# Sealing Ring Testing and Characterization

## Problem Statement

"The current sealing ring design process requires numerous iterations of finite element analysis, which is lengthy and costly."

## Objectives

- Define a shape factor that correlates the geometry of a sealing ring with the sealing pressure at a given crush value.
- Decrease the time and cost to analyze sealing-rings by creating an interactive interface that can output several sealing-ring options for a given mechanical application.

## Project Scope

- 23 individual cross sections
- FKM, elastomeric material
- Material Hardness: Shore A 80-90
- Percent Crush: 0-40%

MTS Machine

## Constraints

- Budget: $2000
- 1 kN Max Load

## Technical Challenges

- Each sealing ring requires its own specific groove dimensions for testing, which means a groove must be machined to match each sealing ring.
- An accurate end product requires accurate data collection, and a lot of it. Large amounts of time will be spent conducting high number of tests amassing enormous amounts of data.

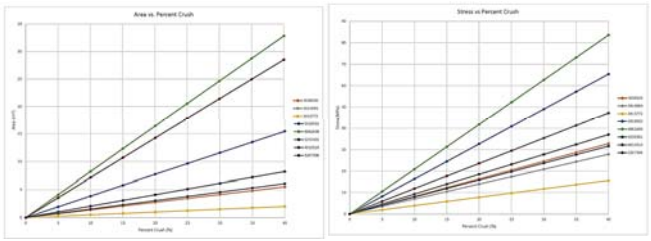
## Testing

- Goal
  - Apply a uniform load to seals that will compress them from 0 to 40 percent crush at 5 percent increments
  - Record data that will give insight to how the seal deforms under the load
- Requirements
  - Uniform applied load along seal
  - Rigid test fixture
  - Seals tested in grooves designed for them
  - Seals tested at lengths at least 10*diameter
- MTS Universal Testing Machine
  - Uniaxial compression
  - Displacement input
  - Interchangeable load cells 1 N – 1 kN
  - Adjustable vice to receive test fixture
- Data Outputs
  - Load needed to achieve percent crush
  - Sealing pressure given by pressure sensitive film

## Data Analysis

- Using the experimental data collected during testing, one can observe how the area in contact with the gland varies over different applied loads. From this, a correlation can be derived and a geometric shape factor can be made.

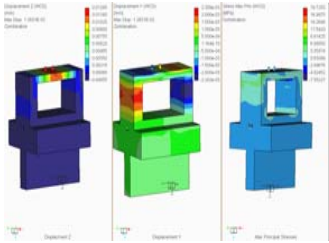
Theoretical Data for Rectangular Cross Sections



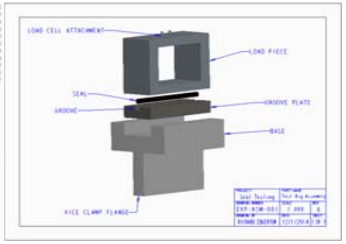
## Test Fixture

- Chosen for simplicity
- Works with pre-existing test equipment
- Material: Aluminum 6061-t6511
  - Machinability
  - Surface Hardness
  - Inexpensive

Test Fixture FEA



Test Fixture Assembly




## Work Done

- Research:
  - Sealing ring cross sections
  - Standards for seal design and pre-existing test procedures
  - Data analysis methods
- Designed the test fixture
- Developed testing procedure
- Ordered materials

## Future Work

- Machine test fixture
- Refine test procedure
- Collect and analyze data
- Define shape factors
- Produce user interface

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