

WHITEFIELD PLASTICS

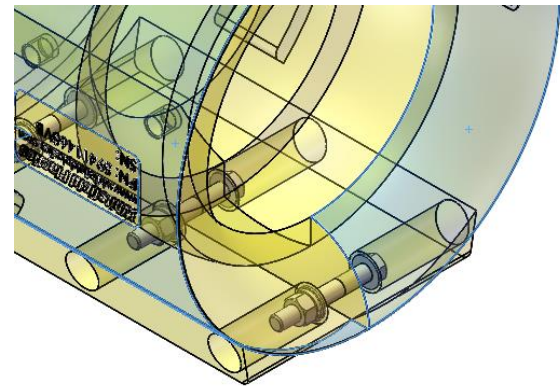
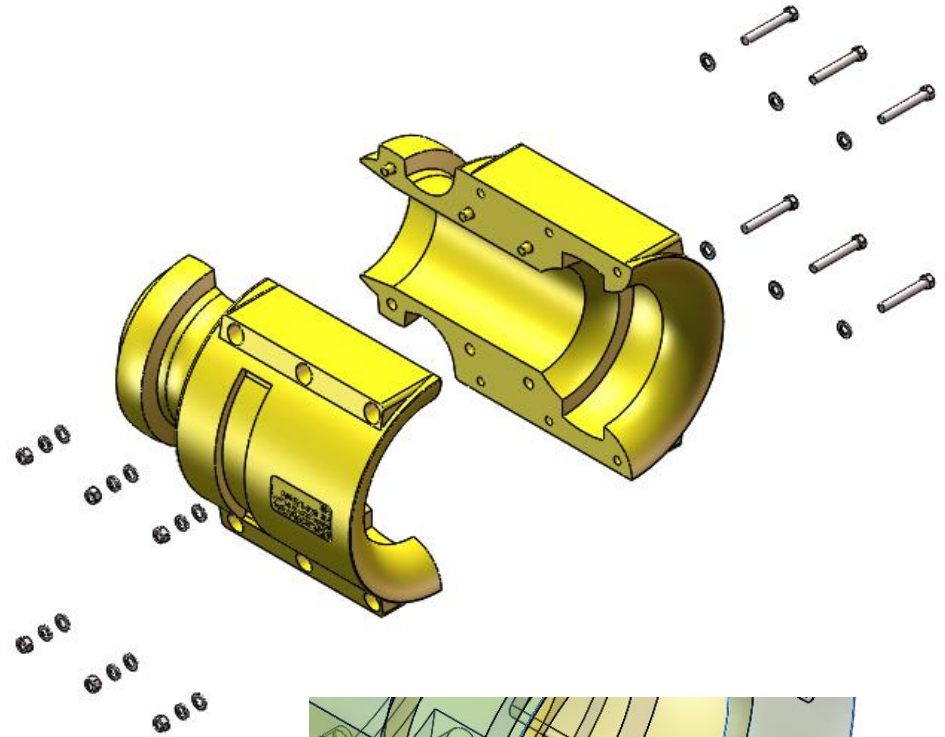
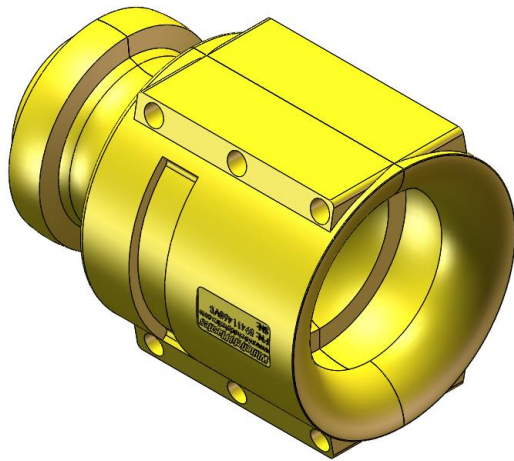
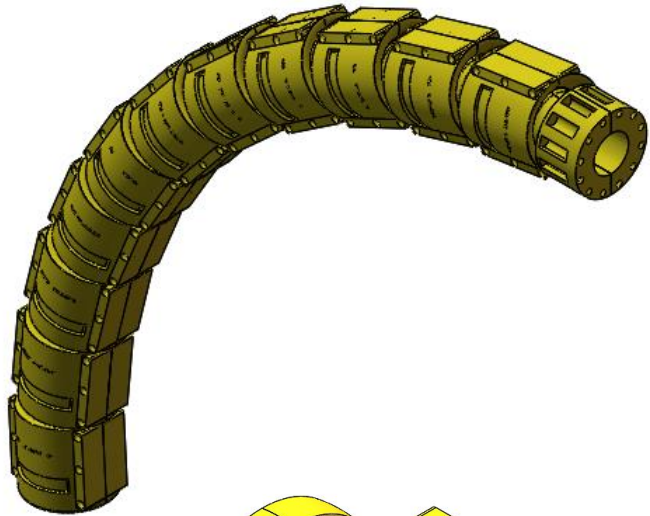
**GETTING TWISTED OVER BOLTS:
A VIABLE OPTION FOR THREADED
METALLIC FASTENERS**

NECESSITY IS THE MOTHER OF INVENTION

– PLATO, 400 BC



VERTEBRAE BEND RESTRICTOR



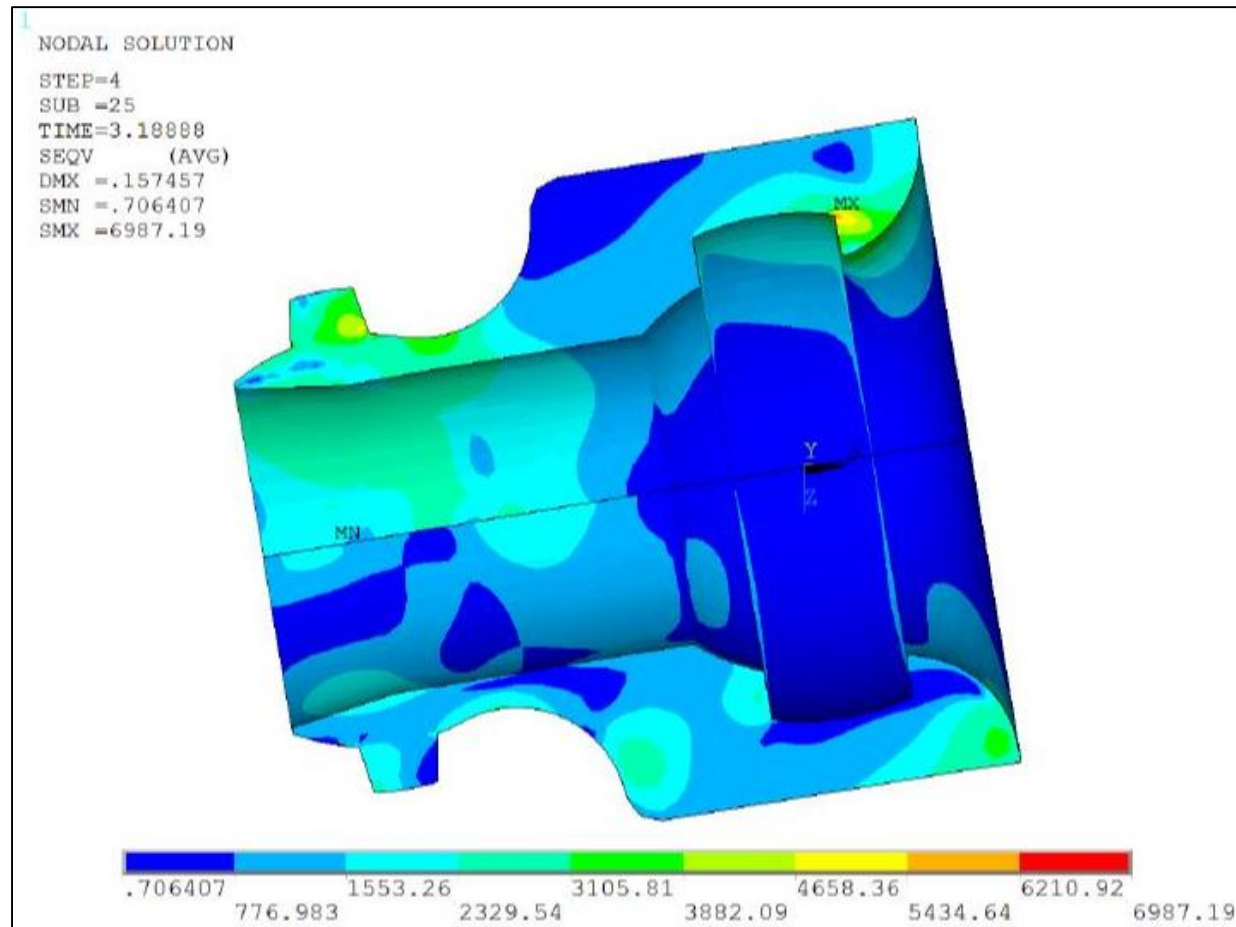
ALL TWISTED UP?

- ▶ The Good
 - Convenient
 - Proven
- ▶ The Bad:
 - Galling / Sticking
 - High Loose Piece Count
 - Hard Cost
 - HSE
- ▶ The Ugly
 - Corrosion
 - Protruding Pieces
 - Soft Cost and Record Keeping



TWOFOLD FEA APPROACH

1. STRESS CONCENTRATIONS IN A VBR BODY



VBR BOLT PERFORMANCE

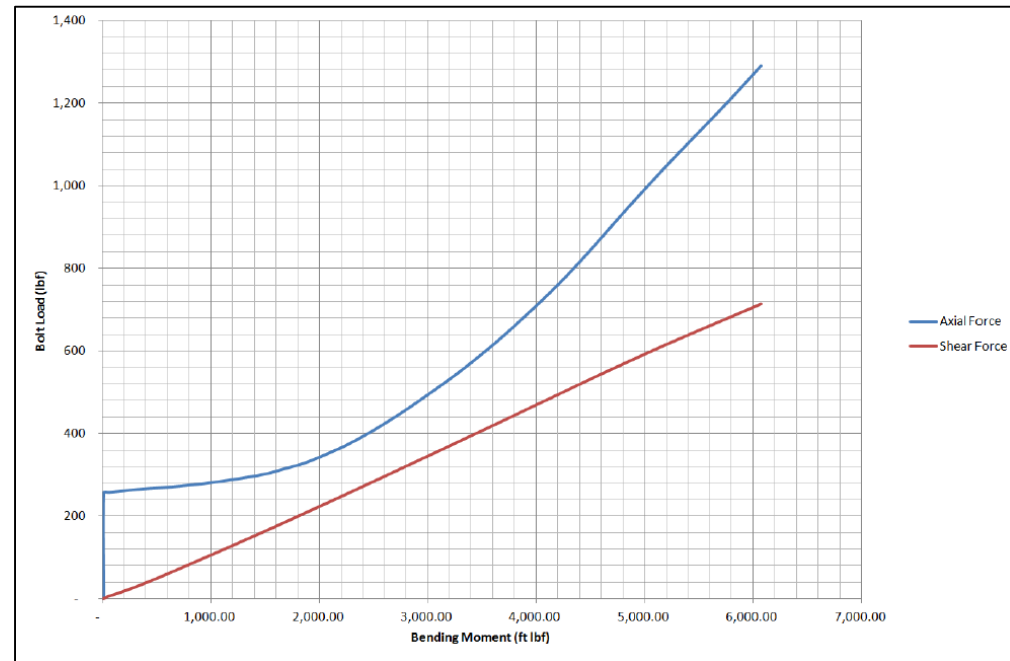
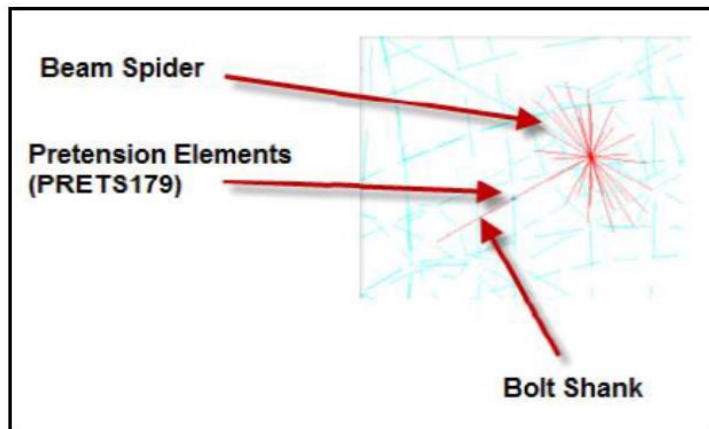
2. How much bolting preload is used?

Qty. 4) 3/8-16 Bolts

Preload = 12,800 lbf

Preload Used (At 3,400 ft/lbf VBR
Load) = 560 lbf

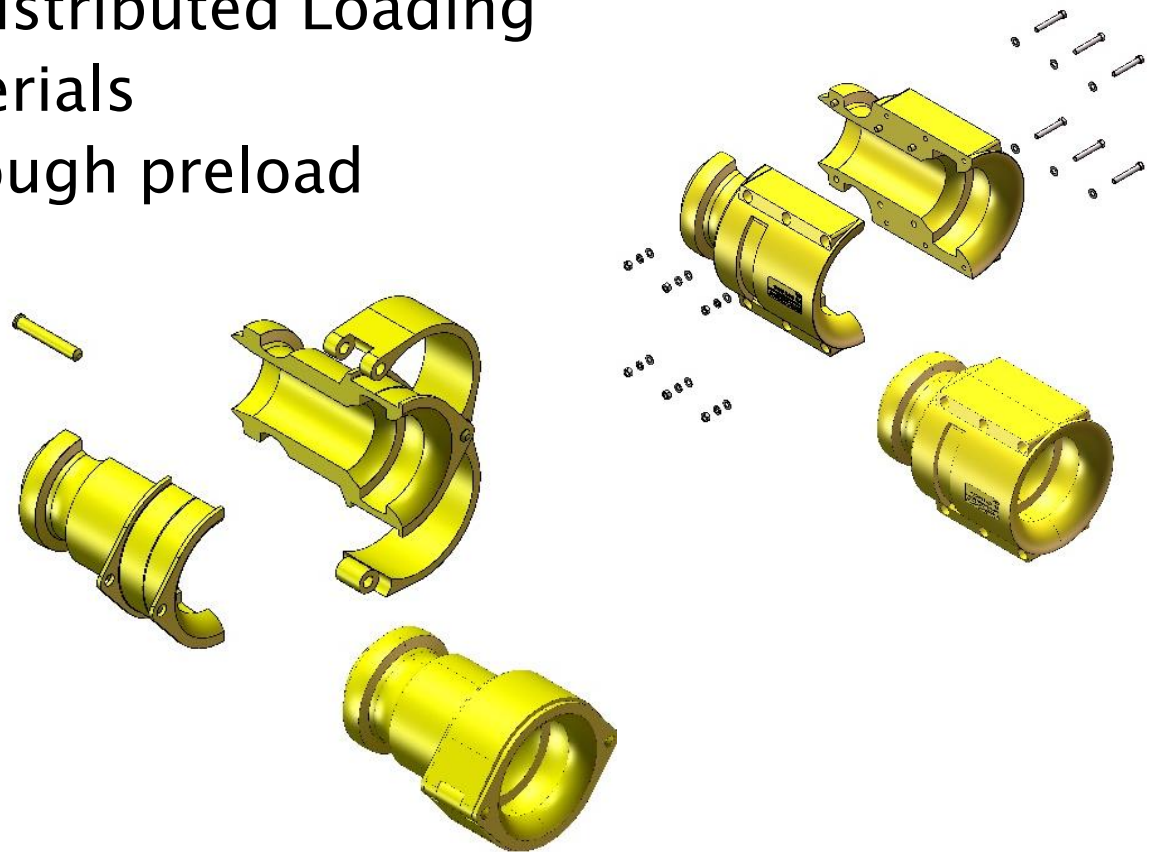
Utilization Factor At Design Load =
23%



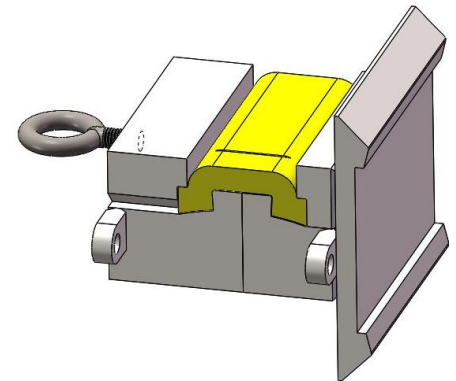
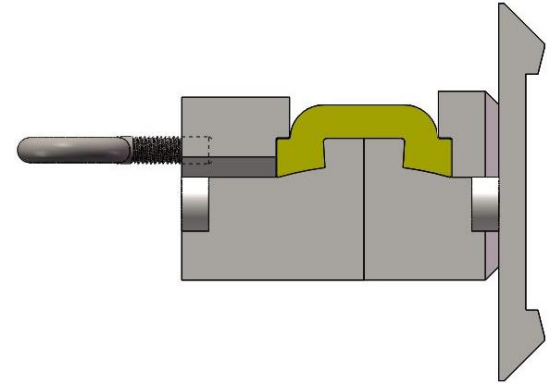
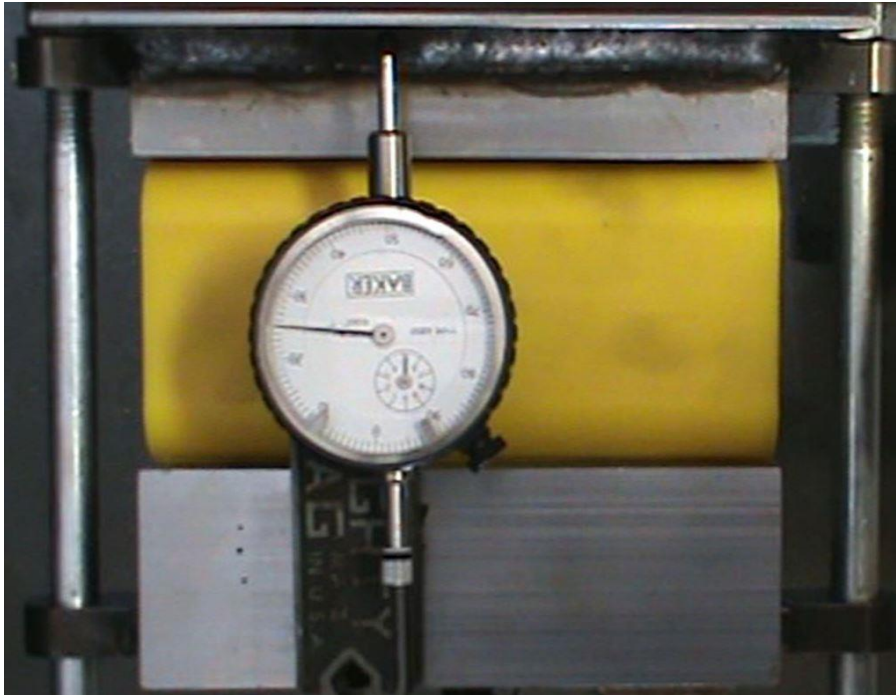
INITIAL DESIGN

▶ Lessons:

- Manage elongation through reduction in total strain.
- Preload and Distributed Loading
- Common Materials
- Retention through preload
- Relative size
- Simplicity



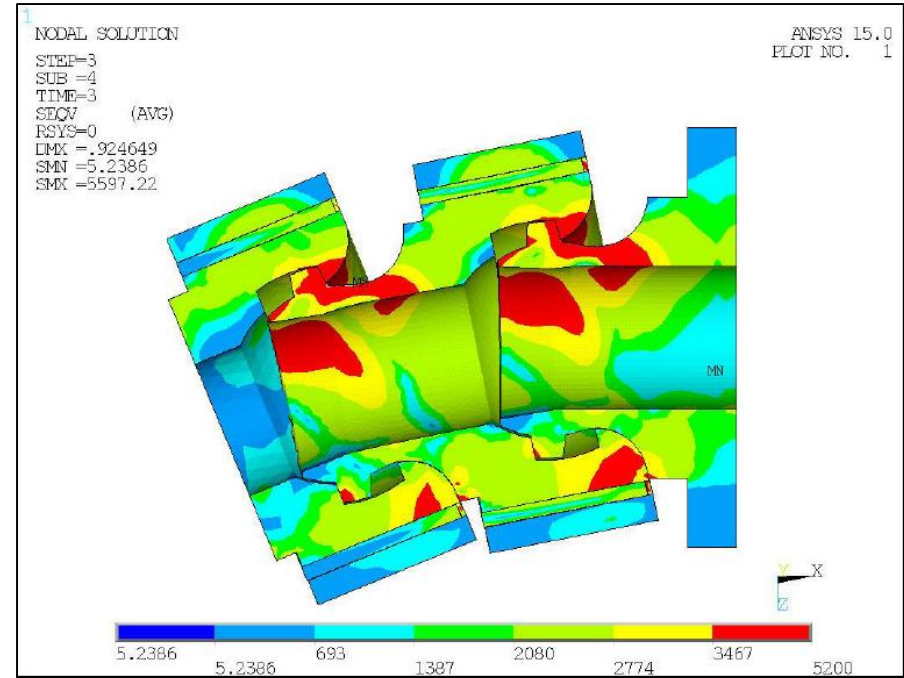
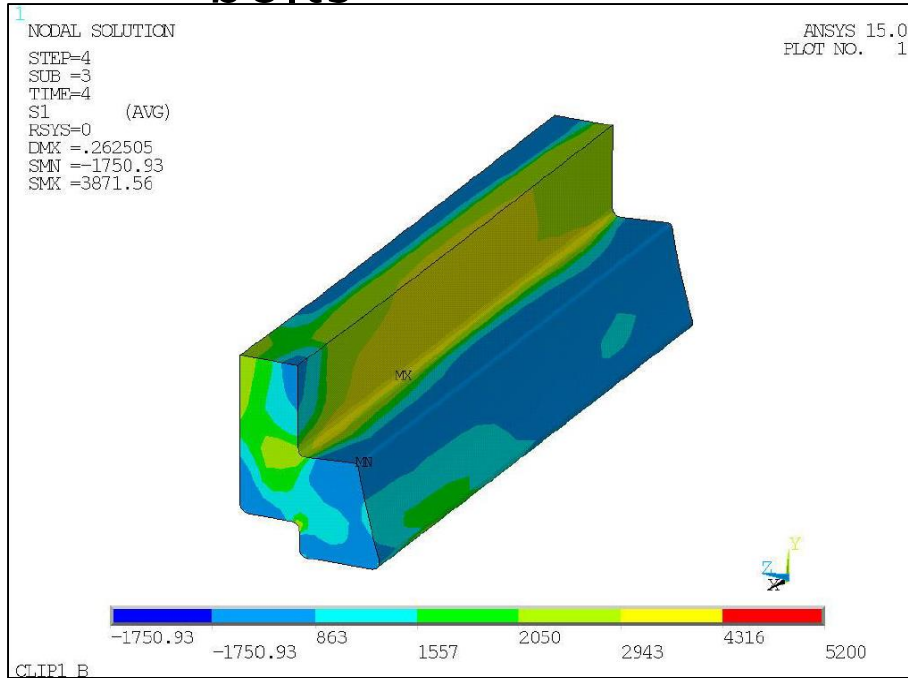
SECOND ITERATION



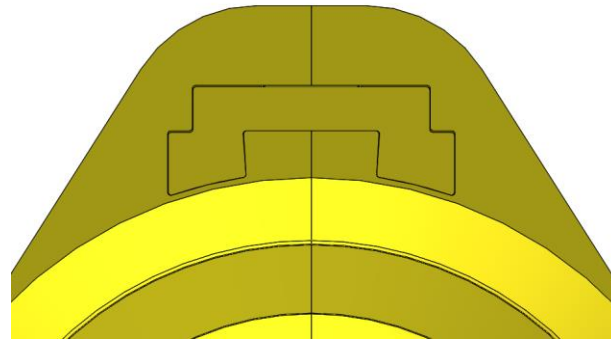
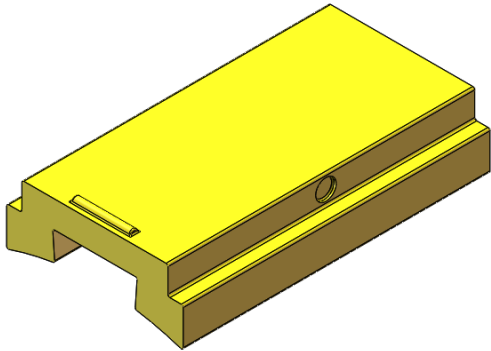
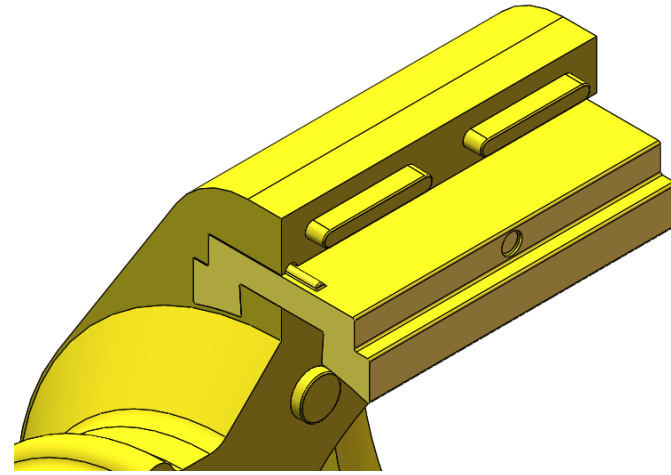
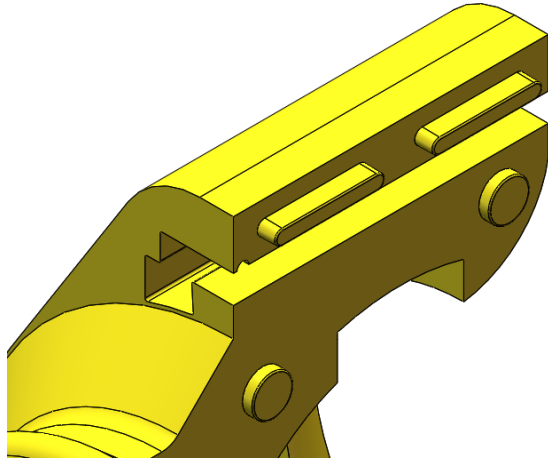
BOLTLESS FEA

▶ CLIP PERFORMANCE

- Distributed clip loading is interchangeable with bolts

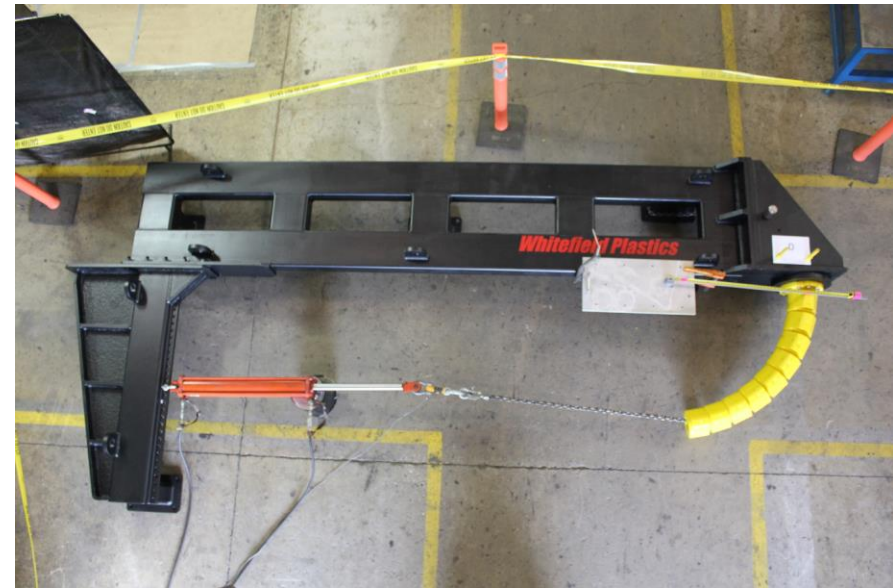
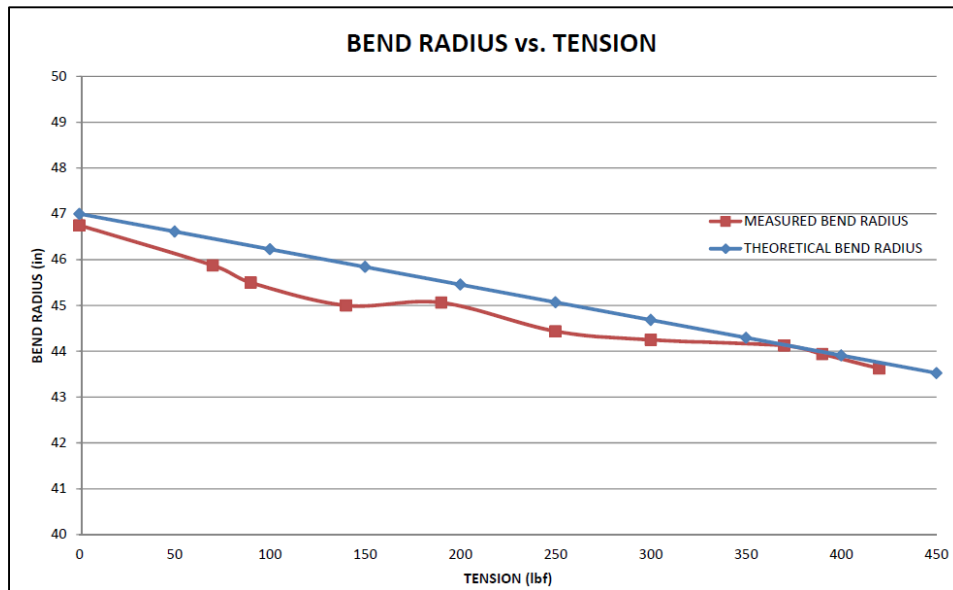


BOLTLESS VBR SYSTEM INSTALLATION



TESTING

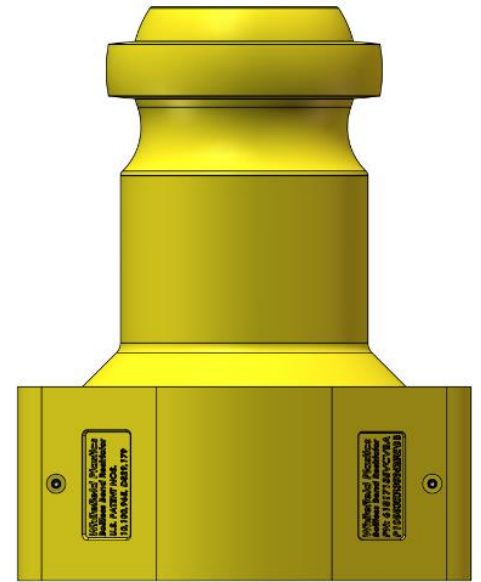
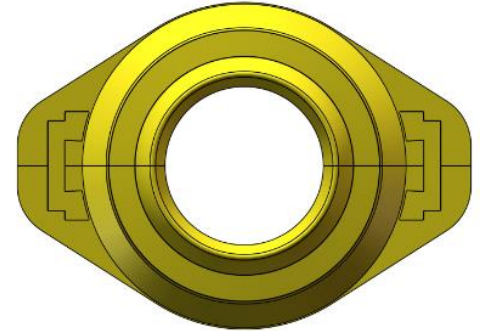
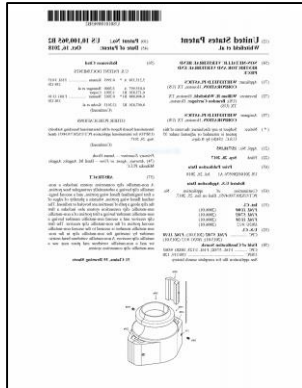
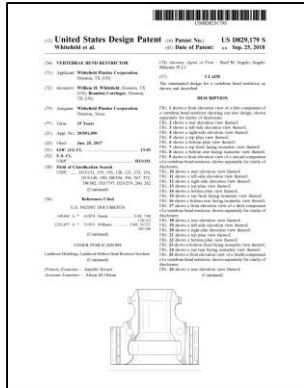
▶ TESTING / CALCULATIONS RECONCILIATION AND VALIDATION



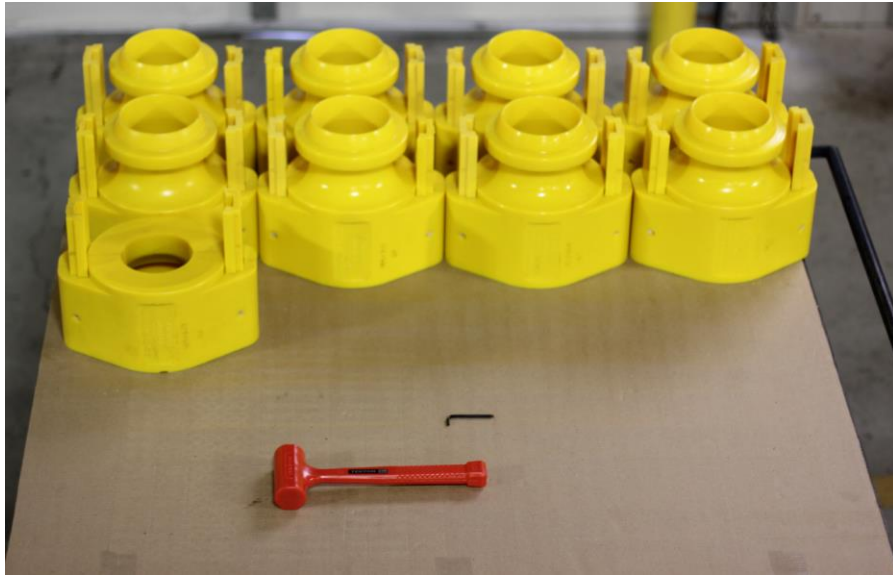
COMMERCIALIZATION



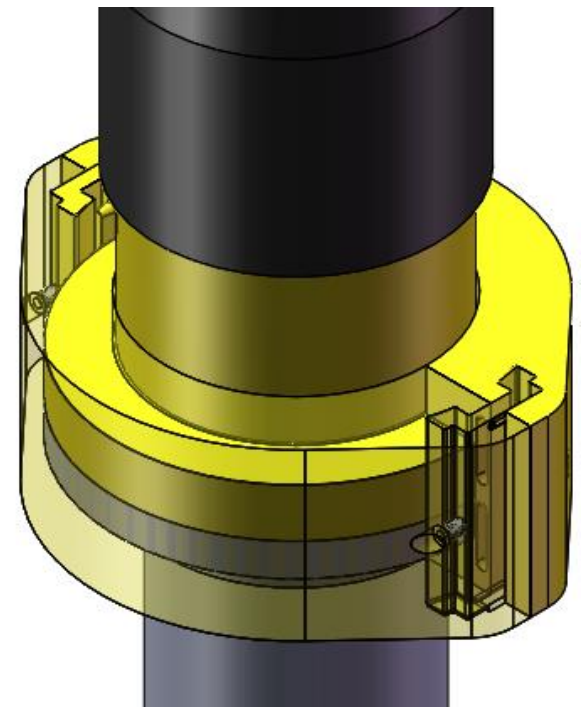
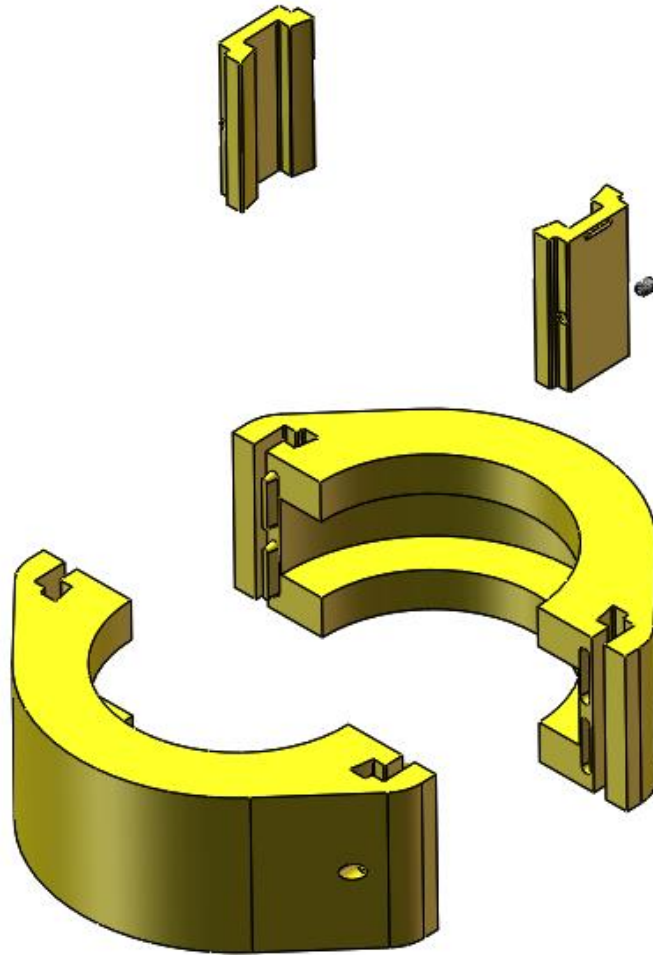
6.18 vs. 4.25 SIDE BY SIDE



SUPERIOR ASPECTS vs. BOLTS



ALTERNATIVE APPLICATIONS



BEYOND THE HORIZON

- ▶ WATER CONNECTIONS
- ▶ WINDFARM TIEBACKS
- ▶ FLEXIBLES
- ▶ SECURE LIGHTING AT ELEVATIONS FOR QUICK INSTALL / REMOVAL FOR RIG MOVE
- ▶ PROTECTIVE SHEATHS



THANK YOU

Questions?

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