Anthropometric Body Dimensions Approach: Table Design Cross-section on Tools Evaporation Rate

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Abstract: The cross-section table is one of many support to the make the Evaporation Tools. The Function of the cross-section table is to place the sensor devices. The differences topography of salt ponds is one of the factors that must be considered in making the design of the table that oriented to user operation. Ergonomics that used to makes the design of the table is the anthropometry body dimensions approach. Based on the 95% percentile of Madurese anthropometry, then the table is designed flexibly. The flexibility can be seen in height control features of the table the which has a maximum height of 159 cm and a minimum height of 88 cm based on the D1 and D2 dimensions, the table foot locker features has a length dimension of 98 cm based on D1 , D2 and D3 in a row of 1715.5 mm, 1634.6 mm and 1437.1 mm for adjusting the height of the table cross-section features a handle with a high of 11 cm and the handle of the ball diameter of 4 cm based on the dimensions D28 and D29 to the 95th percentile male in a row at 185.6 mm and 95.5 mm for moving the position of the table sectional pulling and pressing. The length and width of the table by 56 cm cross section are based on the dimensions of 54cm by dimension D33 and D23, D24 and D25. The use of anthropometry is intended that the user can be comfortable when use the evaporation of tools without difficulty because the table design was made based on the operator dimensions using anthropometry approach.

1 INTRODUCTION

The table is one of many support to the make the Evaporation Tools. The function of the table is to place the sensors or the other devices that support the evaporation tools, therefore the table of the evaporation tools are needs to designed. According to the function. In addition, the design of the table. Also needs to Consider the user's need Because it is important to designing the product According to the user antropometry. (Sutalaksana, 1999). It is intended that the design of the table in accordance with user needs in a functional, technical and technological, economical, aesthetic and ergonomic.

A product design is said to be ergonomic when it Consider various aspect, one of the which is the anthropometric aspect. To obtain a proper comparison between products made with the end user needs anthropometric data, where the characteristics of a country will show a variety of different (H. I. Castellucci, 2019). According to the research results of Yu-Chi Lee (2019) anthropometric data can be used for a relevant consideration in the development of ergonomic products, equipment, and design workstations. The use of anthropometry for the design of tools, equipment and working environment that is well designed, can improve productivity, safety, comfortable and work performances (Klamklay et al, 2008). Pheasant (2003) also added that the anthropometry is a very important part of ergonomics.

Anthropometry is a study relating to the dimensions of the body that the body size, shape, strength and capacity for work (S.Z.M. Dawal et al, 2012) relating to the design (J.J Shiru et al, 2012) and composition of the human body / end user (J. Majumder, 2014) that aims to improve productivity and reduce musculoskeletal disorders (MSDs) (P.Salunke et al, 2015). Anthropometry that the data used in the design of to improve safety and comfort, the design of equipment and facilities in the country of Indonesia should take into account the ethnic differences in anthropometric in Indonesia (A.Widyanti, 2015).

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Based on this, the table design as the evaporation tools support is designed by considering the functions, technical and ergonomic aspects with the anthropometry approach. The table is the Madurese male dimension. This is because the evaporation of tools is designed for Madura salt farmers as the users so that the table design accordance with the Madura salt farmers dimension.

2 LITERATURE REVIEW

Ergonomics is one of the sciences that Identifies and collects the informations about the data related human or behaviors, abilities, limitations and the characteristics. The information is used to design a productive, safe and effective comfort of machine, equipment, work systems and work environment. Ergonomics is a systematic branch of science to Utilize information about human behavior, abilities and limitations in designing a system optimize work so that goals can be Achieved Effectively, safely and comfortably (Sutalaksana, 1999). To make products by holding ergonomic principles in the design and work system, anthropometry approach has been used for a long time (I.W Taifa et al, 2017).

Kroemer and Grandjean (2005) define that anthropometry as the science of measuring the dimensions of the human body and an important factor in considering the process of designing facilities or equipment. Because anthropometry is used as a task adjustment with humans. Three principles of applying anthropometric data in designing various products that depend on the type of product. The first principle of the design principle for extreme individuals, in the form of a design made can be used by extreme individuals, which is too large or small compared to the average to fulfill the target, then a large percentile is used (90th, 95th or 99th percentile) or a small percentile (1th, 5th or 10th percentile). The second principle of the design principle that can be adjusted, in the form of designing products that can be adjusted to the wishes of consumers like in the car seat. The last principle is the principle of designing the average size, in the form of design based on the average human size. This principle is used if the design of designed must be used for various sizes of the human body (Wingnjosoebroto S, 2008).The dimensions of the human body anthropometric have symbols in the form of numbers that have Reviews their meanings to make it Easier to write, Anthropometric dimensions of the human body proposed by Pheasent (2003) there are 36 body dimensions items, as show in Figure 1.

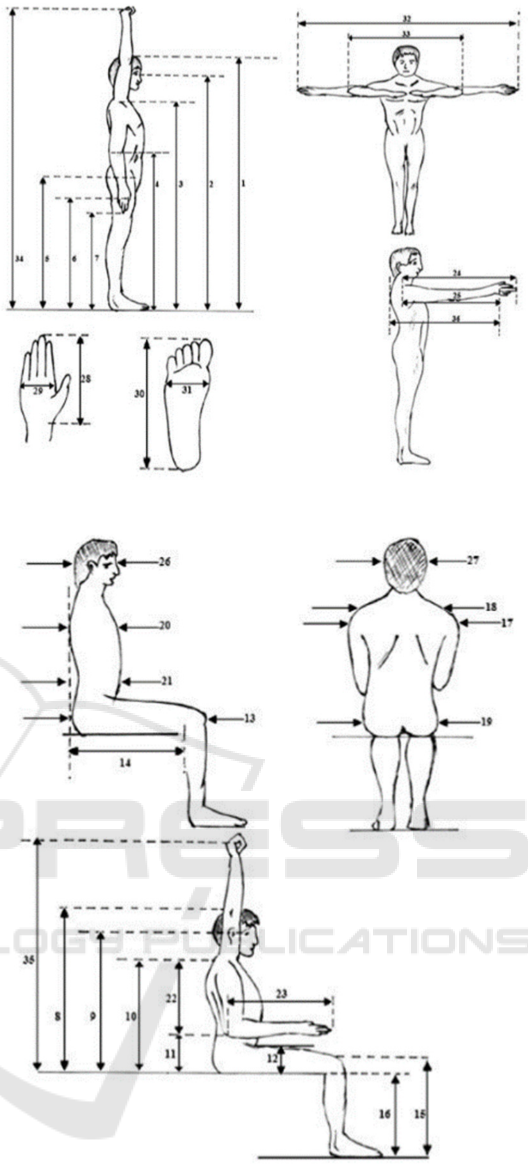


Figure 1: 36-dimensional image of the body.

Pulat (1992) offers a product design concept to support the efficiency and safety in the use of product design. The concept is designed for reliability, comfort, duration of use, ease of use, and efficient in use. So that each product design to meet the desires of the wearer it should be done through several approaches including:

a. Knowing the needs of the user. User requirements can be defined based on the needs and market orientation, interviews with potential product users and uses personal experience.
b. The function of the product in detail. Specific function products that can satisfy the user must

be explained in detail through a list of items each function of the product.

c. Perform analysis on product design tasks.
d. Developing products.
e. Test against the user of the product.

An ergonomic product design called when attention to several aspects, among others; anthropometric, physiological, biomechanical and psychological compatible with human users. In designing a product should be user-oriented production, distribution friendly, friendly installation, user operation and maintenance friendly. In the design of a product that is very important to note is a human-centered design of the wearer or the human centered design (Sutalaksana, 1999).

3 RESEARCH APPROACH

This study took place in laboratory ergonomics and system design work, starting in July up to August 2019. The need for a cross-table as one of the supporting tools evaporation rate, according to the functions and human needs as a user, then the cross-section table design should pay attention to ergonomic factors, one important aspect in designing appropriate ergonomic factors that aspect of anthropometry. Kroemer and Grandjean (2005) defines as the science of measurement anthropometric dimensions of the body and become an important factor in considering the process of designing facilities or equipment, because anthropometry is used for adjustment with a human task. Body dimensions are used as a cross-reference table that manufacture body dimension data Madurese man who quoted from research Fikri (2017) in his research related Anthropometric Measurement of Ethnicity Young Adult community Madura. That is because the user of the tool brine evaporation rate with the supporting cross-section table that is still devoted to Madura. The dimensions of the body of Madurese man who used to design the cross-section of the table, as shown in Table 1.

Table 1: The dimensions of the body of Madurese man who used to design the cross-section of the table.

No	Notation Dimensions	Dimensions	Definition
1	D1	High Body	The vertical distance from the floor to the top of the head
2	D2	high-Eye	The vertical distance from the floor to the outside corner of the right eye
3	D3	High Shoulder	The vertical distance from the floor to the top of the right shoulder (acromion) or the tip of the right shoulder blade
4	D23	The length of the forearm	The horizontal distance from the forearm was measured from the back of the right elbow to the tip of the middle finger
5	D24	Long-range arms forward	The distance from the top of the right shoulder (acromion) to the tip of the middle finger right hand elbow and right wrist straight
6	D25	Shoulder length grip arms forward	The distance from the top of the right shoulder (acromion) to the center of the cylinder rod is gripped by the right hand, elbow and wrist straight
7	D28	light-fingered	Distance from the wrist crease to the tip of the middle finger of the right hand with the hands and all fingers straight and open.
8	D29	The width of the hand	The distance between the two sides outside the four books right hand fingers are positioned straight and meetings
9	D33	The width of the hand	The distance is measured from the tip of the elbow right hand to the left hand end of the elbow.

By using a percentile 95%, following the body dimension data Madurese men, as shown in Table 2.

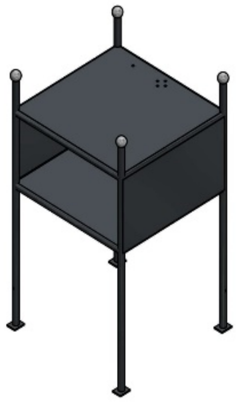
Table 2: a percentile of the body dimensions data Madurese man who used to design the cross-section of the table.

Dimen sion	Average	ST DEV	Percentile		
			5	50	95
D1	165.00	4:00	158.45	165.00	171.55
D2	155.70	4.73	147.94	155.70	163.46
D3	138.10	3:42	132.49	138.10	143.71
D23	46.59	0:51	45.76	46.59	47.42
D24	74.91	1:04	73.20	74.91	76.62
D25	65.96	1:08	64.18	65.96	67.74
D28	17:24	0.80	15.92	17:24	18:56
D29	8:54	0.61	7:54	8:54	9:55
D33	98.64	3:30	93.22	98.64	104.06

4 RESULT AND ANALYSIS

Based on data from the Madurese male body dimensions, then the cross-sectional design table as a support tool brine evaporation rate is made by a production-oriented user, user distribution, user installation, operation and maintenance user friendly, human-centered users. As it is reflected in the design below.

Table cross-section has a minimum height of 88 cm to a maximum of 158. This is because the D1 dimension or dimensions of 171 cm height, dimension D2 or high dimensional eye has a height of 163 cm. Salt ponds have sometimes erratic topography of the land does not even mean that results in the tool will have a slope so that the tool is not optimal in performing functions and uses. Anticipating that the tool brine evaporation rate feature flexibility given that the legs can be added height. The legs can be added height up to 70 cm so that the total reaches a maximum height of 193 cm. A secondary function of the flexibility features that can be used to adjust the viewing distance between the user with tools based on the user's body dimensions, are presented in Figure 2 and Figure 3.



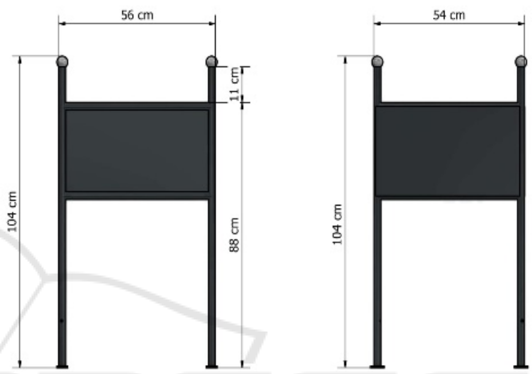


Figure 2: The design of the high position of minimal cross-section table.

Part A is a table of accessories that will be used as the handle so as to facilitate the user to change the position of the table. Part A has a diameter of 40 mm and the circumference of 125.6 mm so as to facilitate the operator or user that has the D28 and D29 to the 95th percentile male in a row at 185.6 mm and 95.5 mm for moving the position of the table sectional pulling and pressing, are presented in Figure 5.

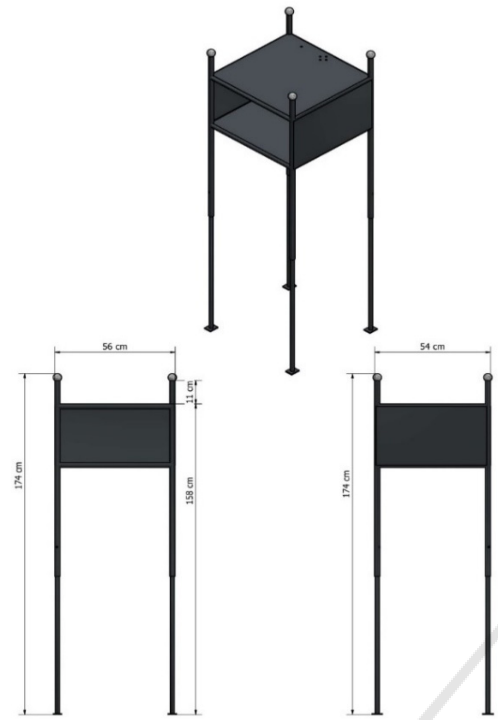


Figure 3: The design of the high position of minimal cross-section table.

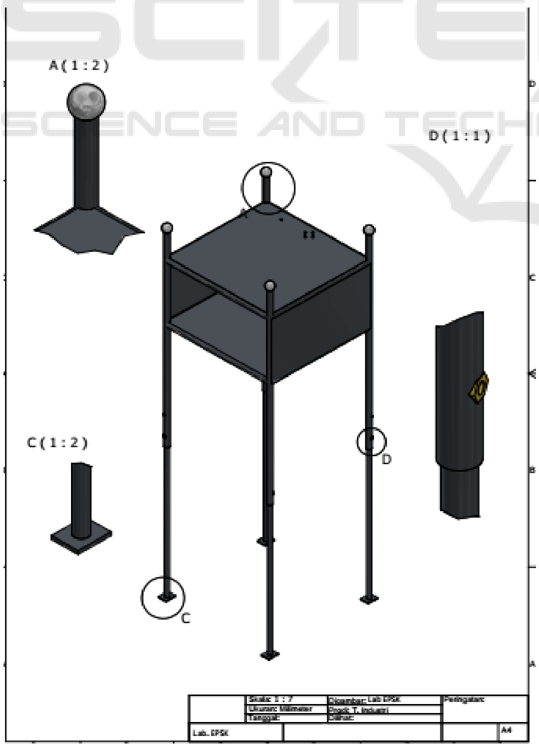


Figure 4: 3D Design sectional table.

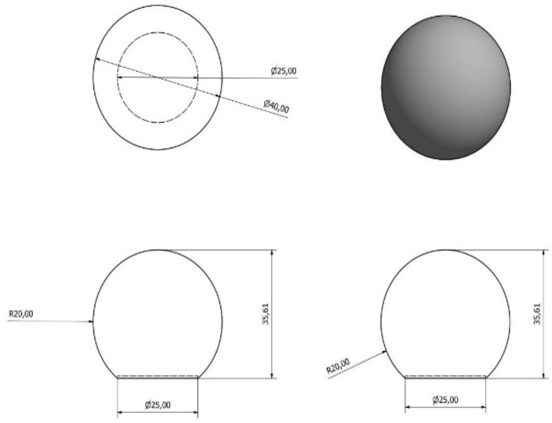


Figure 5: 2D Design Part A.

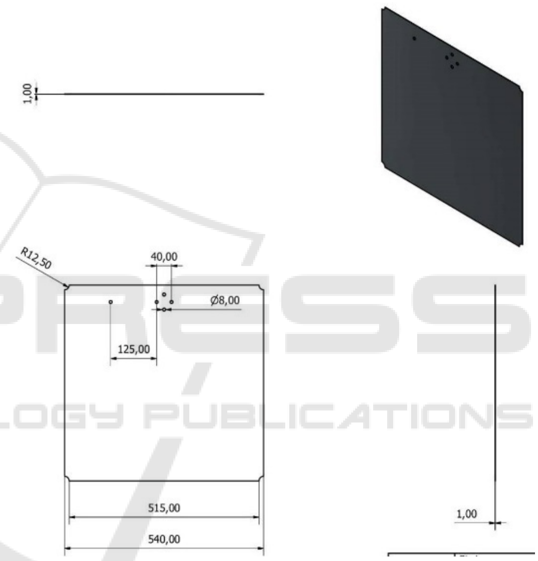


Figure 6: 2D Design Part B.

Pedestal table is divided into the upper and lower part pedestal table, which will be used as a place for a container of salt water until the sensors are used on the appliance, are presented in Figure 6. Pedestal table has a length of 540 mm outside making it easier for operators to D33, 95th percentile male of 1040.6 mm to reach all devices on top of it. Alas table also has a width of 520 mm making it easier for operators who have D23, D24 and D25 with a 95th percentile male in a row at 474.2 mm, 766.2 mm and 677.4 mm to reach all devices that are thereon or therein.

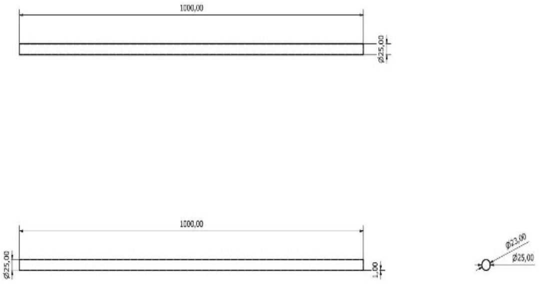


Figure 7: 2D Design Part C.

Part C is an outer table legs that will be used as a buffer table and as a place for part G so that the height adjustable table. Part C has a height of 1000 mm so as to facilitate the operator who has a D4 with a 95th percentile male of 1056.8 mm to perform all operations with a table in a state of minimum height. Part C has a diameter of 25 mm and a circumference of 78.5 mm so as to facilitate the operator who has a D28 with a 95th percentile male of 185.6 mm for moving the sectional table by holding the top, as shown in Figure 7.

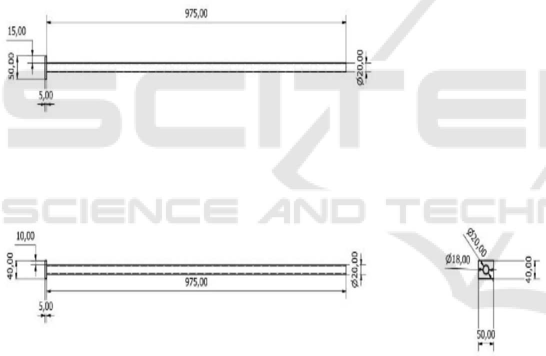


Figure 8. 2D Design Part D.

Figure 8 is Design Part D is the inner table leg that will be used to set the height of the table so as to facilitate the user to adjust the table so as not skewed in areas with irregular topography. Part D has a length of 980 mm so as to facilitate the users with D1, D2 and D3 with a 95th percentile male in a row of 1715.5 mm, 1634.6 mm and 1437.1 mm for adjusting the height of the table cross-section.

5 CONCLUSIONS

One approach in manufacturing ergonomic table design cross-section, is anthropometry body dimensions. Based on anthropometric data base Madurese percentile male with 95%, then the table is designed with a flexible cross-section. Flexibility can be seen from the design features height adjustment table cross-section that is a maximum height of 158cm and a minimum of 88cm based on the dimensions D1 and D2, this is because the D1 dimension or dimensions of 171 cm height, dimension D2 or high dimensional eye has a height of 163 cm. Lock feature table leg cross-section has a length of 98 cm is based on the dimensions D1, D2, D3 in a row of 1715.5 mm, 1634.6 mm and 1437.1 mm for adjusting the height of the table cross-section features a handle with a high of 11 cm and the handle of the ball diameter of 4 cm based on the dimensions D28 and D29 to the 95th percentile male in a row at 185.6 mm and 95.5 mm for moving the position of the table sectional pulling and pressing. The length and width of the table by 56 cm cross section are based on the dimensions of 54cm by dimension D33 and D23, D24 and D25.

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