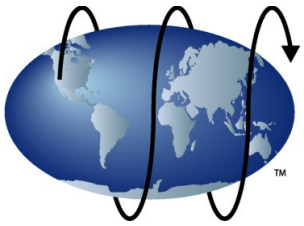


HyPerComp Engineering Overview for Department of Energy Manufacturing Automation and Recycling for Clean Hydrogen Technologies

HyPerComp Engineering. Inc.

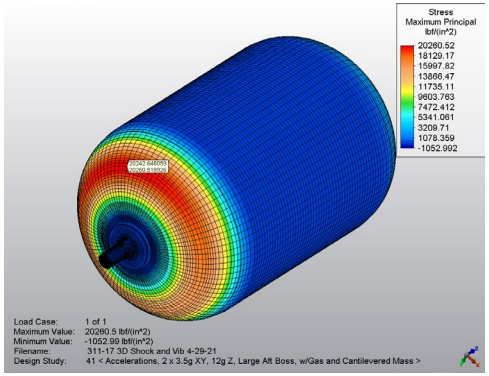
(HEI)

HyPerComp HISTORY

- HyPerComp Engineering (HEI) started business in 1996 (26 years)
  - Founder Mr. Jamie Patterson (still on HEI board)
  - Purchased by Luxfer Gas Cylinders 2013
  - Purchased by TCE March 2018
- Certified to AS9100 D (auditor TUV SuD)
- New manufacturing facility in August 2018
- Recipient of Vanguard in International Business Award by World Trade Center Utah

CORE COMPETENCE:

- Pressure Vessel Design and Development:
  - Extreme pressure applications
  - Light weight requirements
  - High cycle capability
  - Extensive history with Type 3 (metal) and Type 4 (plastic) liners
    - Patented technology
  - Specialize in highly engineered custom applications
  - Numerous Energy Storage applications
    - Compressed Natural Gas (CNG)
    - Hydrogen (Gas and Liquid)
    - Oxygen
    - Nitrogen
    - Helium
    - Breathing Air



FEA

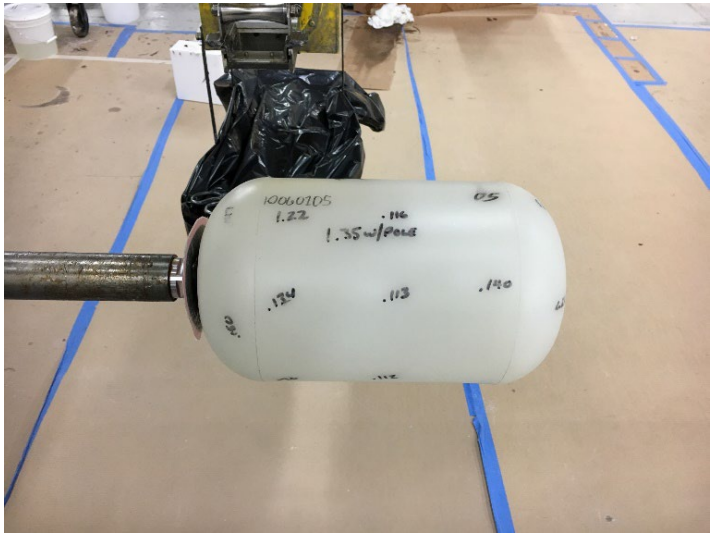
CORE COMPETENCE Cont:

- Pressure Vessel Testing and Qualification:
  - Hydro-Burst Testing/ Hydro-Proof Testing
  - Hydraulic & Pneumatic Cycle Testing
  - Gunfire Testing
  - Bonfire Testing
  - Impact & Composite Flaw Testing
  - DOT Qualification
  - Flaw Creation @ Testing
  - Gas cycle test at extreme temperatures

HEI Liners

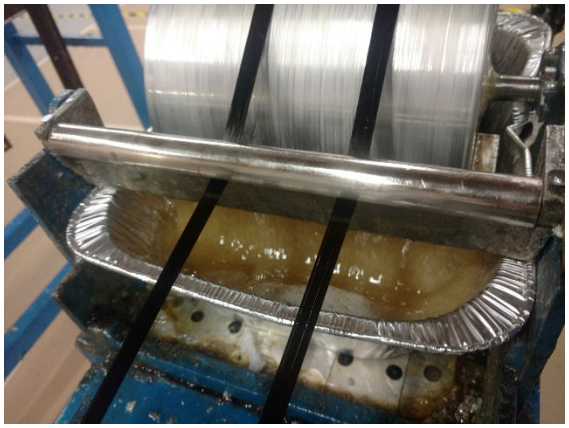
- Steel
- Stainless Steel
- Titanium
- Aluminum
- Plastic
  - HDPE
  - Delrin
  - Nylon
  - PET

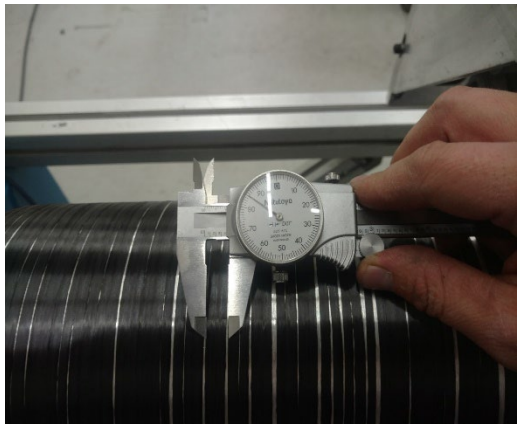
  * in HEI development



Matrix / Resins

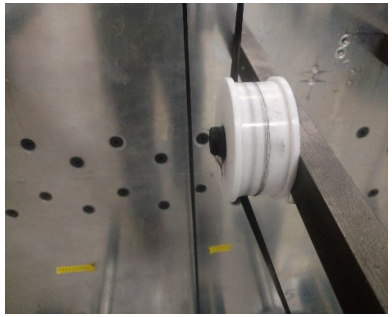
- Familiar with most resins
- Epoxy resins
- Testing location for many resin companies
- Resins
  - High Temp
  - Cryo Temp
  - Low Temp Cure (Type 4)





Fibers used by HEI

- Glass
- Aramid
- Zylon
- Basalt
- Carbon
  - Suppliers: MITSUBISHI / TORAY / TEIJIN / HEXCEL
  - 700 / 800 /1000 / 1100 / IM-8 / UTS 50 / TRH 50
  - Test location for many fiber companies



Vessel Certification

HEI has qualified composite pressure vessels with many worldwide regulatory agencies and/or industry groups including:

DOT (Department of Transportation)
KHK (Japanese Pressure Vessel Certification)
HSE (Health & Safety Executive Maritime)
TÜV (TUV Rhineland Boiler and Pressure Vessel Inspection ASME)
ISO (International Standardization Organization)
DNV (DNV GL Energy Vessel approvals)
NGV2, (ANSI Compressed Natural Gas Standard)
HGV2 (ANSI Hydrogen Gas standard)
ASME (ASME Boiler and Pressure Vessel Certification)
Bureau Veritas (Pressure Equipment Directive PED & ASME)
AIAA S-081 & S-082 Space Systems – COPV's

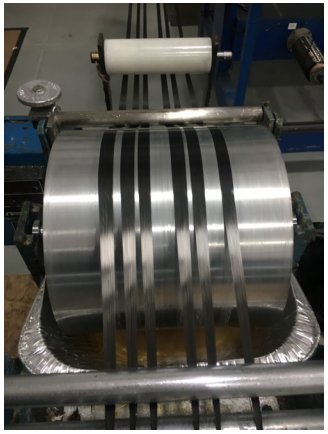
Qualified vessels include type 2, type3, type 4, and many specialized vessels that do not readily fit into categories and were to designed and qualified to specific customer requirements

HEI CUSTOMER BASE:

Cylinder Manufacturing Basic Requirements

Fiber

Winder

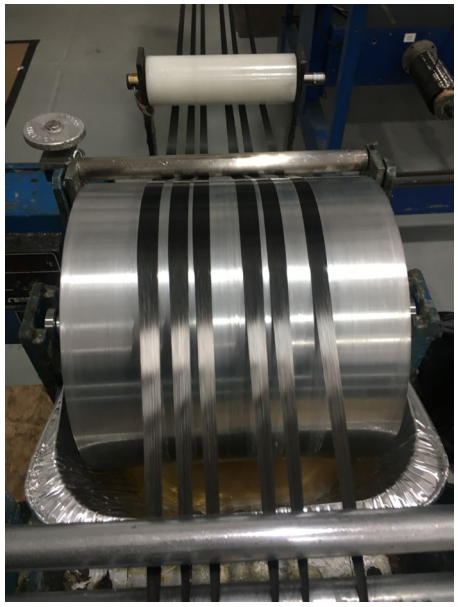


Matrix / Towpreg

Curing System

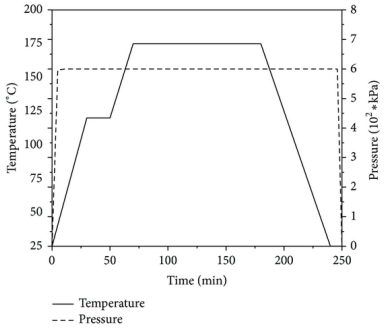
Cylinder Manufacturing Processes

Creel Hold & Tension Fiber

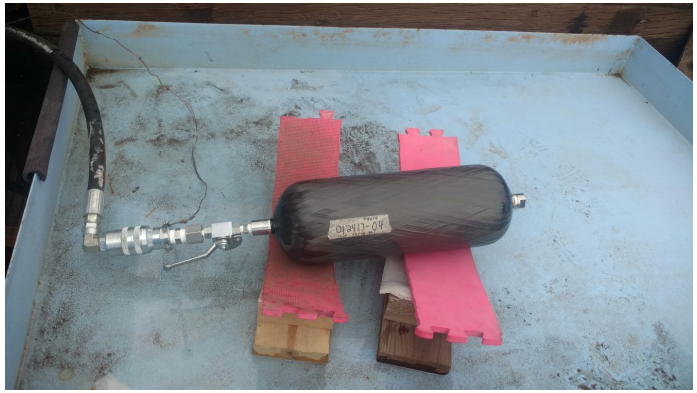


Matrix Immersion

Patten layup



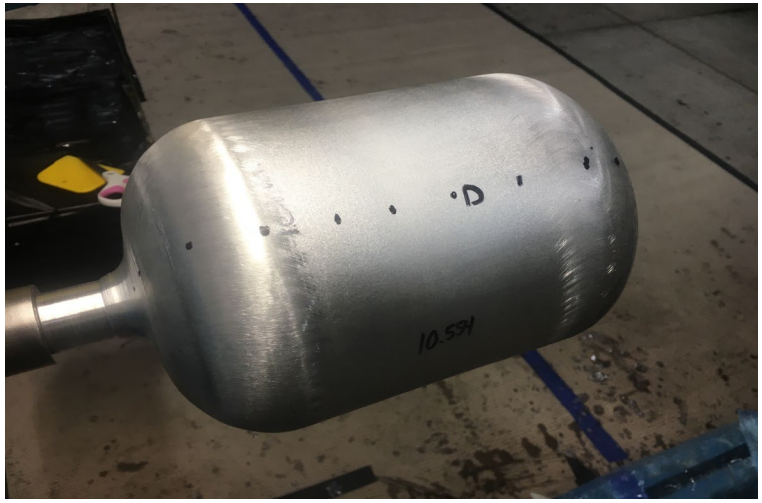
Cure Profile



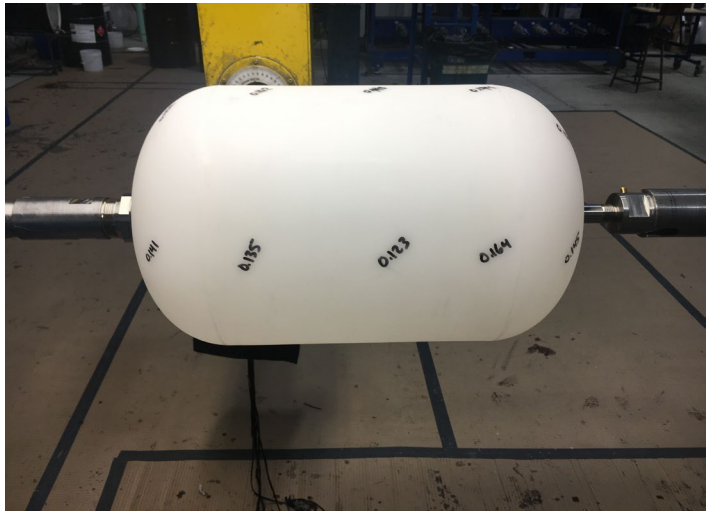
Hydro-Test

Cylinder Manufacturing Processes

Currently a vessel liner is required to provide both a mandrel and a gas barrier



Type 3 metal Liner



Type 4 Plastic Liner

Cylinder Manufacturing Increasing Throughput

Single Part

Two Parts

5 parts

HyPerComp Partnerships

- HyPerComp is looking forward to bringing our technology to benefit the Hydrogen market and discovering how together we can bring new technologies to industry

Thank you