

CHAPTER

4

PORTABLE DRILLING JIG FOR HAND DRILL

Hairul Anuar Abdullah and Naqib Abd Razak

4.1 INTRODUCTION

The drilling process is the process of making a hole on a target object by using a cutting tool named drill bit. The chuck at the end of the drill grips the drill bit, presses it against the target object, and rotates the drill bit to make the hole. Many types of drills like a corded drill, cordless drill, rotary hammer drill, magnetic drill, and drill press are powered by electricity. For work with metal, wood, masonry, and do-it-yourself project up to 12 mm diameter drill bit, fabricators usually use the corded drill, cordless drill, and rotary hammer. Magnetic drills and drill presses are usually used for work with materials that require high precision drilling. Press drill is the most common drilling option because of its easy operation and excellent accuracy. However, the accuracy is challenged when drilling structures like joining two beams perpendicularly. A hand drill is usually used for this situation, yet it is intrincating to adjust the alignment to drill accurately. A jig is needed to assist this process.

4.1.1 Problem Statement

The drilling process is often required to process materials like aluminium profile, hollow metal bar, wood bar, etc. Fabricators commonly use press

drills since the press drill gives an accurate straight drilling result. However, in cases like drilling on a structure like joining two aluminium profiles perpendicularly, the press drill does not seem to be appropriate. In this case, fabricators always use the hand drill, but then, using hand drills might risk the geometry of the structure. Some modifications to the hand drill are needed to overcome the issues.

4.1.2 Objective

The objective of this project is to design a portable drilling jig that can assist fabricators when using hand drills for drilling perpendicular beams while maintaining the accuracy and alignment of the holes.

4.1.3 Scope

The scope of this study is focusing on:

- (1) Background study on existing products, patents and standards related to this project.
- (2) Four concept designs generation of portable drilling jig for hand drill.
- (3) Final design selection of a portable drilling jig for hand drill.
- (4) Computer-aided design (CAD) modelling of the final conceptual design of portable drilling jig for hand drill using SolidWorks.
- (5) Detailed design that consists of design for assembly, failure mode effect analysis, engineering drawing, engineering analysis, and costing.
- (6) Fabrication of drilling jig prototype.
- (7) Functionality testing of the prototype.

4.2 DESIGN PROCESS

This section explains the conceptual design process.

4.2.1 Problem Identification

Problems are identified by performing critical background research and by understanding concepts from similar products. The focus is on the types and functions of drills, drill bits, and existing drill jigs.

4.2.2 Product Design Specification

To get the best solution for the portable drilling jig (PDJ), a product design specification (PDS) is constructed. The PDS will be a guideline for the design specification of the PDJ. The manufacturing of this product must follow BS 328–1:1993 and BS 1098–2:1977 standards. Table 4.1 shows the PDS for the PDJ.

Table 4.1 Product design specification

Specification	Description
Performance	Portable. Be the guide for horizontal drilling. Fits for 3–10 mm diameter drill bits, twist drill bits, wood drill bits, and 8 cm thickness object. Capable to position the drilled hole according to marked line. Capable to guide the drilled hole to be perpendicular against the surface of the target object. Can be operated by one person. Installation in less than 60 seconds. Capable to guide drilling for plastic, wood, and metal object. Capable to drill on any position in the surface of the object.
Size and Weight	Weigh less than 1 kg. Maximum dimension is 10 cm × 10 cm × 30 cm.
Cost	Less than RM150.00.
Material	Light weight metal and not easily damaged by impact. Corrosion resistant.
Aesthetics	Must present reliability and compactness.
User	Fabricator, technician, and DIY person
Safety	No sharp edges and able to set up gloved hands.
Manufacturing Facility	Availability of sustainable tools and fabrication material. Availability of facilities provided by UTM.

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