PURDUE UNIVERSITY | School of Industrial Engineering

IE 43100 Fall 2022

TEAM 03

Maintenance Test Bench - Amazon

Vince Allen, Jay An, Ethan Brooks, Alfonso Cantu, Justin Smith

1. CLIENT BACKGROUND

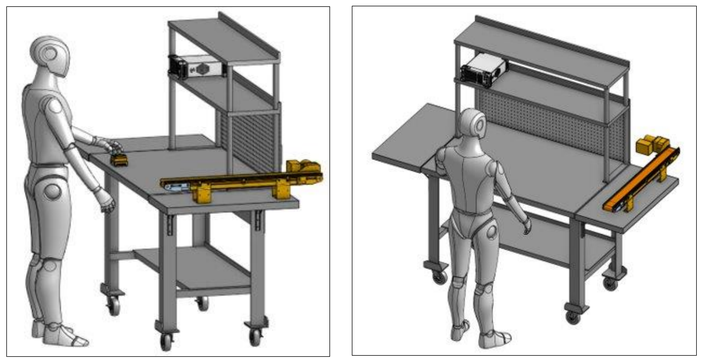
The project the team was working within the Amazon Customer Fulfillment center. Amazon operates over 100 fulfilment centers all over the United States. These fulfillment centers are used to handle the logistics required to get a product from an online order, to the customers doorstep. Given the high quantity of traffic to Amazon every day, efficiency is paramount in such centers. This nonstop operation provides the backbone for the convenience Amazon customers utilize every day. The scope of the project and the test bench being produced aimed to be applied to all fulfillment centers in the United States.

2. PROBLEM STATEMENT

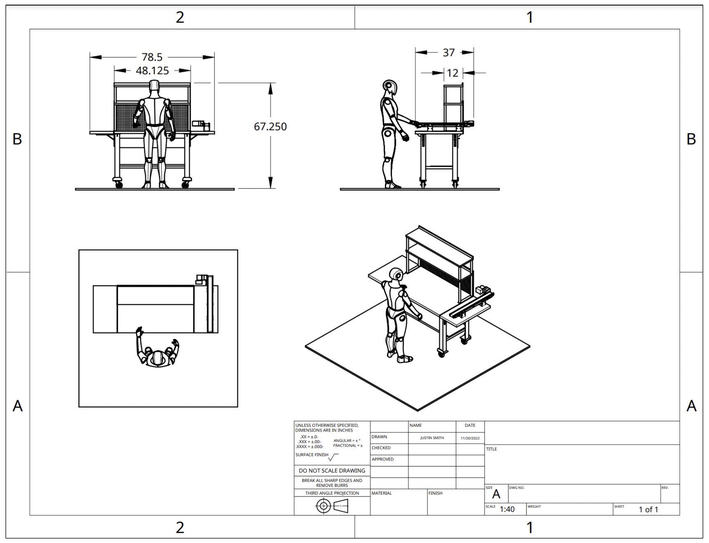
Amazon facilities have no way for manufacturers to adequately test products. This results in many facilities relying on makeshift solutions that might not satisfy safety and ergonomic standards. Our project focuses on the development of a low-cost test bench that will be used to test newly received parts for Amazon's robotic fulfillment centers. Building a proper test bench allows Amazon to have a standardized bench that can be used at all facilities which meets ergonomic, safety, power and technical requirements making maintenance consistent across the company.

5. RESULTS

CAD Layout Design

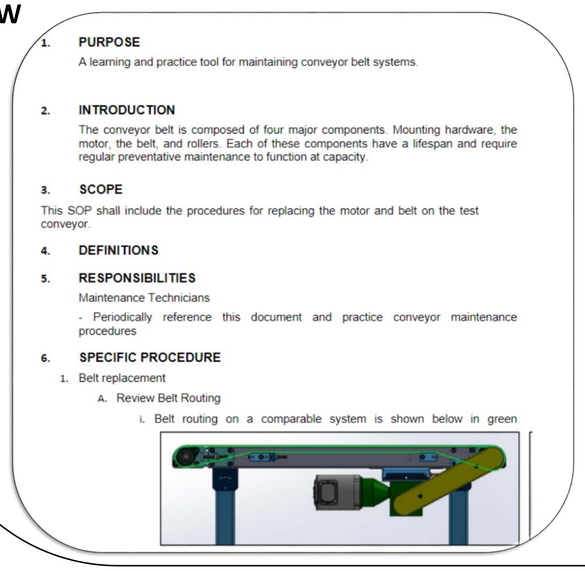


The photos above show multiple angles of the final CAD model of the maintenance testing bench. Main features include wheels for mobility, standing height, and space for tools.



The diagram shows many angles of the testing bench as well as how the bench will fit in space.

SW



1. **PURPOSE**
   A learning and practice tool for maintaining conveyor belt systems.
2. **INTRODUCTION**
   The conveyor belt is composed of four major components. Mounting hardware, the motor, the belt, and rollers. Each of these components have a lifespan and require regular preventative maintenance to function at capacity.
3. **SCOPE**
   This SOP shall include the procedures for replacing the motor and belt on the test conveyor.
4. **DEFINITIONS**
5. **RESPONSIBILITIES**
   Maintenance Technicians
   - Periodically reference this document and practice conveyor maintenance procedures
6. **SPECIFIC PROCEDURE**
   1. Belt replacement
      A. Review Belt Routing
         i. Belt routing on a comparable system is shown below in green

Bill of Materials

Item #	Manufacturer Part Number	Manufacturer	UOM	Qty	Description	Mounting Hardware Included?	Cost Per Unit (USD)	Cost Total (USD)
1	5964T82	McMaster-Carr	Ea	1	Stainless Steel Worktop	N/A	$518.17	$518.17
2	4767T86	McMaster-Carr	Ea	2	Workbench Leg	NO	$293.09	$586.18
3	4767T62	McMaster-Carr	Ea	1	Workbench Leg Lower Shelf	YES	$151.64	$151.64
4	4767T27	McMaster-Carr	Ea	1	Workbench Leg Support Brace	YES	$80.16	$80.16
5	5983T31	McMaster-Carr	Ea	1	Top Shelving	YES	$636.02	$636.02
6	18575A23	McMaster-Carr	Ea	1	Back Pegboard	NO	$29.79	$29.79
7	51697T03	McMaster-Carr	Ea	1	Side Worktops	N/A	$139.74	$139.74
8	1294A51	McMaster-Carr	Ea	4	Side Worktop Shelving Bracket	NO	$33.80	$135.20
9	5734K222	McMaster-Carr	Ea	1	Ready-to-Run Conveyor	NO	$1,781.17	$1,781.17
10	5734K512	McMaster-Carr	Ea	4	Bracket for Ready-to-Run Conveyor	YES	$30.92	$123.68
11	90584A517	McMaster-Carr	Pk	4	Number 10 Screws	N/A	$6.17	$25.68
12	91251A391	McMaster-Carr	Pk	2	5/16"-24 Screws	N/A	$11.68	$23.36
13	90630A150	McMaster-Carr	Pk	2	5/16"-24 Locknuts	N/A	$4.20	$8.40
14	18575A51	McMaster-Carr	Ea	1	Mounting Kit for Pegboard	N/A	$2.41	$2.41
							Total Cost:	$4,241.40

The Bill of Material provides a comprehensive list of all building material and parts that are used in construction of the testing bench as well as their associated cost. It also provides a direct link to the parts on Mc-Master Carr.

The document to the left is the Standard Work that provides a clear written instruction for operation and maintenance of the testing bench. This work order in critical for standardization and proper use among all facilities. This also follows the Amazon standardized template for seamless integration.

3. TASK AND METHODS

Data Collection: project focused primarily on utilizing preexisting schematics from international plants. Although there are no existing testing benches in United States based facilities, there are some similar models at Amazon's international sites. The team was able to obtain various files to help visualize and constrain a possible model.

CAD: The team decided to utilize CAD in the design of the bench. It is easy to constrain a design within CAD software. Adjustments could easily be made as the requirements from the customer evolved as the project progressed. Perhaps the most important use of CAD, was the ability to use premade parts from McMaster-Carr. This was both for convenience as well as a customer requirement. Using premade parts made it so that the team could save time while also utilizing industry standard sizing.

IE Tools: Many IE tools were considered such as ergonomic design, economic study, process improvement, and quality control.

4. Discussion

1. **Standard Work**
   - ✓ Follow Amazon standards
   - ✓ Clear, concise instruction with visuals
   - ✓ Follow manufacturers recommendation for COTS components
2. **Bill of Materials**
   - ✓ Provide an accurate list of all components within the test bench
   - ✓ Contains pricing as listed by McMaster-Carr to give a rough estimate for the price to build for the test bench
   - ✓ Formatted it to match with Amazon standard BOMs
3. **CAD Layout**
   - ✓ Assures that new parts are fit for the job before being installed on the equipment
   - ✓ Design includes a subsystem for technicians to practice replacing a conveyor belt

6. Conclusion

- Test bench satisfies customer requirements
- Delivered 3 quality products to Amazon
  1. Testing Bench
  2. Bill of Material
  3. Standard Work
- Amazon can use the skeleton of our design to apply it to different sectors.

Customer Benefits:

- In Process Quality Control
- Periodic technician training for common maintenance routines
- Standardized materials for widespread Test Bench rollout

Client Information

Contact: Joseph Mueller
josemuel@amazon.com

amazon