Fabrication Staging and Shipping Rack System

The University of Texas at Dallas ● Department of Mechanical Engineering ● MECH 4382 - Spring 2014

Project Overview

Project background:
- Total Facility Solution fabricates and ships out various tubing and pipes to other companies within the US.

Current Shipping Method:
- Build a rack system in the back of the shipping truck while the freight company is charging TFS for the down time.
- Loading process starts upon the completion of the rack building process.

Problem statement:
- The shipping process is not found to be productive mainly because of the down time. Unloading/loading process can take up to 3 days using current method.

Goal:
- To find an alternative rack system method that will facilitate the daily operation and minimize the down time.

Current Rack System

Alternative Rack System Requirements

• The ability to breakdown and adjust the height.
• Ability to stack the rack modular.
• Provision to move with the forklift.
• Ability to lock movement while in transit.
• Clean sub-lab requirement (on none marking wheels, no metal to metal contact and surface rust protection...)
• Ability to connect modular rack to each other.
• Total Facility Solution logo on the rack modular.
• Maximum height should be less than 8 feet.
• Allow spacing between horizontal rungs for at least 10” o.d. pipe.
• Structure stability.

Stacking Requirement

• The rack folds down to a compact size for return shipping.
• Racks align to stack up to four racks.

Rack Prototype Modular Design

Connection Requirement

• The height on each modular can be adjusted to the desired height via the connecting uprights.
• Maximum height of each rack does not exceed 8 feet.
• The racks can be connected to each other by using the C-Rungs as the connection method.

Clean Room & Locking Mechanism Requirement

The surface of the entire modular will have clear coat on it to meet clean room requirements.
- Non marking wheels
- Locking mechanism

Forklift provision

• Forklift loops are welded on the base rack to allow up to four racks to be stacked and transported via forklift.

Height Adjustment

• Maximum height does not exceed 8 feet.
• Height surpasses 6 feet.

Structure Stability Requirement

• It is evident by our prototype model that the entire structure has met the stability requirement. Although failure would first occur at the joints.
• Our FEA analysis also show that the racks will be very stable under the applied load conditions.
• 2000 lb. down force was applied on the shown sides of the rack and no weld failure occurred (max displacement 0.019 inches)
• 400 lb. horizontal force applied on the vertical square tubes of the rack and also there is no structure failure due to the weld at the joints.

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Conclusion

• Prototype solves the down time issue, maximizes shipping, and satisfies all the requirements made by the sponsor.
• Easy to assemble/disassemble for transportation
• Cost efficient compared to the existing shipping method

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