**FracLock Assembly System**

Team: Cody Hedrick\(^1\), Project Engineer & Finance Manager. Jackson Shaw\(^2\), Manufacture Engineer Lead & CAD Director. Jeremy Seeyave\(^2\), Test & System Engineer

Sponsor: FHE LLC

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**Background**

- **Lock Ring Subassembly**: 1,500 lb
- **Castle**: 1,000 lb
- **Lower Sub**: 1,800 lb
- **Piston Subassembly X3**: 225 lb each

**Fabrication & Fluid Power Departments**

**FracLock Assembly Area**

**Single Overhead Crane for Three Departments**

**Requirements**

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<th>Requirement</th>
<th>Objective</th>
<th>Test Method</th>
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<td>1. Eliminate dependency on overhead crane &amp; workers inactivity</td>
<td>100%</td>
<td>Load Test</td>
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<tr>
<td>2. Lifting system rated to 2000 lb with a minimum safety factor of 2 for OSHA</td>
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<td>3. Move parts over an area of 150 ft(^2), cross dimensions 15 ft x 10 ft</td>
<td>200 ft(^2)</td>
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<td>4. Perform 90% assembly via a single operator safety</td>
<td>95%</td>
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<td>5. Improve assembly time by 30%</td>
<td>50%</td>
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<tr>
<td>6. Eliminated damage to piston coating, sensors, and O-rings in assembly process</td>
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</table>

**Objectives**

- **Reduce Assembly Time by 50%**
- **Boasts $150,000 in Revenue Yearly**

**FracLock System**

- **7,000 lb**
- **Lock Ring Subassembly**
- **1,500 lb**
- **Castle**
- **1,000 lb**
- **Lower Sub**
- **1,800 lb**
- **Piston Subassembly X3**
  - **225 lb each**

**FracLock Assembly System**

- **Team**: Cody Hedrick\(^1\), Project Engineer & Finance Manager. Jackson Shaw\(^2\), Manufacture Engineer Lead & CAD Director. Jeremy Seeyave\(^2\), Test & System Engineer

**Sponsor**: FHE LLC

**Reduced Assembly Time by 50%**

- **Boasts $150,000 in Revenue Yearly**

**Background**

- Eliminate dependency on overhead crane with dedicated mobile lift-assist device per assembly station (2)

**Requirements**

1. Eliminate dependency on overhead crane & workers inactivity
   - **Objective**: 100%
   - **Test Method**: Load Test

2. Lifting system rated to 2000 lb with a minimum safety factor of 2 for OSHA
   - **Objective**: Pass
   - **Test Method**: Functionality Test

3. Move parts over an area of 150 ft\(^2\), cross dimensions 15 ft x 10 ft
   - **Objective**: 200 ft\(^2\)
   - **Test Method**: Visual Test

4. Perform 90% assembly via a single operator safety
   - **Objective**: 95%
   - **Test Method**: User Feedback

5. Improve assembly time by 30%
   - **Objective**: 50%
   - **Test Method**: Timed Assembly & User Feedback

6. Eliminated damage to piston coating, sensors, and O-rings in assembly process
   - **Objective**: 100%
   - **Test Method**: Supervisor & User Feedback

**Acknowledgments:** FHE LLC; Craig Powell, P.E – FHE Engineering Supervisor; Chris Penick – Assistant Professor of Mechanical Engineering; Nathan McNeill, Ph.D., P.E – Instructor, Mechanical Engineering.
Methods

### Design Criteria (DC)
- Mobile Gantry crane support a physical load of 4,000 lb
- Static load test mobile gantry crane with a load of 4,000 lb

### Test Methods (TM)
- Load: 2,000 lb
- Safety Factor: 3.5 ≥ 5.0
- Finite element analysis on the gantry crane using SOLIDWORKS proved that the new lift-assist device supports 2,000 lb with a minimum safety factor of 2.

Results

1. Passed load test.
2. Expecting full functionality of hoist & trolley via remote control (off-the-shelf-items)
3. Expecting full movement when installed

- DC Electric hoist & trolley operate smoothly for lift and transverse movement with a 2,000 lb load via remote control
- TM Ensure electric hoist & remote control operate properly for vertical lift at 2,000 lb rated capacity
- DC Gantry crane rolls smoothly when pushed and static otherwise
- TM Push mobile gantry crane with 2,000 lb load to verify smooth motion

Acknowledgments:
- FHE LLC; Craig Powell, P.E – Engineering Supervisor;
- Chris Penick – Assistant Professor of Mechanical Engineering;
- Nathan McNeill, Ph.D., P.E – Instructor, Mechanical Engineering.
**Methods**

**Design Criteria (DC)**
- DC 360° Rotational ability for ease of assembly
- DC Instillation tool for prevention of O-ring damage during assembly

**Test Methods (TM)**
- TM Test block to ensure that block rotates 360°
- TM Tracking the number of damaged O-rings
- TM Tracking the number of damaged piston sensors

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**Results**

**Results**
1. The block will perform the required building and pressurizing for testing
2. No O-rings have been damaged since addition to assembly process
3. No sensor have been damaged since addition to the assembly process
Conclusion

Reduce Assembly Time by 50%
Triple FracLock Monthly Production per Station
No Broken Sensor and O-rings w/ Install Tools
$600,000 in Labor Savings for 4-years Contract for 4 stations

### Part Name | Source | Cost
--- | --- | ---
I-beam, W 6X9 | Pacific-Steel, Grand Junction, CO | $66
Square Tube, TS 2X2X1/8 | Pacific-Steel, Grand Junction, CO | $64
Square Tube, TS 3X3X1/8 | Pacific-Steel, Grand Junction, CO | $166
Grainger H4 Electric Chain Hoist | www.grainger.com | $3,191
Strongway Electric Trolley, 2,200 lb. Capacity | www.northerntool.com | $180
Stand, Automotive Engine, 1,250 lb. Capacity | www.grainger.com | $228
V-groove Track, L 1.5X1.5X1/4 | www.mcmaster.com | $74
V-groove Casters, 800 lb. Capacity | www.mcmaster.com | $176

**Total** |  | **$4,145**