Basic Technical Document

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Abstract

This deliverable is about design criteria and target specifications, within the design criteria the reader will understand how we ranked our design criteria, our functional and non-functional requirements, and our constraints for the whole project that we must abide by. There will be 3 products that have been benched marked by our team showing what our group thinks of each product through our chosen metrics. This document also contains group 17 thoughts from client meeting 1 and how that affected our decision-making process.

1. Design Criteria

1.1. Functional Requirements

- Drill and tap holes in less than 30 minutes.
  It currently takes about 30 minutes for a laborer to drill and tap all the holes for the door hinges. Reducing this time is crucial for decreasing the total manufacturing time of each door.
- Accommodate different-sized holes and hole placement.
  There are 4 different types of door hinges that AMBICO will be using. It is essential that the jig can be quickly adjusted to drill the appropriate holes for the holes.
- Drill straight holes
  The holes must be drilled and tapped straight so the door hinges can be installed properly.

1.2. Non-functional Requirements

- Easy to use as well as safe.
  An easy-to-use tool is ideal so inexperienced labourers can quickly learn how to effectively drill holes using the tool while doing it safely.
- The jig cannot damage the door.
  The wood cannot be damaged while the jig is being pressed up against the wood or is holding the door in place while drilling or tapping is happening.
- Durable.
  People make mistakes, especially when they are tired and working a labor-intensive job. It is possible that the tool may be dropped, or someone may hit it with another item.

1.3. Constraints

- Work well in a dusty environment.
  There is quite a bit of dust created from the woodwork that occurs in the factory. Therefore, a tool that still operates well when covered with dust is required for it to be useful.
- The price should reflect the durability and effectiveness of the product.
  A higher price is willing to be paid if the tool saves the labourer a significant amount of time and if the tool has a long life span. However, if the tool does not save much time or if it must be replaced frequently, it won't make sense to spend a lot on the tool.

1.4. Summary of Design Criteria

Functional Requirements	**Non-Functional Requirements**	**Constraints**
Time Per Door	Easy to learn and use	Works in a dusty Environment
Adaptability Between Bits	No damage to door	Cost
Hole Precision and Alignment	Durability	

2. Metrics

Weight	The mass of the product in pounds (lbs.).
Size	The dimensions of the product in terms of maximum length, width, and height in centimeters.
Cost	The overall cost of the product in USD.
Effectiveness	The capability to drill and tap holes in a timely manner and seeing how straight the holes are to 90 degrees.
Ease-of-Use	How easy it is to be able to read and then be able to use the product.
Durability	How much of a beating the product can take (from reviews of bench marked products).
Maintenance	How easy it is to clean and use the product without having to constantly replace parts.

3. Bench Marking

There are currently no automated solutions for drilling the holes for door hinges, so Table 2.1 only compares handheld tools.

Our importance rating will range from 1-5, with 5 being the highest importance and 1 being the lowest

3.1. Technical Bench Marking

Tool / **Metrics**	**Importance Weight**	**1 – Essential Hinge Jig 3”**	**2 - Self-Centering Hinge Bit**	**3- Cabinet Hardware Jig**
Weight	3	N/A	0.25 lbs.	1.345 lbs.
Size	4	3 Inch Imperial Kit	291 - 5/64" Bit, 293 - 9/64" Bit	17.04 x 2.71 x 2.48 inch

		3 x Extrusions (2 x 625mm 1 x 655mm) 6 x Joining Bars with 2.5mm Hex Key 3 x Clamps with fixings 6 x 3" Hinge Blocks with clamp Stops. 1 x 2mm Head Hook and Stop 1 x 3mm Head Hook Stop 1 x Teletube for transportation		
Cost	1	$268.7	$9.48	$35.91
Ease of use	4	Easy – Screw-on clamps to attach to the door	The **Hinge Bits** have an adjustable collar for decreasing the drill depth, Makes accurate pilot holes for hinges	DIY friendly device offering easy to move parts and construction of the jig with only 3 steps to construct it
Effectiveness	5	Guides are placed along jig to easily measure size of holes	Spring-loaded outer guide with chamfered head, and adjustable drill depth	Guides and measures can easily find the exact place to drill holes for the hinges, perfect for cabinets too, easy, and sturdy design allows for precise movements in the jig
Material	2	Made of metal or high-quality plastic	Made of steel	Made of solid aluminum alloy and stainless steel
Durability	4	No Data but should be able to withstand a fall based off the metal design	No Data but there is a possibility of the spring breaking if dropped	Based off the customer reviews metal design of the jig makes it very durable

3.2. User Bench Marking

Tool / Metrics	Importance Weight	1	2	3
Time	5	Saves time by eliminating the use of random measurements as one jig can do many at once	Quick spring-loaded mechanism allows for a quick puncture in the material to create holes and move on to other tasks	Quick – no clamps needed to slow down the process to measure the dimensions of the holes or lines that are needed to be created for the hinges
Time Per Door	5	N/A	N/A	Tool can be used to quickly measure many cabinets or doors at the same time saving time on each door that is worked on
Hole precision and alignment	5	Open aperture allows for various sizes of hinges and adjustability for various cut out sizes, base plate contains measuring scale to easily align the wood to the holes	Precise tip makes it easy to create accurate holes in the surface	Tight tolerance between rulers for marking holes accurately
Ease of use	4	Color coded hinge size attachments for easier comparison between measurements	added fire check block used to set a hinge 100mm (about 3.94 in) from the top hinge helps fit these doors as simply as possible	3 step assembly instructions with only 2 movable parts
Damage to door	5	Light or none as many clamps used to distribute clamp force of the jig meaning not a lot of force is used to hold	Does not touch the door, only the holes for the hinge	None, only used to measure and press up against a surface

		down the jig in one spot		
Works in a dusty environment	3	Woodworking tool meaning it can work around wood cutting, steel makes it not prone to be scratched by wood chips	used for piercing wood and carpentry so it can be used around wood dust infested areas	Can work in environments for when you need to drill holes on doors, cabinets, drawers, and other woodworking appliances
Durability	4	Strong steel base adds a level of rigidity due to its low elasticity coefficient giving the users the ability to use it for many years	The steel casing of the jig allows the jig to have a level of protection around it from drops and can protect the mechanism from being exposed to any elements that may break it	Very good, made of only strong metals (aluminum and steel) for the construction of the jig

4. Target Specifications

Design Specifications	**Relation (=, < or >)**	**Value**	**Unit**	**Verification Method**
Functional Requirements				
Time Per Door	<	30	Minutes	Test
Adaptability Between Bits	=	Yes	what	Test
Hole Precision and Alignment	=	Yes	N/A	Test
Constraints				
Functional properly in a dusty environment	=	Yes	N/A	Test
Weight of handheld tool	<	15	Pounds	Analysis
Cost	No exact number	No exact number	No exact number	No exact number
Non-Functional Requirements				
Easy to learn and use	=	Yes	N/A	Test
No damage to door	=	Yes	N/A	Test
Durability	=	Yes	N/A	Test

5. Conclusion

It is important that the jig designed for such a purpose can be used far more efficiently than current conventional standards while maintaining the same safety level for the operators of the tool. The tool should be adapted to properly measure 4 different door hinges of varying dimensions, while also remaining stable relative to the door when being used to avoid drilling screw holes that are not straight and non-functional. Ideally, the jig should be durable and long-lasting, and it should be able to withstand an impact or fall. The price should reflect the efficacy of the final product. If the product has a long life span, is durable, and greatly reduces the time it takes door drill the doors then the client will be willing to pay a premium price.

6. Reflection

Client meeting one wasn't a very detailed one in terms of what the client would like to see as no matter who the client always has a design, they would prefer but it is our job to come up with more and give them the solutions they didn't think of right away. Client meeting 1 included AMBICO introducing themselves at what type of company they are and how they operate. They included that from start to finish a door takes 30 mins to complete. From that, we can understand the stages of drilling and tapping take the longest as they're asking us to come up with a solution. They gave us the details of the different types of hinges that they drill which include 2 different hole sizes, 3 different sizes of hinges and 4 different types of backsets. So, our jig needs to be versatile. They also mentioned that since they work with wood and metal doors it is a very dusty factory and floor, so it needs to withstand those conditions. They also would like their labourer to understand how to use it after being shown and doesn't require a whole diploma for the jig to operate. The company didn't give us a budget on how much they're willing to spend but in class, we have a budget of $50 CAD.

7. References

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