Improved Hook and Loop Test Method

THE DESIGN LAB at Rensselaer

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VELCRO®

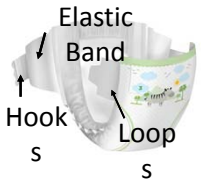
Purpose

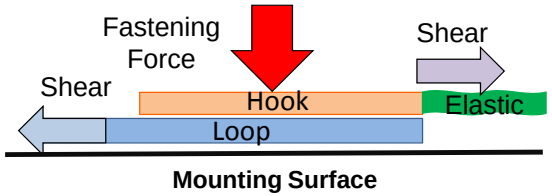
Develop test method to accurately predict performance of Velcro hook and loop fasteners in diapers

Semester Objectives

- Write test procedure for measuring peel and shear forces to simulate real world conditions of Velcro's hook and loop fasteners on baby diapers
- Design and build test fixture to measure peel and shear forces under varying elastic pre-loads on a surface that simulates the geometry and compliance of a baby's body

Problem Identification





Current Method	Diaper Fasteners	In Reality
• No shear force applied during fastening force • Mounting surface is a flat hard surface	• Velcro hooks attached to elastic band • Hooks stretch over baby's belly and attach to loops	• Shear pre-load resulting from elastic • Fastened on compliant and curved surface, not on flat hard surface

Project Approach

Problem Identification
- Characterize fastener behavior in diapers

Quantify Parameters
- Shape and properties of infant's waist
- Determine spring constant of elastic diaper band

Develop Test Platform
- Design fixture for peel and shear testing
- Develop test procedure using new fixture

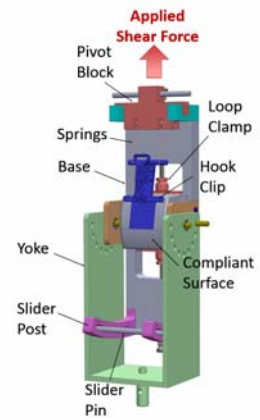
Verify and Compare Results
- Perform gage R&R study
- Gather data with new test fixture
- Compare results to existing tests

Design Requirements

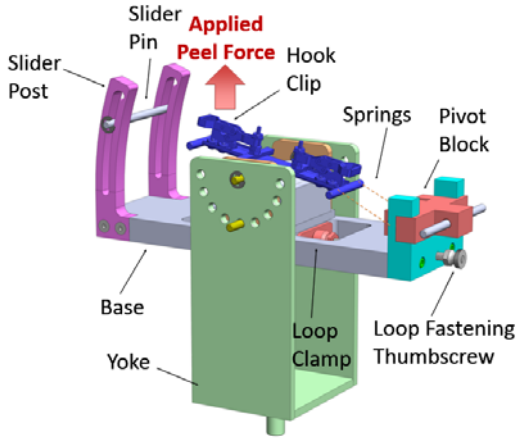
- Pre-loading system spring constant
  - 1.2 lbf/in
  - Determined from Load vs. Stretch tests of elastic waistband

- Testing surface Shore A hardness
  - 5A – 10A
  - Determined from durometer testing of team members' bodies
- Testing surface geometry
  - anatomically correct for baby in Size 3 diapers
- Normal mating force
  - 1.5 – 2 lbf
  - Determined from measuring force on scale when fastening diaper
- Fixture positions
  - 0° - 90° in 22.5° increments

Final Solution

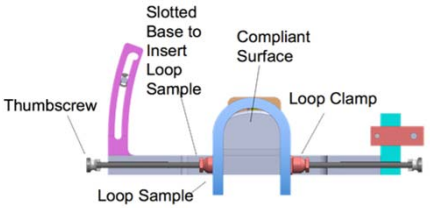


Fixture in Shear Mode



Fixture in Peel Mode

Loop Fastening



Hook Fastening