## Safety At Heights

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## We'll Cover

- Fall Hazard Identification and Analysis
- Dynamics of Fall
- Fall Protection
- The Components Of A Personal Fall Arrest System
- Fall Protection Equipment Selection and Use.
- Fall Rescue
- Inspection
- Standards Update

## When is fall Prevention Required

- Unprotected sides and edges.
- Leading edges
- Excavations
- Ramps, Runways and other walkways.
- Low-sloping Roofs
- Steep roofing Work
- Precast Concrete Erection
- Formwork and reinforced steel work
- Residential construction
- Maintenance of Equipment
- Equipment Installation
- Hoisting Areas
- Other walking and working surfaces.
- Over 6 feet in Height




## Solution!!! Hierarchy Of Controls

- Engineer out the hazard
  - Bring work to ground / use railings
  - Design Out Hazard
- Work practice controls
  - Prohibit workers to be at heights
  - Utilize Mobile Platforms.
- Use Personal Fall Protection Equipment
  - Harnesses, lanyards, anchorage connectors
  - Limit Fall Distance
  - Reduce Forces

## Fall Hazard Analysis

- Identify reason for exposure.
- Fall Hazards
- Additional Risk and Hazards
- Rescue Ways and Means
- Evacuation Ways and Means
- Corrective Action
- Training

### Fall Hazard Identification Data Sheet

REF. NO. _____	
SOURCE: Date: _____ City: _____ State: _____	
REFERENCES: Title: _____ Date: _____ City: _____ State: _____	
LOCATION: City: _____ State: _____ Country: _____	
REASON FOR EXPOSURE TO HAZARD: _____	
FALL HAZARDS Unprotected Edge _____ Unprotected Floor _____ Unprotected Opening _____	<input type="checkbox"/> Fall Distance <input type="checkbox"/> Under 6 Ft. <input type="checkbox"/> Over 6 Ft. <input type="checkbox"/> Over 8 Ft.
ADDITIONAL HAZARDS Unprotected Edge _____ Unprotected Floor _____ Unprotected Opening _____	<input type="checkbox"/> Working/working Surface <input type="checkbox"/> Shock /uplift <input type="checkbox"/> Special Situation <input type="checkbox"/> Other
RESCUE WAYS AND MEANS: _____	
EVACUATION WAYS AND MEANS: _____	
HAZARD ANALYSIS <input type="checkbox"/> Preliminary <input type="checkbox"/> Final	Annual Exposure Time: Less than _____ 10-199 hrs. _____ 200-999 hrs. _____ 1000 hrs. _____
CORRECTIVE ACTION <input type="checkbox"/> Preliminary <input type="checkbox"/> Final	Severity: <input type="checkbox"/> High <input type="checkbox"/> Considerable <input type="checkbox"/> Medium <input type="checkbox"/> Low

## Fall Protection

- Housekeeping
- Guard Rails
- Safety Nets
- Positioning Device
- Warning Line System
- Control Access Zones
- Safety Monitoring
- Fall Arrest System (Still going to Fall!)



## How Fast Does A Fall Occur

- You Can Blink Your Eyes Three Times In One Second
- 1st Blink - 18" departed From where started
- 2nd Blink - 6' departed and looking for handhold
- 3rd Blink - 13' departed and traveling 25' per second per second
- You are now building up your fall force



### FORCE

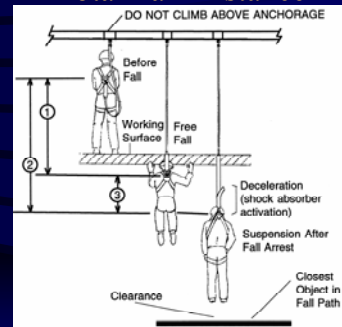
- Force = mass x velocity
- velocity = time over a distance x acceleration

### EXAMPLE

- 200lb. Worker
- Falls a distance of 5ft. takes .57 sec.
- Acceleration = 32ft/sec<sup>2</sup>
- Velocity = .57 x 32.2 = 18.354
- Pounds of Force = 200 x 18.353 = 3670.8



## Total Fall Distance



$$TFD = FFD + DD + HEFF + VEL + SF$$

Total Fall Distance = Free Fall Distance + Deceleration Distance + Harness Effects + Vertical Elongation + Safety Factor

## Fall Arrest System

- The Full Body Harness  
Connects to the...
- Lanyard  
Connects to the...
- Anchorage Connector



Personal Fall Protection starts with:

- Fall Restraint - Body Belts, *used as travel restriction or work positioning devices only*
- Fall Arrest - Full Body Harness with appropriate force limiting accessories



The First Component Of A Personal Fall Arrest System

- Full Body Harnesses
- Provides skeletal support with:
  - D Rings (Up to 4)
  - Body Straps
  - Leg Straps



### Full Body Harnesses Can Be Accessorized

- Add-On
- Support / Positioning Belt
- Tool Belts
- Back Pads
- Leg / Shoulder or Back Pads
- Lanyard Retainer Clip
- Medical ID Tags



### Specific Use Harnesses

- Specialty Harnesses Are Available among them:

- Tower Worker
- Tactical / S.W.A.T.
- Bucket Truck (no metal parts above waist)
- Riggers (Rescue/Theatre)
- Welding (hot metal)



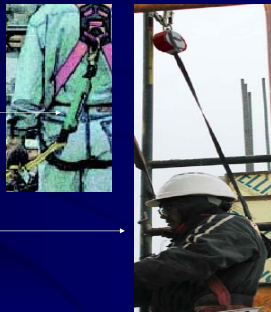
The Second Component Of A Personal Fall Arrest System Is The Lanyard

- Ties off with appropriate attachment devices to anchorage connector and harness
- Limits fall forces



### To Limit Fall Forces

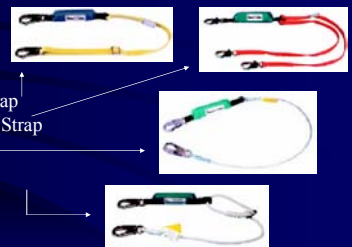
- Absorb energy of fall
- Limit fall distance



### Shock Absorbing Lanyards

A number of materials for a number of jobs

- Pouch Style
- 1" Nylon Web Strap
- 1" Polyester Web Strap
- Wire Rope
- Nylon Rope



## Shock Absorbing Lanyards

A number of *materials* for a number of jobs

Integral web style shock absorber (shock absorption is built into the webbing)

- Nylon
- Polyester
- Polyester and expandable



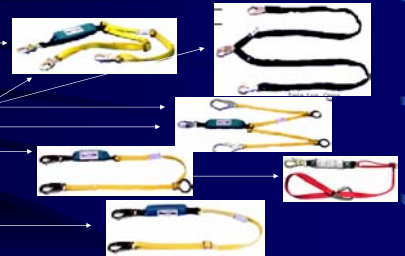
The lanyards above allow for bi-directional use

## Shock Absorbing Lanyards

A number of *configurations* for a number of jobs

Styles

- Twin-Leg
- Tie Back
- Adjustable Length



And Numerous Combinations

## Self Retracting Lanyards

Several *configurations* for a number of jobs



- Nylon Line
- Wire Rope

The line locks and shortens a fall



## Restraint / Positioning Lanyards

A number of *materials / configurations* for a number of jobs

- Nylon / Polyester Web
- Wire
- Chain
- Nylon Rope
- Kernmantle Rope

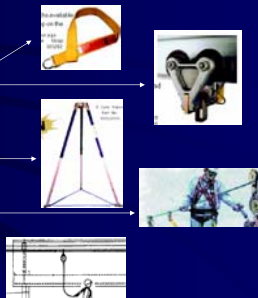


## Anchorage Connectors

connect lanyard to anchor point

They are all shapes and sizes

- A simple strap
- An I-Beam trolley
- A tripod
- A wire rope lifeline
- A rigid rail



## And Snaphooks & Carabiners Forever

And all snaphooks



And all carabiners

MUST BE



Dual-Action Locking Style



Remember - *Never connect two active gates*

## Anchor Point

- And all of that:
- Harness
- Lanyard
- Anchorage Connector
- We tie off to an anchor point



A point that only needs to be strong enough to be able to hang 5000 lb. from (or 2 times the maximum arrest force it could be subjected to.)



## ~~The End~~

oops someone fell

### Rule

If we put someone up at risk, we ought to be able to get them down if they fall and cannot regain footing or are unconscious



### Right?



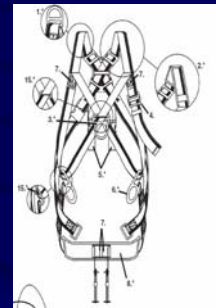
## Fall Rescue

- If the victim is conscious and unhurt how long do we have to get the person down?
- Sometime before the whistle blows - can't pay overtime for a guy hanging around.



## Inspection

- User Inspection
- Formal Inspection



## User Inspection

- User of fall protection equipment must inspect equipment before each use.
- Follow guidelines as specified in manufacturer user instructions.
- Remove from service if any concern about condition of equipment

## Formal Inspection

- Performed by competent person different from user.
- Required by manufacturer to occur every 6 months typically.
- Follow inspection as outlined in instruction manuals
- Document formal inspections in a detailed inspection and maintenance log.

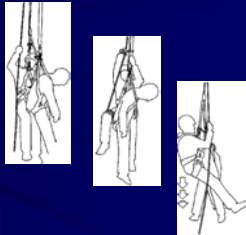
## Z359 Standard Changes (First Since 1992)

- Addresses a critical need for guidance in creating fall protection programs
  - Clear Lines of Authority and Responsibility
  - Detailed Job Planning
  - Expanded Training
- Broadens the scope of standard to include additional work tasks and equipment types
  - Work Positioning
  - Travel Restraint
  - Rescue
  - Rope Access
- Improves strength and performance of products intended to protect worker health and safety
  - Establishes Testing Requirements for some fall protection equipment
  - Increased snaphook & carabiner gate strength
  - Additional testing for twin leg lanyards
  - Establishes minimum requirements for positioning, restraint and

## Z359 New Standard Release

- Approximately 250 pages of New Documents.
- Estimated publication in late 2006.
- Provisions of Z359.1 dealing with gate strength will take effect on March 1, 2007.  
(Proposed)

- The written fall protection plan worked
- The written rescue plan worked
- The plans are reviewed on an annual basis



**Questions?**