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# Fall Protection Hardware Development

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# Introduction

- Behind the scenes look at Fall Protection Hardware Development

# Topics of Discussion

- Falling: The statistics
- Testing - ANSI Z359.1
- Future Direction - ANSI Z359.1
- Product Development
- Manufacturing

# Falling: The Statistics

- 53\* Deaths
- 3800\* serious injuries

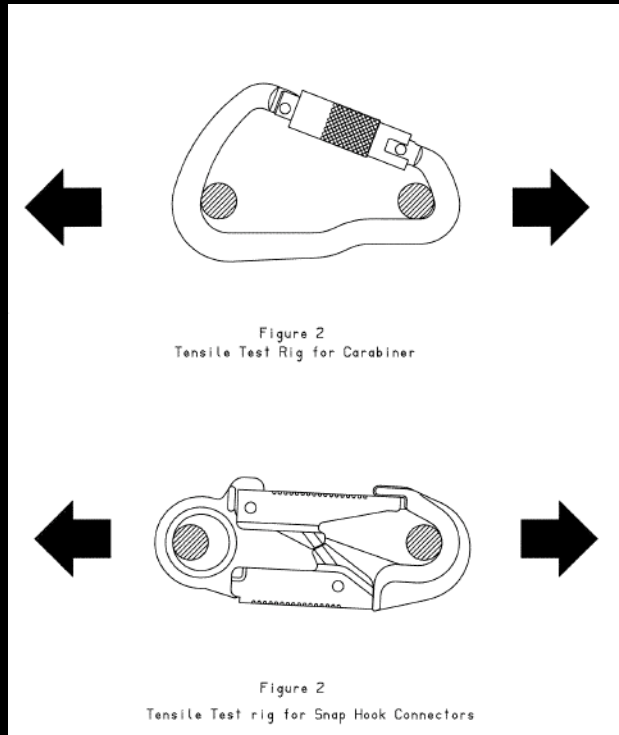
\* 2004-5 data from HSE (Health and Safety Executive)

# Testing - ANSI Z359.1

- Hooks/Carabiners
- D-Rings, O-Rings, Oval Rings
- Buckles, Adjusters
- Corrosion Resistance

# Testing - ANSI Z359.1

- Hooks/Carabiners: Tensile



# Testing - ANSI Z359.1

- Hooks/Carabiners: Gate Face Load

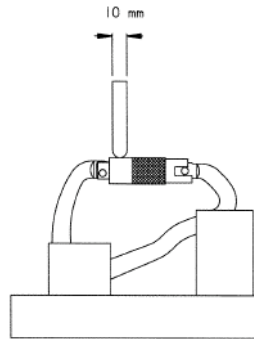


Figure 3  
Gate Face Test Rig for Carabiner

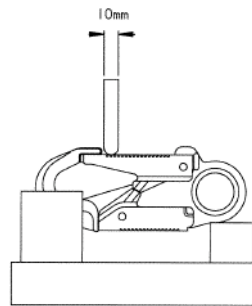


Figure 3  
Gate Face Test Rig for Snap Hook Connectors

# Testing - ANSI Z359.1

- Hooks/Carabiners: Gate Side Load

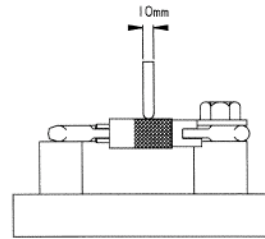


Figure 4  
Side Load Test Rig for Carabiner

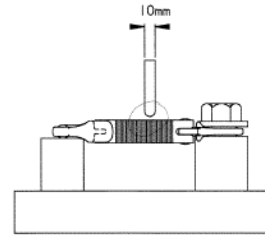


Figure 4  
Side Load Test Rig for Snap Hook Connectors

# Testing - ANSI Z359.1

- Hooks/Carabiners: Gate Side Load

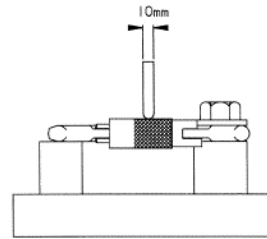


Figure 4  
Side Load Test Rig for Carabiner

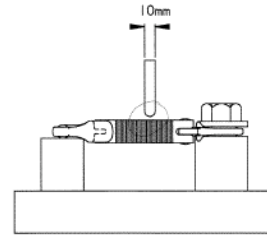
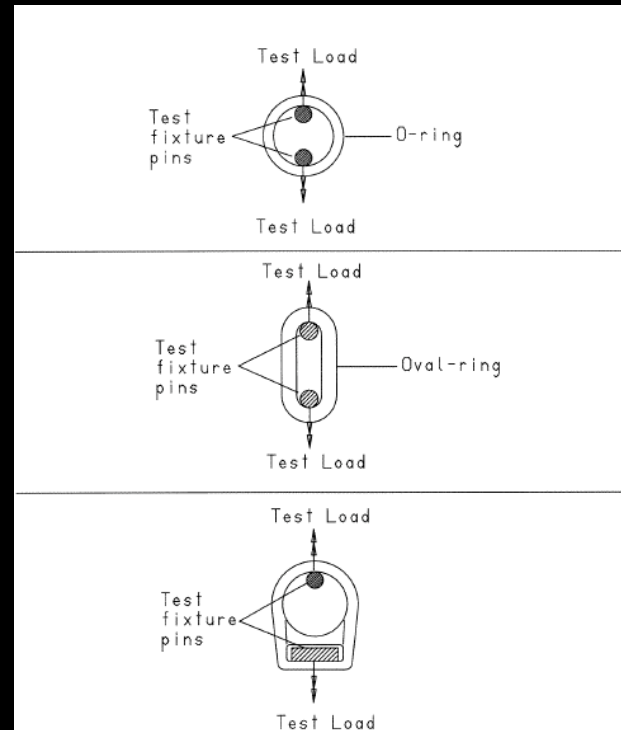


Figure 4  
Side Load Test Rig for Snap Hook Connectors

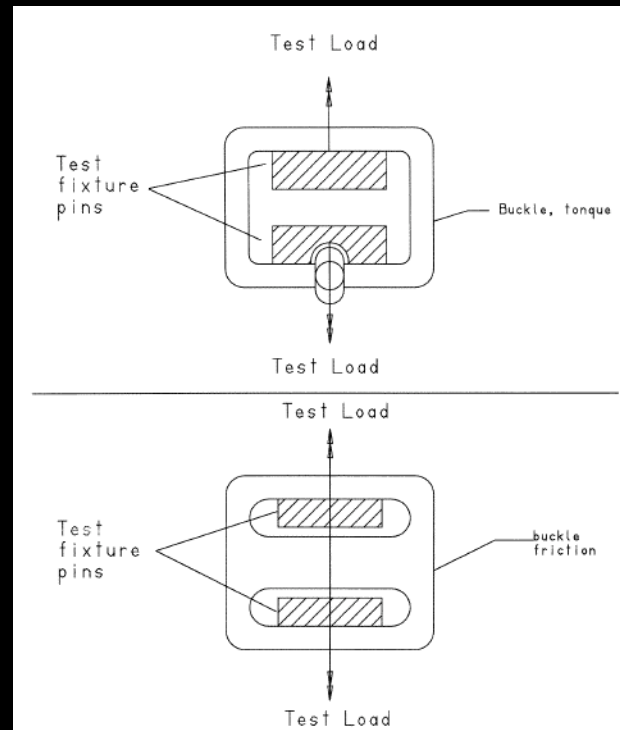
# Testing - ANSI Z359.1

- D-Rings, O-Rings, Oval Rings



# Testing - ANSI Z359.1

- Buckles, Adjusters



# Testing - ANSI Z359.1

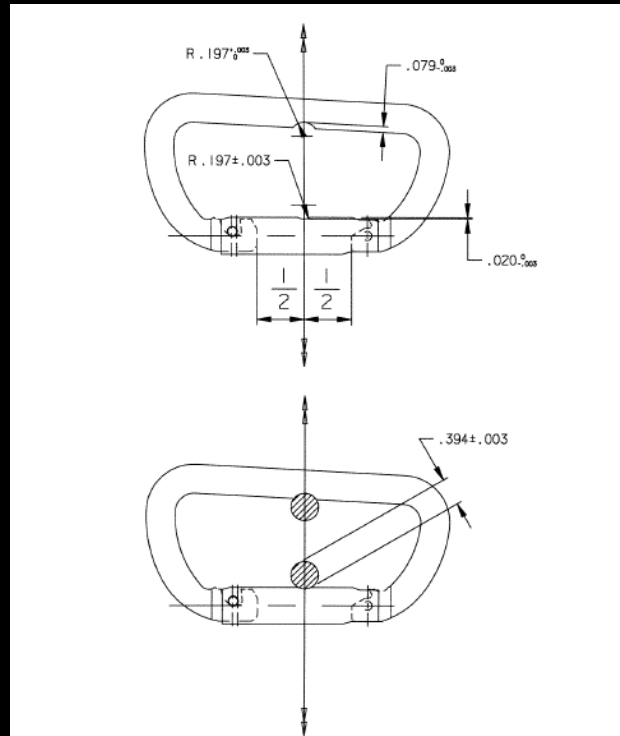
- Salt Spray
  - ◆ Salt spray booth
  - ◆ Test ends with first indication of red rust

## Future Direction - ANSI Z359.1

- Gate Face: 220 lbs to 3600 lbs
- Side Load: 350 lbs to 3600 lbs
- Minor Axis loading
- These are *significant* changes

# Future Direction - ANSI Z359.1

- Hooks/Carabiners: Minor Axis



# Product Development

- Concept Development
  - ◆ Increased Gate strength
  - ◆ Consideration for use and abuse
  - ◆ User Friendliness
  - ◆ Visual Appeal
  - ◆ Innovative

# Product Development

- Product Design
  - ◆ 3-D modeling
  - ◆ Finite Element Analysis (FEA)
  - ◆ Failure Mode Effect Analysis (FMEA)

# Product Development

- Prototyping
  - ◆ Wire Cutting
  - ◆ Laser Cutting
  - ◆ 3-D Printing

# Product Development

- Innovation Challenges
  - ◆ Thinking outside the box.
  - ◆ “We’ve never done it that way!”
  - ◆ Historical restrictions

# Manufacturing

- Processes
  - ◆ Forging
  - ◆ Stamping
  - ◆ Tumbling/Vibing/Burnishing
  - ◆ Heat Treating
  - ◆ Plating
  - ◆ Anodizing

# Manufacturing

- Testing
  - ◆ Dimensional Analysis
  - ◆ Hardness testing
  - ◆ Destructive Pull testing
  - ◆ Proof loading
  - ◆ Visual Inspection
  - ◆ Functional Inspection
  - ◆ Sampling of Finished Batches of Product

# Manufacturing

- Traceability
  - ◆ Manufactures Logo
  - ◆ Part identification Number
  - ◆ Year of Manufacture
  - ◆ Traceability Code