YOUNGSTOWN STATE UNIVERSITY

PEELER TABLE DESIGN

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MECH 3762L

OUTLINE

- **Purpose**
- **Project Criteria**
- **Initial Design**
- **Final Design**
- **Room for Improvements**

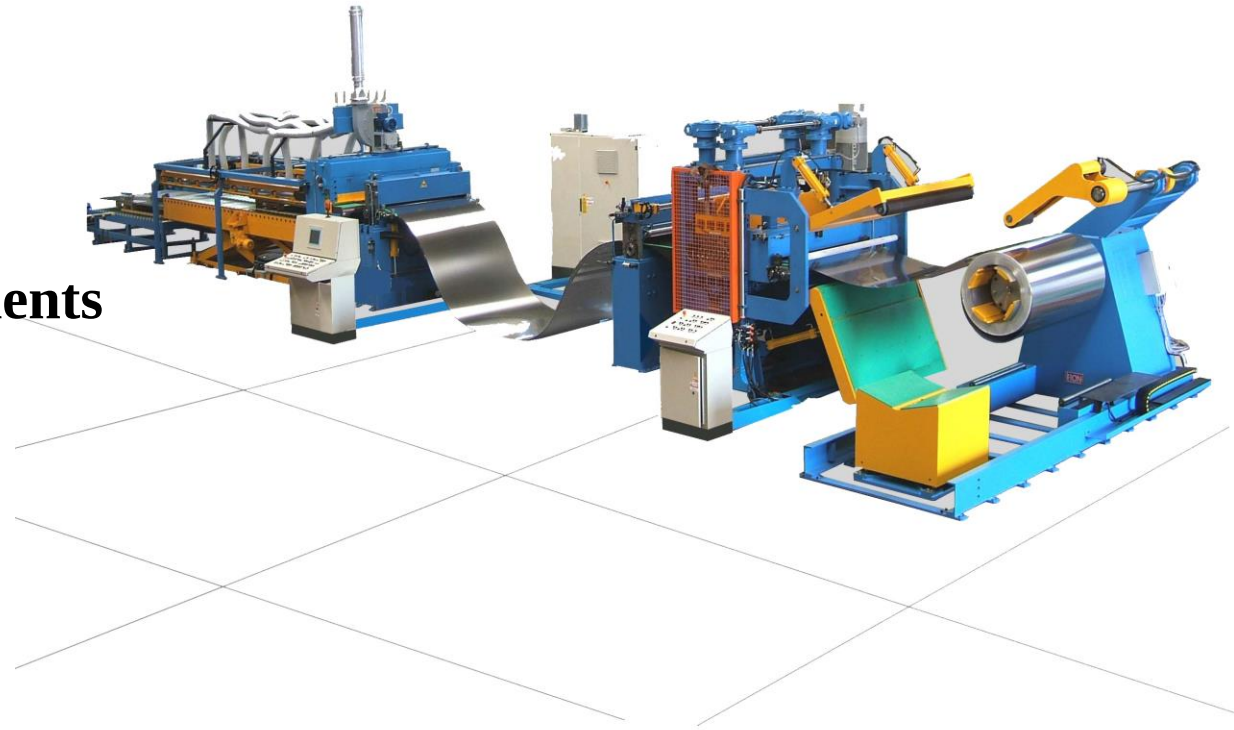
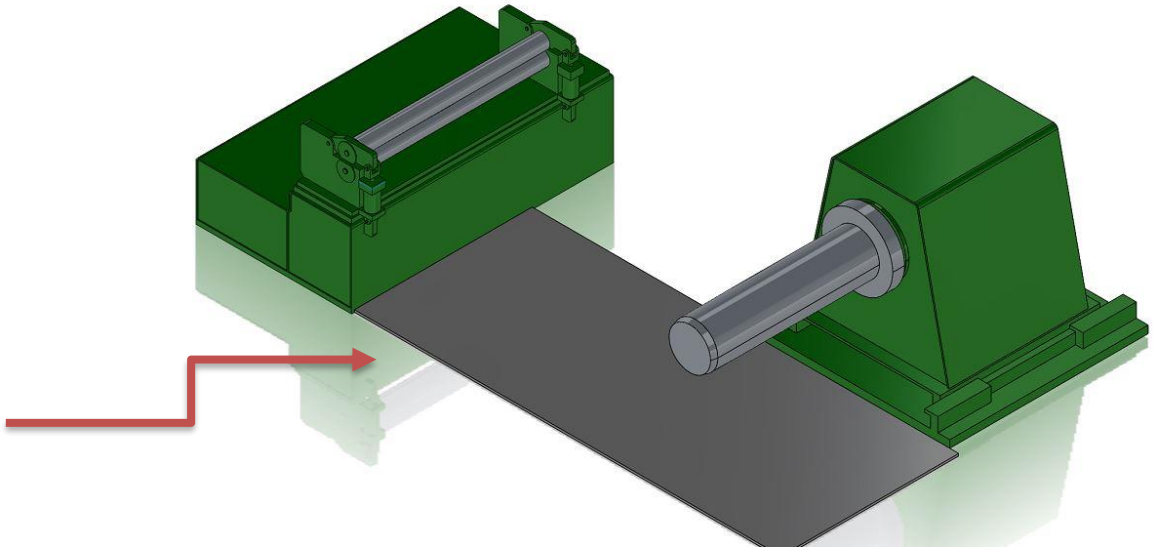


Image Credit : Chicago Slitter.

Purpose

- Design 2 main Parts of Slitter Line.
  - Hold down Arm
    - To hold and uncoil the leading edge of Strip.
  - Peeler table
    - To guide the sheet to the pinch roll of slitter .

Design to fit in a given footprint .



Project Criteria

- Arm with powered roller.
- Power supplied by existing hydraulics.
  - Psys=**1500 psi**.
- Accommodates coil dimension.
  - Strip width:
    - Max: **52 inch**
    - Min: **15 inch**
  - Strip Gauge: **10-gauge** max
  - Coil Diameter: **68-inch** diameter max

Costumer Request manual control of Peeler table and hold down arm.

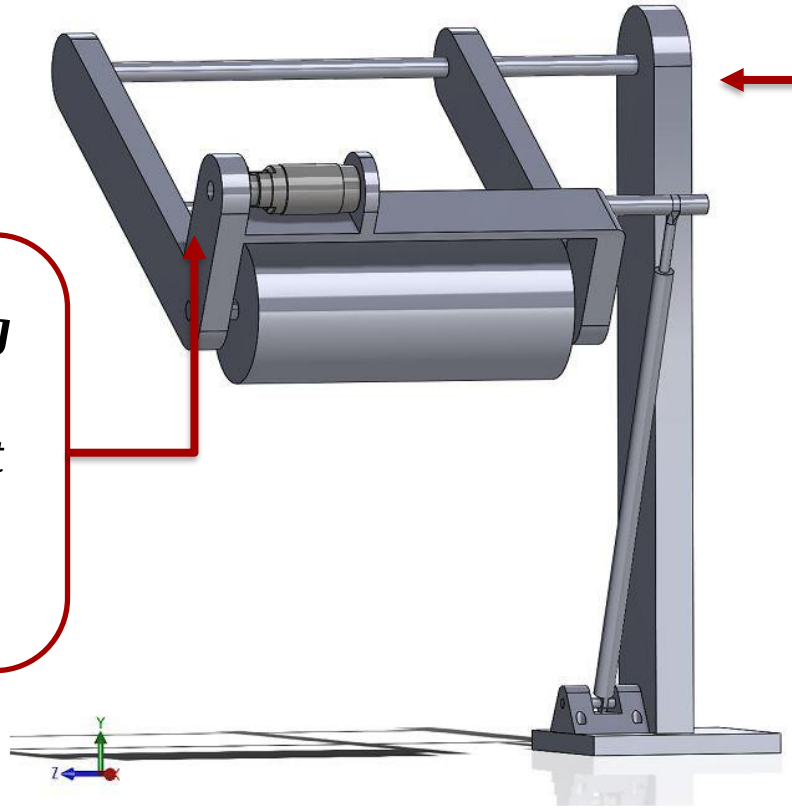
Initial Design: Peeler Table

Entire moment due to the table is acted on two of these vertical support. Adding support on the front will help.

Difficult to machine the designed shape.(Not Practical)

Mounted to the ground. Mount on the frame would be better.

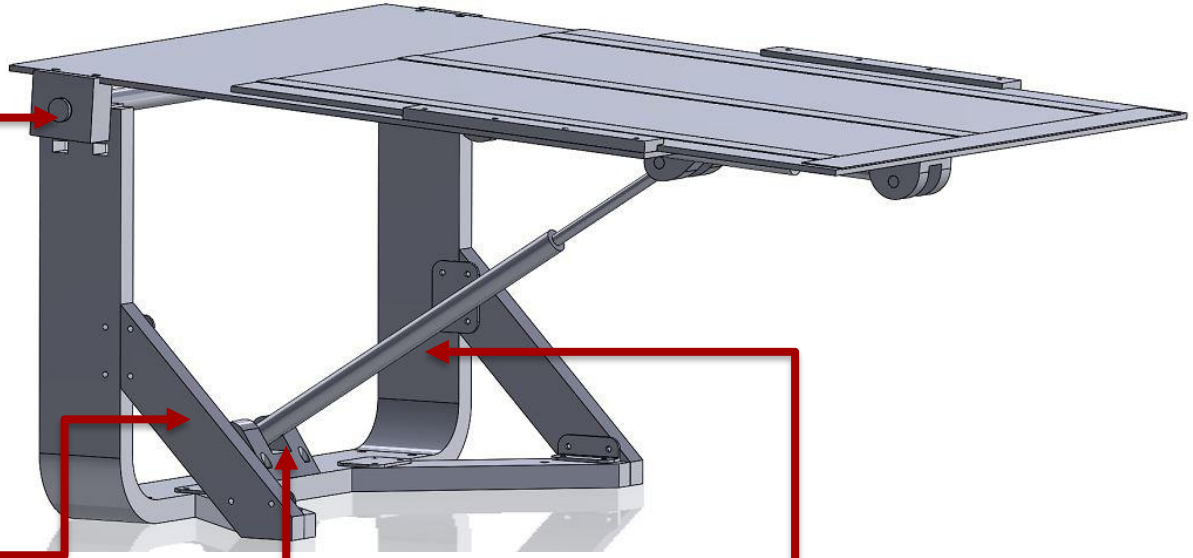
Initial design: Hold down arm



Thought of using belt for power transmission but decided chain would be better.

Entire load is supported by this support, thus subjected to large moment.

Final design



McMaster-Carr Press-Fit Bushing

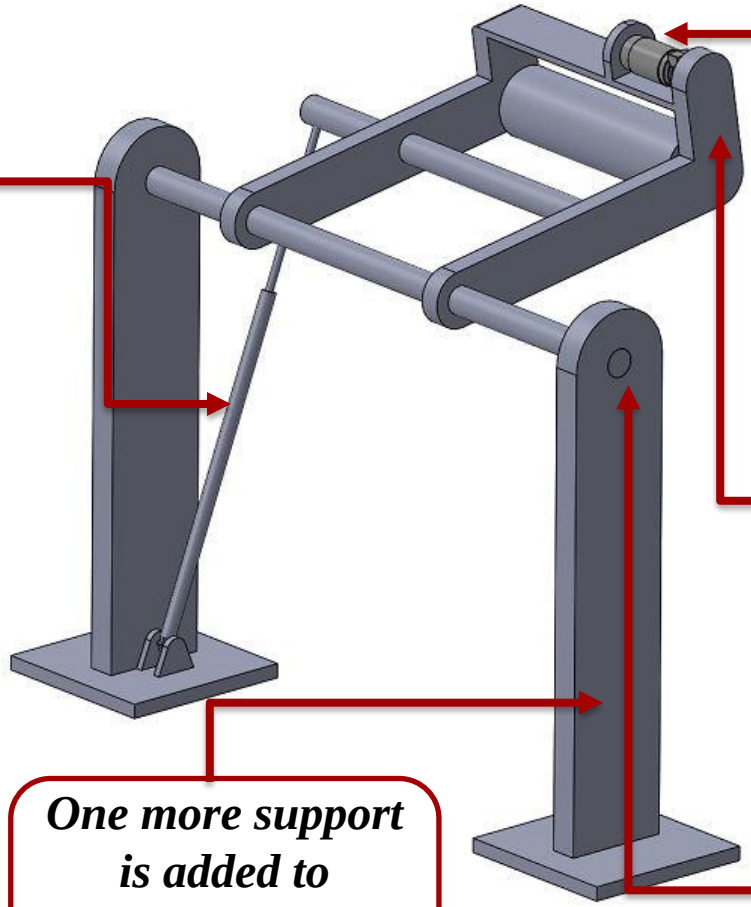
Additional member decreases the moment on vertical member

Hydraulics mounted on the frame

Hydraulic Cylinder (Heavy duty Roundline Welded-Series RDH)

Final design

Hydraulic Cylinder (Heavy duty Roundline Welded-Series RDH)



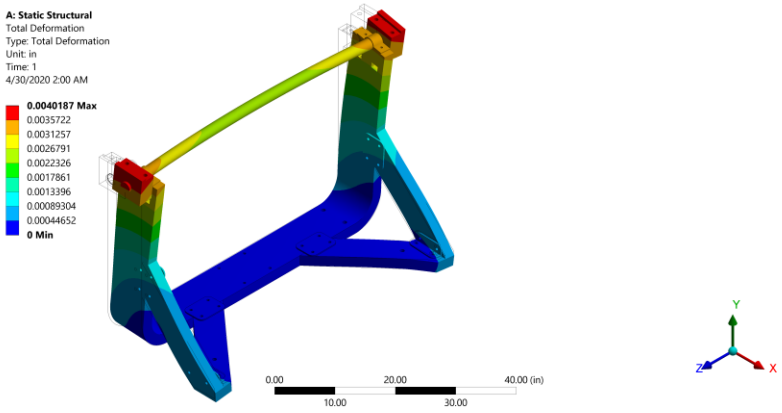
Medium Duty Motor- Torqmotor TL Series

Sprocket to torque from motor to roller

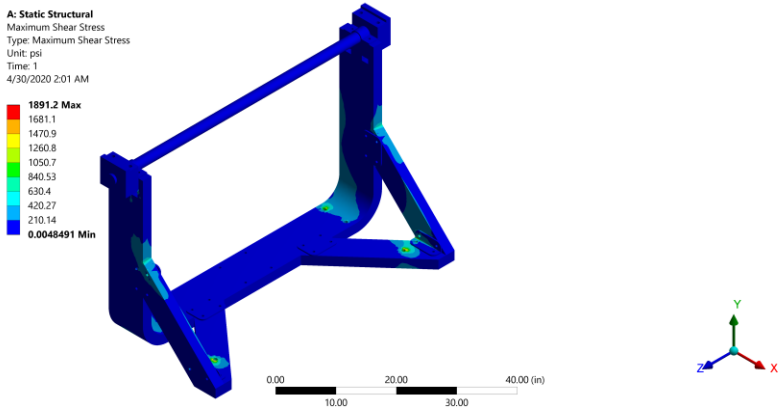
One more support is added to decrease stress on other arm

Angular contact ball bearing

FEA

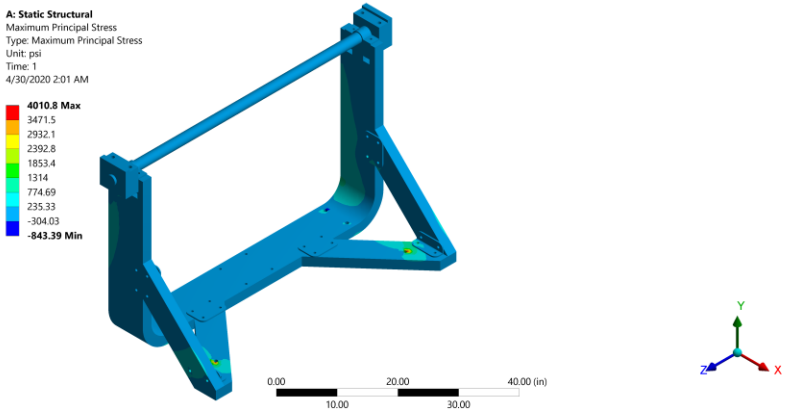


Total Deformation



Max Shear Stress

Max Principal Stress



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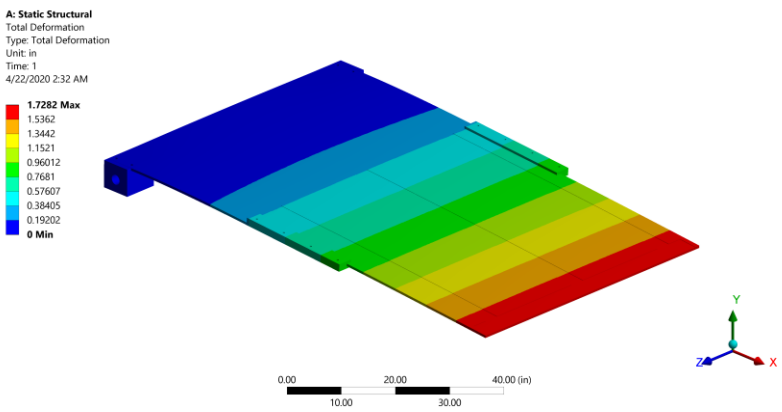

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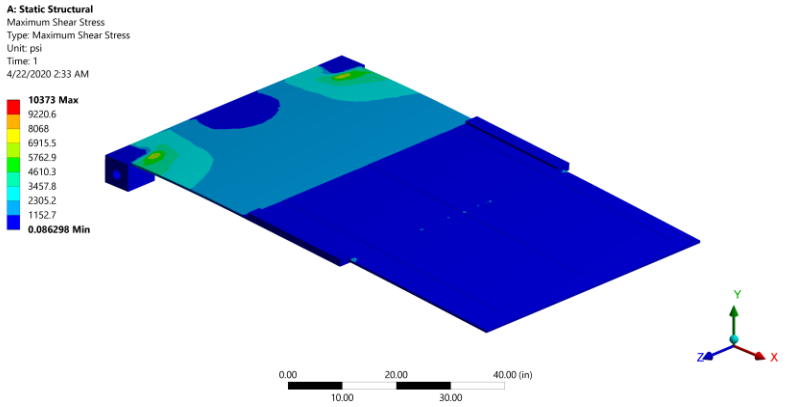

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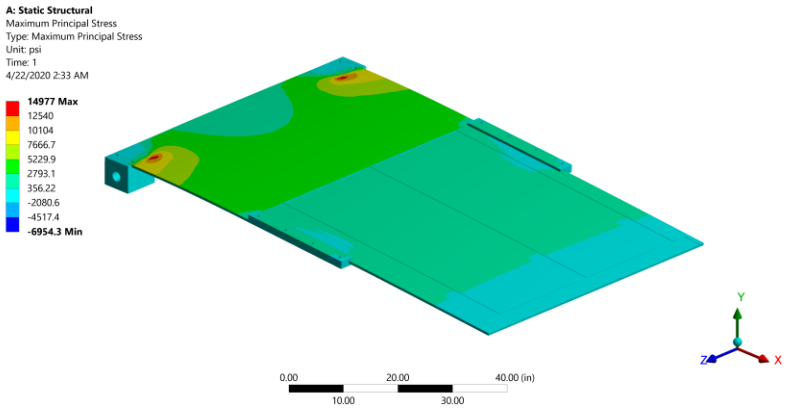

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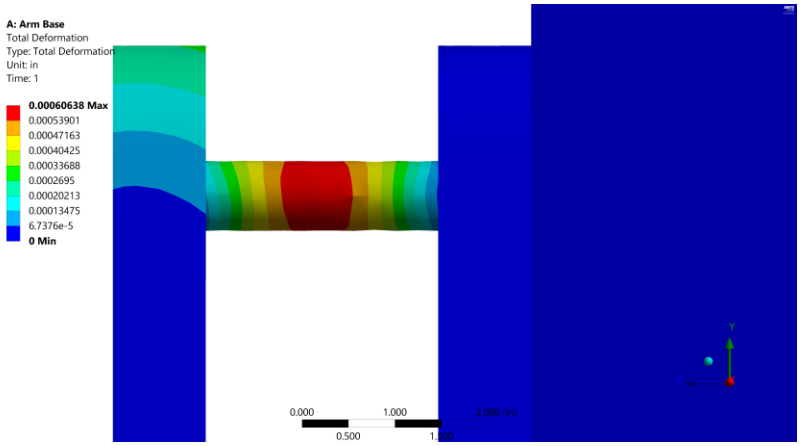
Table Support FEA

FEA



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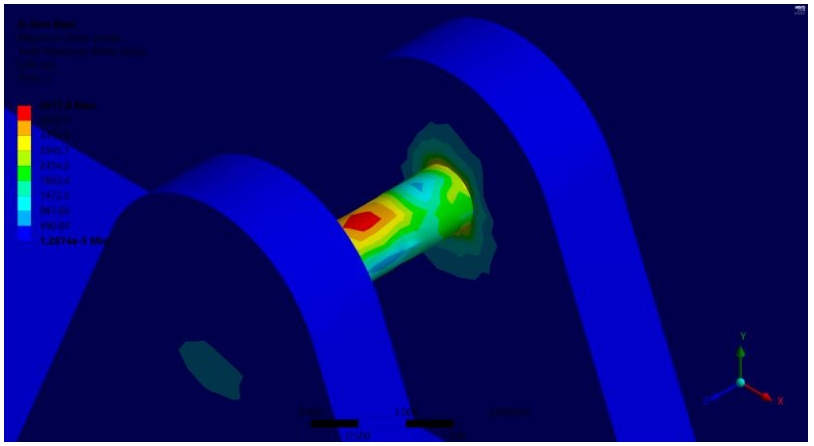

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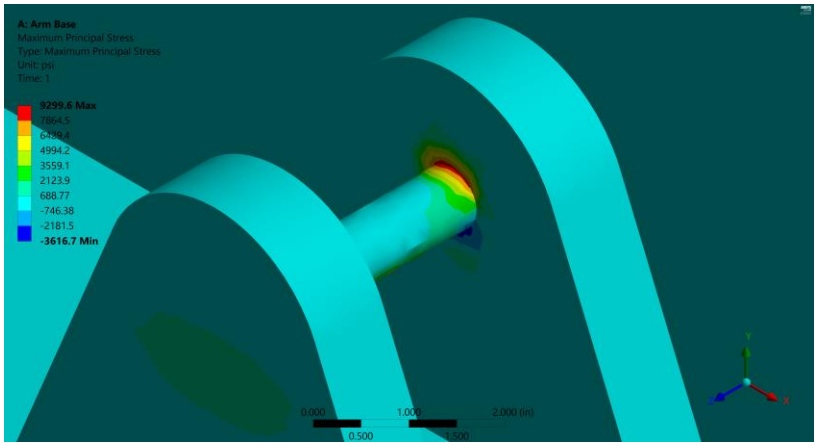

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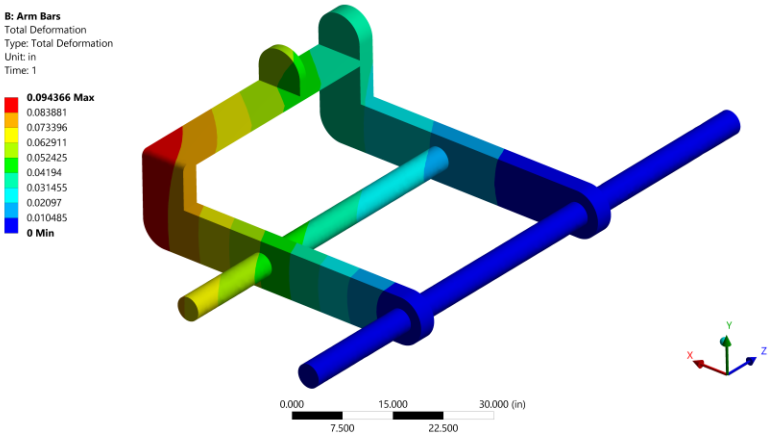

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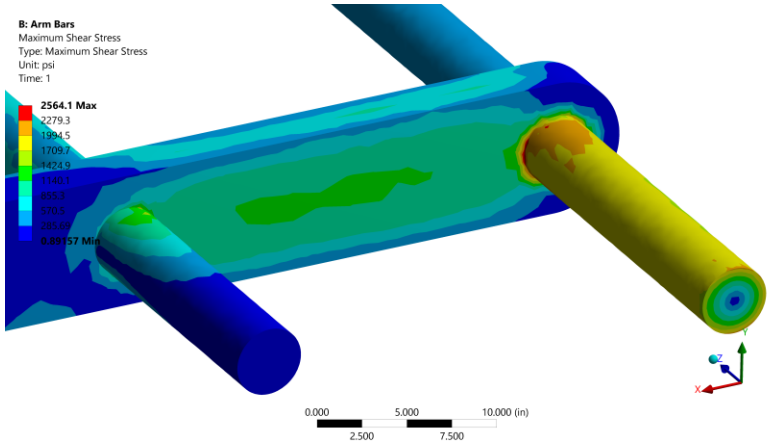

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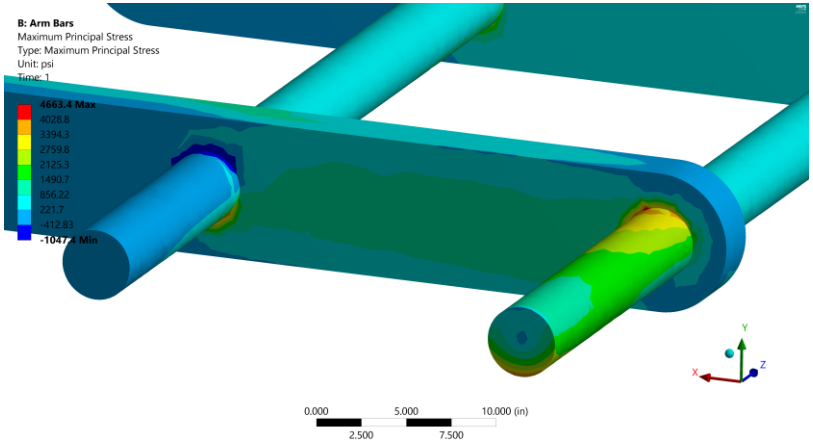

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Pin Support FEA

Basic Calculation results

Hydraulic Cylinder

- **Fext**(Table): 1634 lbf
  - **P**(needed):520 psi
- **Fext**(Arm): 3042.26 lbf
  - **P**(needed): 969 psi

Hydraulic motor

- Torque required : 8311 lb-in

(*Assuming strip velocity to be 3 in/s*.)

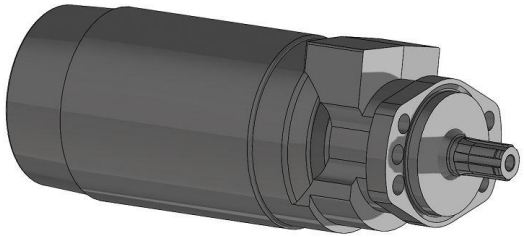
Bearings and bushing

- **Fr**(hinge): 950 lbf
- **Fr**(Arms support): 701.83 lbf
- **Fr**(Roller): 412.64 lbf

Hydraulics Cylinder and Motor

- Hydraulic Cylinder (Heavy duty Roundline Welded-Series RDH)
  - **Fluid type:** Filtered hydraulic oil
  - **Bore Diameter:** 2 inch
  - **Rod Diameter:**1 inch
  - **Mounting type:** Pivot mounting
  - **Configuration:** Welded cap

- Hydraulic Motor (Medium Duty Motor- Torqmotor TL Series)
  - **Max Output Torque:** 10,300 lb.-in
  - **Shaft Diameter:** 1.25-inch nominal

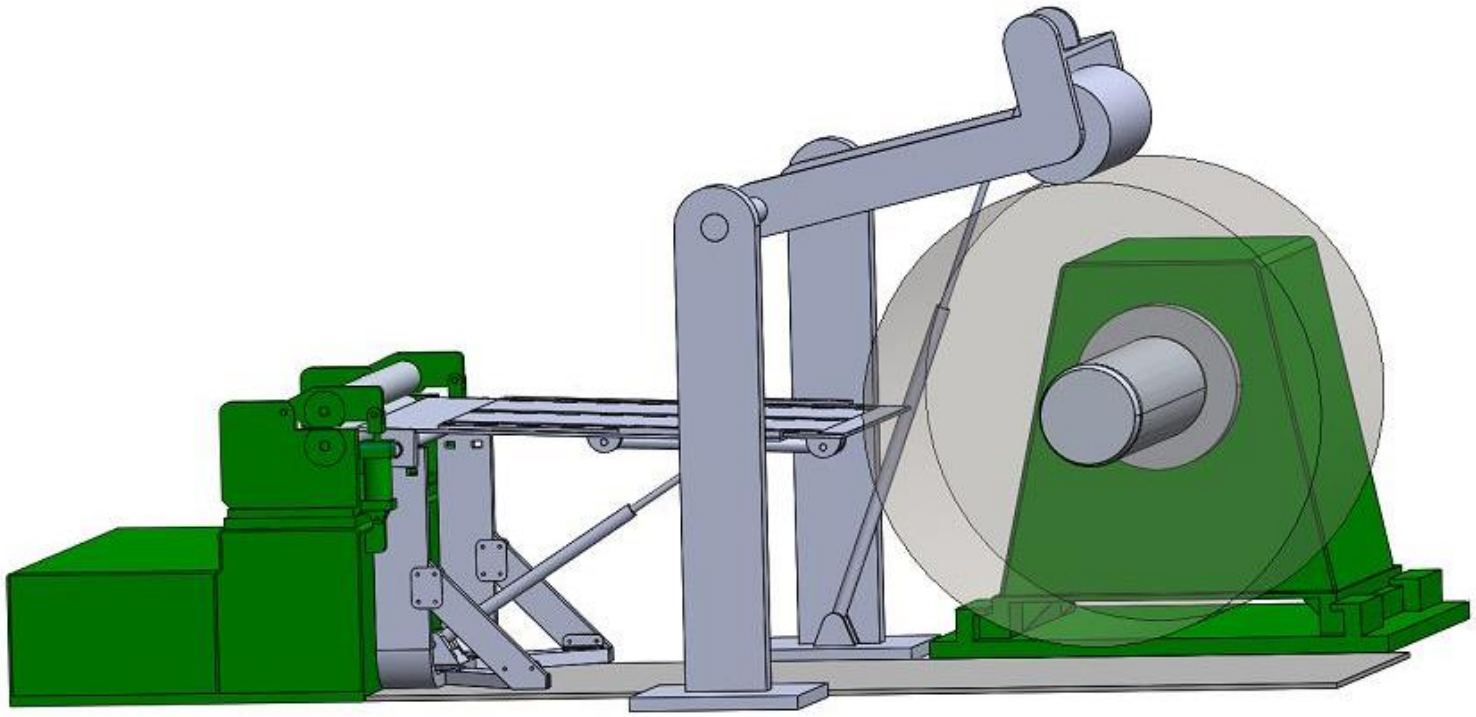


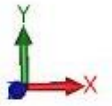
Bearings

- Ball Bearing
  - From McMASTER
- Radial Load Capacity
  - Dynamic: 3750 lbs.
  - Static: 2700 lbs.
- Material
  - Steel
- Maximum Speed
  - 10,000 rpm
- Bore Diameter
  - D=1”

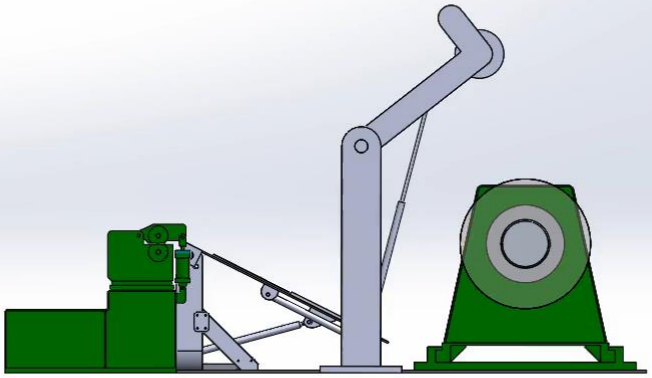
From Manufacturer

Full Assembly





Animation



<u>Stroke Velocity</u>

- **V**(*Table*): **1 in/sec**
- **V**(*Extended table*): **2.1 in/s**
- **V**(*Hold-down arm*): **1.2 in/sec**

Room for improvements

- Pin Calculations.
- Run fatigue analysis.
- Attach hold-down arm to table frame.
- Modify table to further increase factor of safety.

Thank You !!