

DESIGN GALLON WASHING TOOLS USING ERGONOMIC FUNCTION DEPLOYMENT METHOD

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ABSTRACT:

Bottled Water (AMDK) is water that has been processed with special treatment and packaged in bottles or other packaging that qualified drinking water. AMDK Tirtawening is one of the companies under PDAM Bandung City that produce bottled water. This study focused on washing gallon because on the existing washing gallons conditions, is still done manually. Therefore, appear the washing gallon tool that combines three gallons washing production processes in one tool by previous researchers. In the previous design, the technical feasibility has not been used Rapid Upper Limb Assessment (RULA) then obtained a score of 5 (insert dirty gallon) and 6 (turned on the washing gallons). It can bring the fatigue impact too fast, even more AMDK Tirtawning conduct mass production that is 600 to 1,200 gallons per day. This study aims to produce design proposals gallon washing tool that has the ergonomics side so as to reduce the risk of fatigue in workers. This study uses Ergonomics Function Deployment (EFD). EFD is the development of a method of Quality Function Deployment (QFD) by adding a new relationship between consumers need and the ergonomic aspects of the product. Steps being taken in this study is evaluation of ergonomic aspects to consider in choosing the ergonomic attributes with ENASE (Efektif, Nyaman, Aman, Sehat, Efisien) principle, the determination of attributes, the determination of the target specifications, matrix needs, the establishment of House Of Ergonomics, final specifications and the final draft. Recommendations concept tool made based on the results of this study is to produce a concept of ergonomic improvement tools and concepts tools that can reduce fatigue in workers.

Keywords AMDK Tirtawening, Rapid Upper Limb Assessment, Fatigue, Ergonomi Function Deployment

1. INTRODUCTION

Bottled Water (AMDK) is water that has been processed with special treatment and packaged in bottles or other packaging and qualified drinking water. Association of Water Companies Bottled Indonesia (Aspadin) said that in now day, there are approximately 500 companies engaged in the drinking water industry.

Tirtawengin drinking water is one of the companies under PDAM Bandung that produce bottled drinking water. Activity process of drinking water production Tirtawening particular section of gallons of them, ranging from the arrival of trucks carrying gallons of dirty, disposal of residual water contained in a gallon, washing gallons outside, flushing, washing gallon inside, flushing gallons in, sterilization, charging gallon, install the cover gallon, transfer gallon to truck

In the existing condition washing gallons, is still done manually. Therefore, emerging tool that combines three gallons washing

production processes in one tool. Here is a tool that has been designed gallons laundering by previous studies (Bennarivo, 2016).

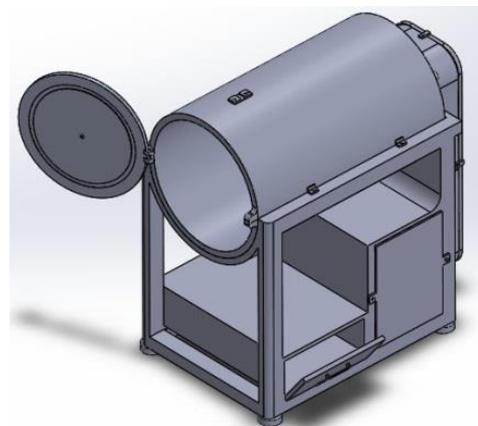


Figure 1 Design Tool Washing Galon (Bennarivo, 2016)

Mechanism of the tool design results of previous studies that incorporate gallons of dirty washing tool gallon. Then close the front of the washing apparatus gallon. Then the machine is turned on and do the washing process gallon inside as well the outside. Furthermore, the process of flushing gallons. In previous research design, has not done the technical feasibility of using Rapid Upper Limb Assessment (RULA). The following is an analysis of the technical feasibility of using RULA.

Table 1 Preliminary Concept Analysis RULA on Laundering Gallon

Activity	Work Posture	Score	Note
Replacing dirty gallon		5	Have a medium risk, immediately conducted an investigation, the changes to be done
Turning on the washing apparatus gallon		6	Have a medium risk, immediately conducted an investigation, the changes to be done

By looking at the RULA results of the value of the design tool washing gallon earlier research, it can be demonstrated not technically feasible. This can result in the arrival of fatigue or fatigue due to working too fast gallon bottled water Tirtawening conduct mass production with a number that is 600 to 1,200 gallons per day

Based on the elaboration of the problems above case studies, evaluation and improvement of the design proposals to ensure that the application of the proposed instrument to facilitate workers and also reduce the risk of fatigue. Washing tool that has been designed gallons in previous studies, were evaluated to determine how well the device has met the technical

aspects of the functional, aesthetic, and ergonomic aspects when in use.

2. THEORETICAL BACKGROUND

2.1 Ergonomic

Ergonomics is about the human aspect of the work environment are reviewed in anatomy, physiology, psychology, engineering, management and design / design. Ergonomics discipline approach is geared to improve human work performance, such as accuracy and safety in addition to reducing the incidence of fatigue (Fatigue) were too fast and were able to improve the utilization of human resources as well as human and minimize equipment damage caused by human error (Juniani, 2007).

2.2 Antropometri

Anthropometry is a collection of numerical data relating to the human body characteristics such as size, shape, and strength as well as the application of these data handling design problem (Nurmianto, 1996).

2.3 Display

Display is part of the environment that should provide information to the worker to his job to be smooth (Sutalaksana, 1979).

2.4 Evaluation of Ergonomics In Design Process Products

In the design of the product will be approached from a variety of disciplines. Science study of ergonomics (human factors) tried to relate the design of products to be harmonized with human, based on the capacity and the limitations of the corner of reviews their physiologic or psychology ability with the aim to improve the work performance of the human systems - products (Santon, 1998).

2.4 Ergonomic Function Deployment (EFD)

Ergonomics Function Deployment (EFD) is a development of the Quality Function Deployment (QFD) by adding a new relationship between consumers and the ergonomic aspects of the product (Ulrich & Eppinger, 1995).

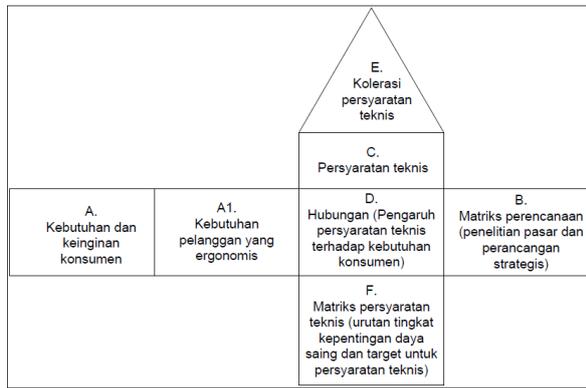


Figure 2 House Of Ergonomics (EFD)

3. RESEARCH METHOD

The conceptual model in this study are described in Figure 3 below.

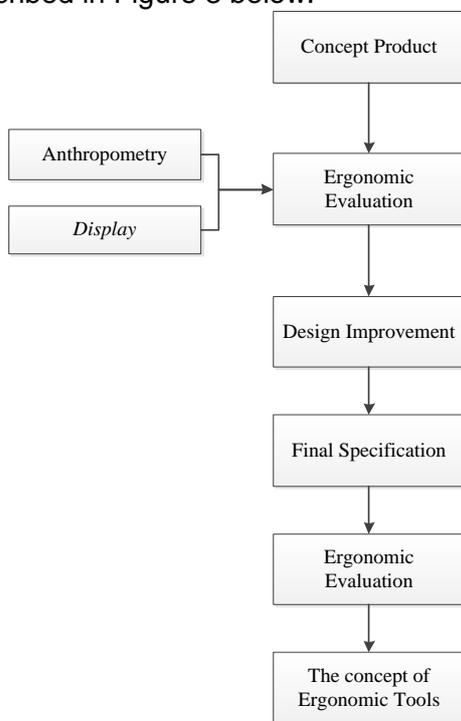


Figure 3 Conceptual Model

The initial stage of this research is to obtain the concept of previous researchers, ergonomics evaluation of this research focuses on anthropometry, evaluation display. The evaluation will be a consideration in determining the ergonomic equipment specifications. The next stage is the stage of ergonomic function deployment (EFD) used according to the needs and desires of consumers in accordance with the principles of ergonomics are used as a tool product attributes laundering gallon.

4. RESULT AND DISCUSSION

In the first phase of the input data obtained by previous research the concept and dimensions of the washing apparatus gallon. Here is the starting dimension laundering tool gallon.

Table 2 Dimensions Originally Washing Equipment Gallon

No	Dimension	Size
1	High-laundrying gallon	50 cm
2	Diameter cap laundrying gallon	30 cm
3	Long laundrying gallon	61. 50 cm
4	Width Laundrying gallon	39 cm

The next step is to identify the product attributes based on the identification of ergonomics and ergonomic evaluation results that have been done. Product attributes to the concept of laundering gallon tool is the result of the evaluation of ergonomics and desires of consumers. The following is an attribute that is used by the ergonomic aspects which translates into a hierarchy of needs.

Table 3 Hierarchy of Needs

No	Requirements Ergonomic	Product Atributte	Translati on of attributes
1	Effective (which has been specified)	The size of the tool according to the anthropometric dimensions Indonesia	Handling corpeson ding size anthropometry
		Tools have information about functions	Display shows the playback function Display shows the descriptio n of hazards
2	Comfortable (behavior is conditioned to provide a level of performance is stable, free from the risk)	Cover gallon comfortable when opened	-
3	Safe (condition in which a person is in a state without anxiety)	Tools posture safe for workers	-

No	Requirements Ergonomic	Product Atributte	Translatio n of attributes
4	Healthy (Eliminate things that can cause health problems / illness)	neutral body position	-
5	Efficient (Goals can be achieved with effort, cost, sacrifice low)	Hand range when the engine	-

After determining the Hierarchy of Need will be processed again into the ergonomics of product concept based on the principle of effective, convenient, safe, healthy, and efficient (ENASE). Here are the attributes needed in the washing apparatus gallon.

Table 4 Product attributes

No	Ergonomic Requirements	Product Atributte
1	Effective	Handling corresponding size anthropometry
		Display shows the playback function
		Display shows the description of hazards
2	Comfortable	Cover gallon comfortable when opened
3	Safe	Tools posture safe for workers
4	Healthy	Tool has a neutral working posture
5	Efficient	hand range when the engine

Based on the identification of attributes obtained ten technical characteristics which would then be processed to determine the target specification in the washing apparatus gallon. Technical characteristics obtained from the study of literature. Here is the technical characteristics are obtained.

Table 5 Technical Characteristics

No	Technical Characteristics
1	Dimensions range of hand
2	Display danger type
3	Display round type
4	The width of the opening handling machines
5	The width of the cover handling gallon
6	Width storage shelf handling

7	Skor RULA
8	High-laundering tool gallon
9	Color display hazard
10	Color display round

Here is a final specification is based on the technical characteristics that have been determined. Final specifications obtained by evaluation of ergonomics and also compare denan similar products. Final specifications in the form of a fixed value.

In determining the value range on the high leaching tool gallons ie high dimensional popliteal coupled with high dimensional elbow in a standing position for each percentile so didapatkan value range 71.63cm - 78.21cm.

Table 5 Antropometri Dimension for Height

Dimension	Data Antropometri yang digunakan	Percentil	Unit
Height of Machine	Popliteal	P5	41.44cm
	Dimensions Height elbow in a seated position	P5	30.19cm

Tabel 7 Dimension of Machine

No	Characteristic	unit	value
1	reach of Hands	cm	57.45cm
2	Type display danger	list	-
3	Display Type speed (RPM)	list	-
4	Type display rotation	list	-
5	The width of the opening handling machines	cm	13.7cm
6	The width of the cover handling gallon	cm	13.7cm
7	Width storage shelf handling	cm	13.7cm
8	Value score RULA	skor/nilai	3
9	High-laundering tool gallon	cm	71.63cm
10	Color display hazard	list	-
11	Color display round	list	-

The final product can be see at the figure 2.

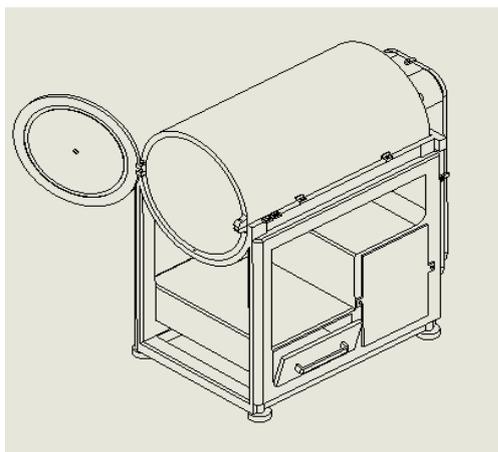


Figure 2. Final Product

5. CONCLUSION

This research resulted in several conclusions including:

1. Based on the results of ergonomic equipment design laundering then obtained the concept of ergonomic tools based on attributes need effective, convenient, safe, healthy and efficient (ENASE). The design concept of the ergonomic tool laundering gallon seen in the attachment.
2. On the concept of laundering gallon ergonomic tool is able to reduce the risk of fatigue due to the awkward position has been achieved due to the testing parameters on ergonomics evaluation has been done. The following results

6. REFERENCES

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table comparison tool laundering ergonomic design with a preliminary design laundering gallon.

Table 8 ergonomics evaluation results of the comparison that has been done

No	Evaluation	Early concept laundering gallon	The concept of the ergonomic washing tool	Note
1	Posture when entering gallon	Score RULA 5	Score RULA 3	The risk of reduced fatigue
2	Posture is the time when turning on the washing tool	Score RULA 6	Score RULA 4	The risk of reduced fatigue
3	Display	There is no display on the tool washing gallon	There is a display on the instrument laundering gallon	There is information contained in a gallon laundering tool that description hazards and working mechanism of the tool

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