KAIZEN OF THE STORAGE FOR HEAT INSULATING STYROFOAM: A CASE STUDY OF SANSUISHA (JAPAN) CO., LTD.

Ms. RUJARPAR PONGBOONCHOO

COOPERATIVE EDUCATION

BACHELOR DEGREE OF INDUSTRIAL ENGINEERING

FACULTY OF ENGINEERING

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Project's name A Study of an Improvement of the storage for Heat Insulating Styrofoam by using Engineering Design: A Case Study of SansuishaCo.,Ltd.

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Prof.DrNobuhiro Sugimura, Osaka Prefecture University.

Job Advisor 1.Mr.Yara Satoshi

Company's Name SansuishaCo.,Ltd

Business Type / Product Container-type package unit and Enclosure-type package unit.

Abstract

Package units manufactured by planning division of Sansuisha have two major types. There are container-type package unit and enclosure-type package unit. Container-type package unit is imported from suppliers in Thailand, while enclosure-type package unit is assembled at Sansuisha's Osaka factory.

For enclosure-type package unit's panel, heat insulating Styrofoam are assembled into panel and covered with plate. The insulation Styrofoam parts are left disorganizely on the floor of production area. The insulation Styrofoam parts have never been assigned storage area. Therefore, the storage shelves are designed and established by considering the Styrofoam shapes and dimensions. The dimensions of shelves are designs by referring the Styrofoam part's dimensions and demands. The adjustable shelves are applied for flexibility.

The insulations are ordered according to demands and just enough for assembly.

Acknowledgement

First of all, I would like to thank everyone who had been helping me in make this project a successful one. My thanks also goes to advisor Asst. Prof. AnchaleeSupithak who had given advices and taken care about the project. Furthermore, I would like to say that I am so grateful for Japanese advisor Prof.DrNobuhiro Sugimura who had always been a very good helper for other things in this project including helping me coping with an internship life in Japan. Lastly, I would like to thank the employees in S SansuishaCo.,Ltd especially work advisor, Mr. Yara Satoshi, who had been taken care of and given a lot of useful advices while I am there as a internship student. Thanks for giving me a lot of knowledge and working advices for making this project.

RujarparPongboonchoo

04 Oct,2016

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Chapter 1

Introduction

1.1Name and Location of the company

The company's Name :Sansuisha Co., Ltd.

Location

Sakai Factory (Headquarter) : 2-6-36 Chikkoshinmachi, Nishi-ku, Sakai-city, Osaka 592-8331

Japan

TEL: +8172-245-3131, FAX: +8172-245-4603, http://www.sansuisha.com

Osaka Factory (Planning Division) : 3-18 Dejimanishi-cho, Sakai-ku, Sakai-shi, Osaka 590-0831 Japan

TEL: +8172-243-4381, FAX: +8172-243-4387, http://www.sansuisha.com

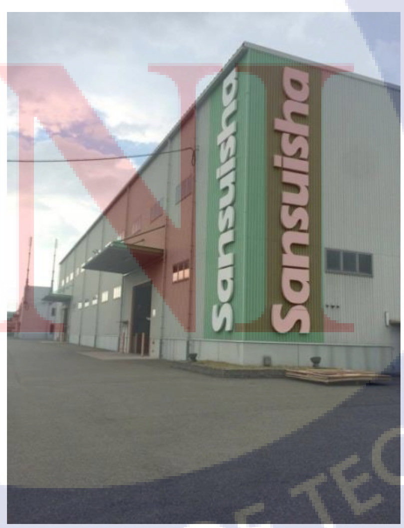

Figure 1.1.1SansuishaCo.,Ltd. Osaka Factory

1.2 Business Type

Sansuisha is an agricultural machine parts coating, and container and enclosure type package unit for storage batteries manufacturing company. Another business is making package unit for product of energy-related field such as mobile communication, broadcasting, and solar energy system equipment. Package units have two main categories, there are Container-type package unit and Enclosure-type package unit.

Figure 1.2.1Container-type package unit

Figure 1.2.2Enclosure-type package unit

1.3 Cooperation form

Headquarter of Sansuisha is in Osaka, called Sakai Factory. They has not only many branches in Japan, but they also has a branch in Thailand. Mostly of branches are tractor's part coating factory, and some branches are package unit manufacturing factory. The factory that I went for an internship is Planning Division called Osaka factory. Organization of Osaka factory has 8 departments.

1.3.1 Sales group

1.3.2 Procurement group

1.3.3 Design group

  1.3.3.1 System design group

  1.3.3.2 Materials design group

1.3.4 Materials group

1.3.5 Assembly group

1.3.6 Production control group

1.3.7 Quality control and inspection group

1.3.8 Construction group

They make product order to order. Customer might have energy-related machine example power conditioner for the solar power system etc;. They will send information of their machine and requirement to our office, then we will design package unit for their request. The package units have two main categories, there are Container-type package unit and Enclosure-type package unit. We design Container-type package unit at Osaka factory, next we send order to supplier in Thailand. Container will be manufactured at there. After we receive container, we will install customer's machines in it. But all of Enclosure-type package unit manufacturing processes are proceeded at Osaka factory. In the installation processes, mechanics from another company come to install customer's machines and do some technical assembly.

1.4 Position and work assignment

During the first three months, I joined to every department for two or three days on a department, and learned about working process of each department. After that, I was assigned to products inspection and sometime I did assembly works too.

1.4.1 External dimensions inspection.

1.4.2 Performance test

1.4.3 Electrical continuity test

1.4.4 Caulking inspection

1.4.5 Final inspection (Before shipping)

1.4.6 Received parts Inspection

1.4.7 CCTV package unit assembly

1.4.8 Packing

1.4.9 Enclosure-type package unit's panel assembly

1.5 Advisor Staff

Mr. Yara Satoshi　　Position: Production Control Group Manager

Tel.: +8172-245-3131　　Fax: +8172-245-4603

Email: s-yara@sansuisha.com

1.6 Internship period

I started going to internship on 12 April 2016 to 7 September 2016. I had gone to work 2 days per week as Tuesday and Friday until 22 July 2016, From25 July 2016, I had gone to work 4 days per week as Monday, Tuesday, Wednesday and Friday until the last day. Total working hours are 408 hours.

1.7 Objective of the work or project

To do 5S at the part assembly area and use collection space beneficially.

1.8 Expectation

Creating shelf to storage heat insulating Styrofoam and moving them to collection space near assembly area.

Chapter 2
Operation Theory and Technology

2.1 Engineering Drawing

2.1.1 Drawing

A drawing is a graphic representation of an object, or a part of it, and is the result of creative thought by an engineer or technician. When one person sketches a rough map in giving direction to another, this is graphic communication. Graphic communication involves using visual materials to relate ideas. Drawings, photographs, slides, transparencies, and sketches are all forms of graphic communication. Any medium that uses a graphic image to aid in conveying a message, instructions, or an idea is involved in graphic communication.

One of the most widely used forms of graphic communication is the drawing.

Technically, it can be defined as "a graphic representation of an idea, a concept or an entity which actually or potentially exists in life. Drawing is one of the oldest forms of communicating, dating back even farther than verbal communication. The drawing itself is a way of communicating all necessary information about an abstract, such as an idea or concept or a graphic representation of some real entity, such as a machine part, house or tools.

There are two basic types of drawings: Artistic and Technical drawings.

2.1.1.1 Artistic Drawings

Artistic Drawings range in scope from the simplest line drawing to the most famous paintings. Regardless of their complexity, artistic drawings are used to express the feelings, beliefs, philosophies, and ideas of the artist.

In order to understand an artistic drawing, it is sometimes necessary to first understand the artist. Artists often take a subtle or abstract approach in communicating through their drawings, which in turn gives rise to various interpretations.

2.1.1.2 Technical Drawings

The technical drawing, on the other hand, is not subtle, or abstract. It does not require an understanding of its creator, only an understanding of technical drawings.

A technical drawing is a means of clearly and concisely communicating all of the information necessary to transform an idea or a concept in to reality. Therefore, a technical drawing often contains more than just a graphic representation of its subject. It also contains dimensions, notes and specifications.

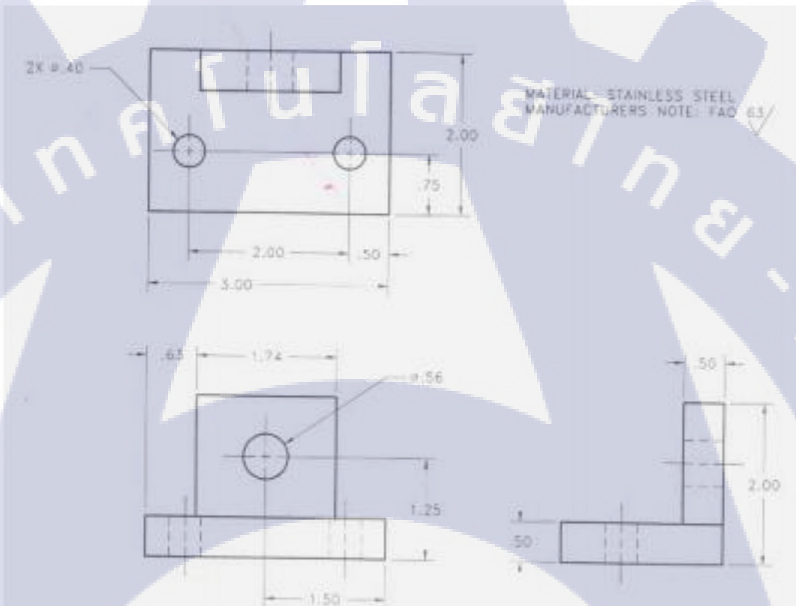

Figure 2.1.1 Technical Drawings

Types of Technical Drawings

Technical drawings are based on the fundamental principles of projections. A projection is a drawing or representation of an entity on an imaginary plane or planes. This projection planes serves the same purpose in technical drawing as is served by the movie screen. A projection involves four components

1. The actual object that the drawing or projection represents
2. The eye of the viewer looking at the object
3. The imaginary projection plane
4. Imaginary lines of sight called Projectors

The two broad types of projections, both with several subclassifications, are parallel projection and perspective projection. Parallel Projection Parallel Projection is a type of projection where the line of sight or projectors are parallel and are perpendicular to the picture planes. It is subdivided in to the following three categories: Orthographic, Oblique and Axonometric Projections.

1. Orthographic projections: are drawn as multi view drawings, which show flat representations of principal views of the subject.

2. Oblique Projections: actually show the full size of one view.

3. Axonometric Projections: are three-dimensional drawings, and are of three different varieties: Isometric, Dimetric and Trimetric.

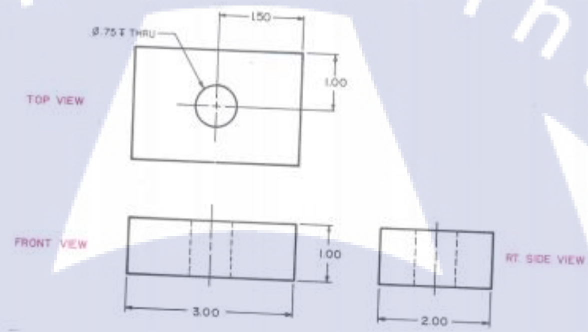

Figure 2.1.2 Orthographic multi view drawing

Figure 2.1.3 Oblique drawing

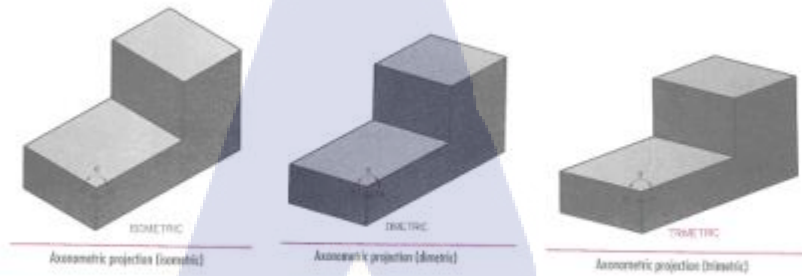

Figure 2.1.4 Axonometric drawing

2.1.3 Purpose of Technical Drawings

To appreciate the need for technical drawings, one must understand the design process. The design process is an orderly, systematic procedure used in accomplishing a needed design. Any product that is to be manufactured, fabricated, assembled, constructed, built, or subjected to any other types of conversion process must first be designed. For example, a house must be designed before it can be built.

2.1.4 Isometric Drawing

The representation of the object in figure 2.1.5 is called an isometric drawing. This is one of a family of three-dimensional views called pictorial drawings. In an isometric drawing, the object's vertical lines are drawn vertically, and the horizontal lines in the width and depth planes are shown at 30 degrees to the horizontal. When drawn under these guidelines, the lines parallel to these three axes are at their true (scale) lengths. Lines that are not parallel to these axes will not be of their true length.

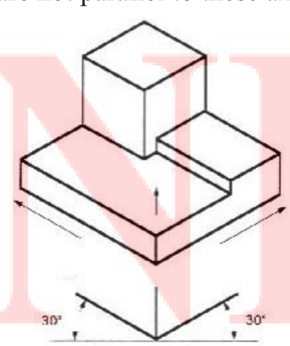

Figure 2.1.5 Isometric drawing

Any engineering drawing should show everything: a complete understanding of the object should be possible from the drawing. If the isometric drawing can show all details and all dimensions on one drawing, it is ideal. One can pack a great deal of information into an isometric drawing. Look, for instance, at the instructions for a home woodworker in figure 2.1.5. Everything the designer needs to convey to the craftsperson is in this one isometric drawing. However, if the object in figure 2.1.5 had a hole on the back side, it would not be visible using a single isometric drawing. In order to get a more complete view of the object, an orthographic projection may be used.

2.1.5 Orthographic or Multi view Projection

Imagine that you have an object suspended by transparent threads inside a glass box, as in figure 2.1.6

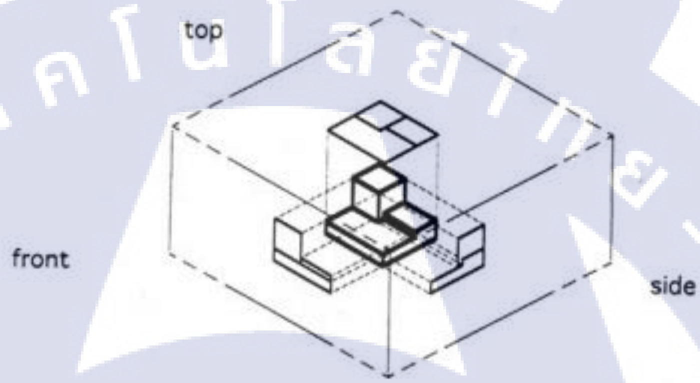

Figure 2.1.6 Orthographic projection

Then draw the object on each of three faces as seen from that direction. Unfold the box (figure 2.1.7) and you have the three views. We call this an "orthographic" or "multi view" drawing.

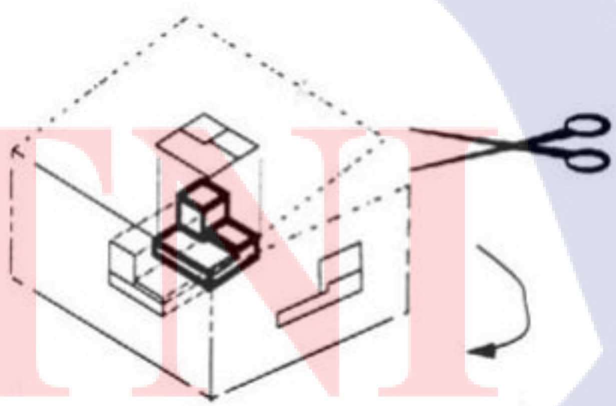

Figure 2.1.7 the creation of an orthographic multi view drawing

Figure 2.1.8.shows how the three views appear on a piece of paper after unfolding the box.

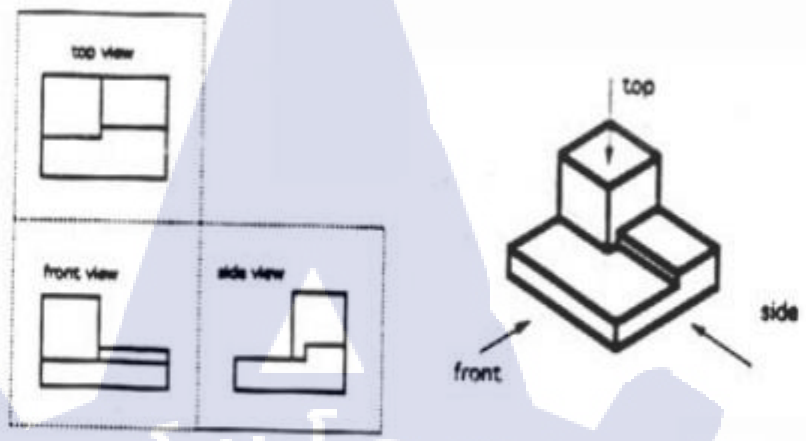

Figure 2.1.8 a multi view drawing and its explanation

The views that reveal every detail about the object. Three views are not always necessary; we need only as many views as are required to describe the object fully. For example, some objects need only two views, while others need four. The circular object in figure 2.1.9 requires only two views.

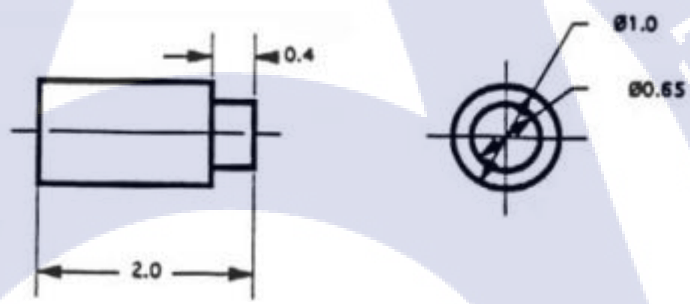

Figure 2.1.9 an object need only two orthogonal view

2.1.6 Orthographic Projection

Basically, Orthographic projection could be defined as any single projection made by dropping perpendiculars to a plane. In short, orthographic projection is the method of representing the exact shape of an object by dropping perpendiculars from two or more sides of the object to planes, generally at right angles to each other; collectively, the views on these planes describe the object completely. Descriptive geometry is basically the use of orthographic projection in order to solve for advanced technical data involving the spatial relationship of points, lines, planes, and solid shapes. The most common means of understanding these types of orthographic projection is The Glass Box method

The Glass Box method, used primarily for descriptive geometry problems, requires that the user imagine that the object, points, lines, planes etc are enclosed in a transparent “box”. Each view of the object is established on its corresponding glass box surface by means of perpendicular projectors originating at each point of the object and extending to the related box surface. The box is hinged so that it can be unfolded on to one flat plane (the paper). The lines of sight representing the direction from which the object is viewed. In figure 2.1.10, the vertical lines of sight (A) and horizontal lines of sight (B) are assumed to originate at infinity. The line of sight is always perpendicular to the image plane, represented by the surfaces of the glass box (top, front, and right side). Projection lines(c) connect the same point on the image plane from view to view, always at right angle. A point is projected up on the image plane where its projector, or line of sight, pierces that image plane. In the figure 2.1.11, point 1, which represents a corner of the given object, has been projected on to the three primary image planes. Where it is intersects the horizontal plane (top image plane), it is identified as 1H , when it intersects the frontal plane (front image plane), it is identified as 1F, and where it intersects the profile plane (right side image plane), it is labeled 1P.

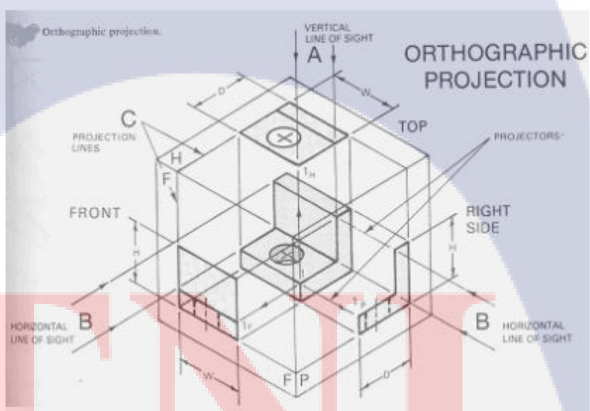

Figure 2.1.10Glass box method

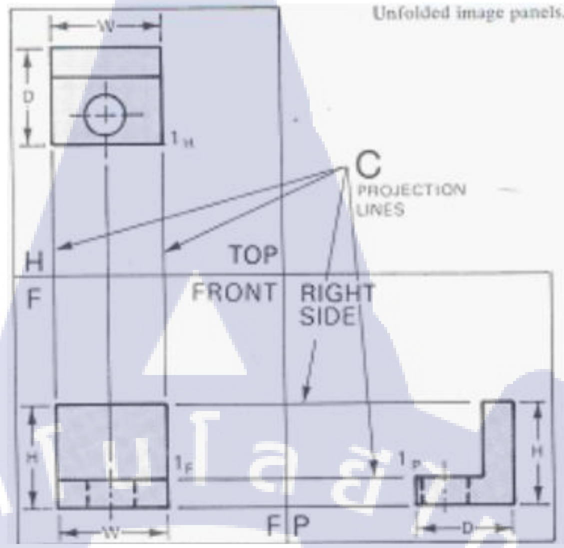

Figure 2.1.11 Orthographic projection of objects

2.1.7 Orthographic views

It is the picture or view or thought of as being found by extending perpendiculars to the plane from all points of the object. This picture, or projection on a frontal plane, shows the shape of the object when viewed from the front but it does not tell the shape or distance from front to real. Accordingly, more than one protection is required to describe the object. If transparent plane is placed horizontally above the object, the projection on this plane found by extending perpendiculars to it from the object, will give the appearance of the object as if viewed from directly above and will show the distance from frontal plane. Then the horizontal plane is now rotated into coincidence with the frontal plane. Now again a third plane, perpendicular to the first two called profile plane are used to view an object from the side.

2.1.8 Classification of surfaces and Lines in Orthographic Projections

Any object, depending upon its shape and space position may or may not have some surfaces parallel or perpendicular to the planes of projection. Surfaces are classified according to their space relationship with the planes of projection i.e. horizontal, frontal and profile surfaces. When a surface is inclined to two of the planes of projection (but perpendicular to the third, the surface is said to be auxiliary or inclined .It the surface is at angle to all three planes, the term oblique or skew is used Although uniform in appearance, the lines on a drawing may indicate three different types of directional change on the object. An edge view is a line showing the edge of a projection. An intersection is a line formed by the meeting of two surfaces where either one surface is parallel and one at an angle or both are at an angle to the plane of projection. A surface limit is a line that indicates the reversal of direction of a curved surface.

Horizontal, Frontal and Profile Surfaces

The edges (represented by lines) bounding a surface may be in a simple position or inclined to the planes of projection depending up on the shape or position, the surface takes its name from the plane of projection. Thus, a horizontal line is a line in a horizontal plane; a frontal line is a line in a frontal plane; and a profile line is a line in a profile plane. When a line is parallel to two planes, the line takes the name of both planes as horizontal frontal, horizontal- profile, or frontal – profile.

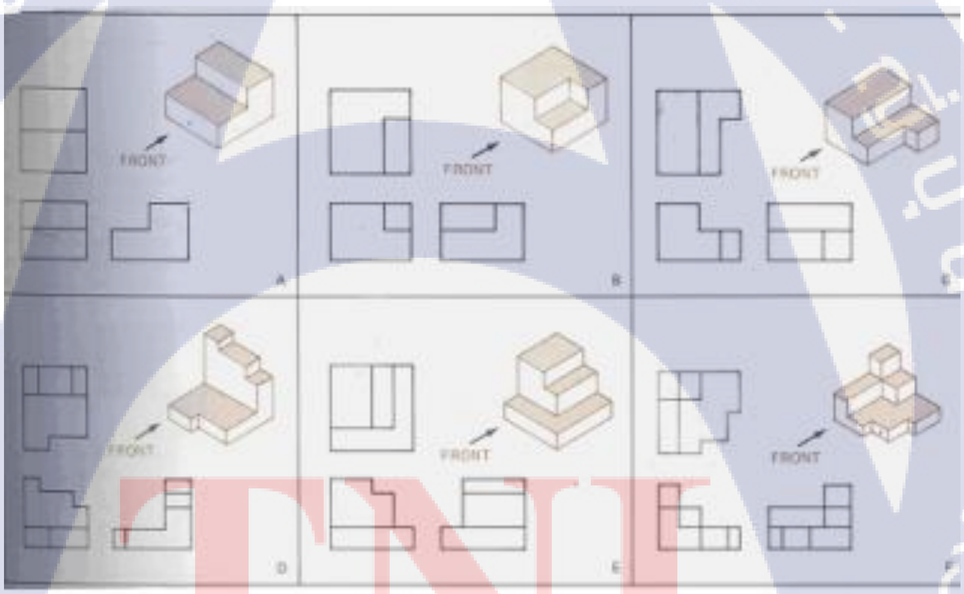

Figure 2.1.12Example of objects havingparallel surfaces to the principal planes

Inclined Surfaces

An edge appears in true length when it is parallel to the plane of projection, as a point when it is Perpendicular to the plane and shorter than true length when it is inclined to the plane. Similarly, a surface appears in trey shape when it is parallel to the planes of projection, as alien when it is perpendicular to the plane, and fore shortened when it inclined to the plane. An object with its face parallel to the plans of projection as figure 2.1.12; a top, front, and right side surfaces are shown in true shape and the object edges appear either in true length or as points. The inclined surface of the object as figure 2.1.13 does not show true shape in any of the views but appears as an edge in front view. The front and rear edges of the inclined surface are in true length in the front view and fore shortened in the top and side views. The top and bottom edges of the inclined surface appear in true length in top and side views and as points in the front view.

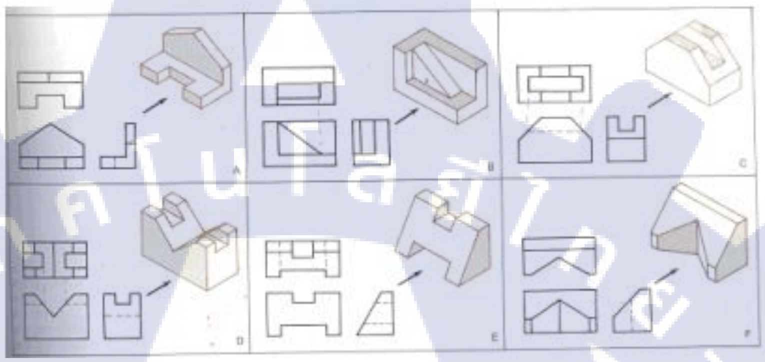

Figure 2.1.13Example of objects havinginclined surfaces

Hidden Surfaces

To describe an object with complex internal features completely, a drawing should contain lines representing all the edges, intersections, and surface limits of the objects In any view there will be some parts of the object that cannot be seen from the position of the observer, as they will be covered by station of the object closer to the observer's eye. The edges, intersections, and surface limits of these hidden parts are indicated by a discontinuous line called a dashed line. Infigure 2.1.14, the drilled hole that is visible in the top-side view is hidden in the front and right side views, and therefore it is indicated in these views by a dashed line showing the hole and the shape as left by the drill.

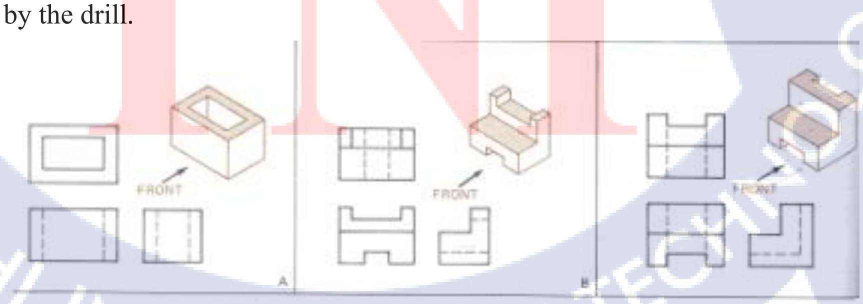

Figure 2.1.14 Example of objects having hidden surfaces

Particular attention should be paid to the execution of these dashed lines. It carelessly drawn, they ruin the appearance of a drawing. Dashed lines are drawn lighten full lines, of short dashes uniform in length with the space between there very short, about ¼ of the length of the dash. This view shows the shape of the object when viewed from the side and the distance from bottom to top and front to rear. The horizontal and profile planes are rotated in to the same plane as the frontal plane. Thus, related in the same plane, they give correctly the three dimensional shape of the object.

Curved Surfaces

To represent curved surfaces in orthographic projections, center lines are commonly utilized. All the center lines, which are the axes of symmetry, for all symmetrical views are a part of views.

1. Every part with an axis, such as a cylinder will have the axis drawn as center line before the part is drawn.

2. Every circle will have its center at the intersection of two mutually perpendicular center lines.

The standard symbol for center lines on finished drawings is a fine line made up of alternate long and short dashes.

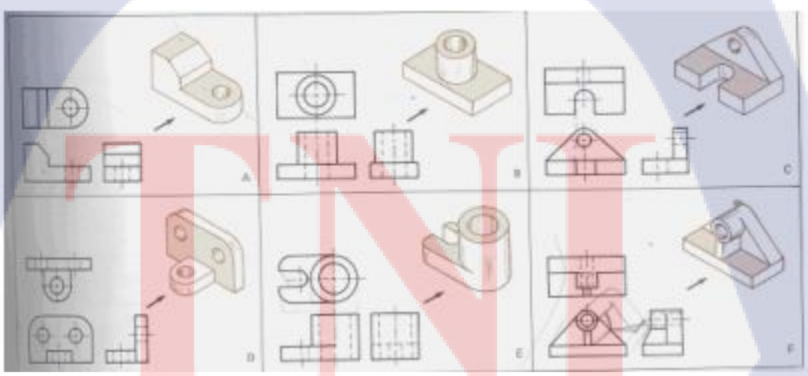

Figure 2.1.15 Example of objects having curved surfaces

2.1.9 Precedence of lines

In any view there is likely to be a coincidence of lines. Hidden portions of the object may project to coincide with visible portions Center lines may occur where there is a visible or hidden out line of some part of the object. Since the physical features of the object must be represented full and dashed lines take precedence over all other lines since visible out line is more prominent by space position, full lines take precedence over dashed lines. A full line could cover a dashed line, but a dashed line could not cover a full line. It is evident that a dashed line could not occur as one of the boundary lines of a view.

When a centerline and cutting- plane line coincide, the one that is more important to the readability of the drawing takes precedent over the other. Break lines should be placed so as not to coincide with other lines of the drawing. The following line gives the order of precedence of lines.

1. Full line
2. Dashed line
3. Careful line or cutting – plane line
4. Break lines 5. Dimension and extension lines.
6. Crosshatch lines.

2.1.10 DIMENSIONING

The purpose of dimensioning is to provide a clear and complete description of an object. A complete set of dimensions will permit only one interpretation needed to construct the part. Dimensioning should follow these guidelines.

1. Accuracy: correct values must be given.
2. Clearness: dimensions must be placed in appropriate positions.
3. Completeness: nothing must be left out, and nothing duplicated.
4. Readability: the appropriate line quality must be used for legibility.

Definitions

- Dimension line is a thin line, broken in the middle to allow the placement of the dimension value, with arrowheads at each end (figure 2.1.16).

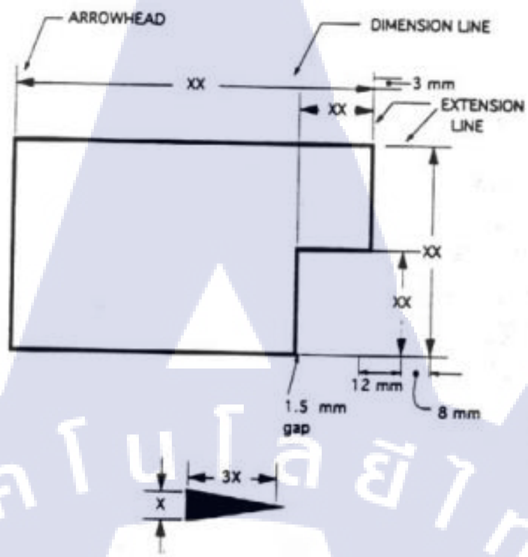

Figure 2.1.16Dimensioning Drawing

- An arrowhead is approximately 3 mm long and 1 mm wide. That is, the length is roughly three times the width.
- An extension line extends a line on the object to the dimension line. The first dimension line should be approximately 12 mm (0.6 in) from the object. Extension lines begin 1.5 mm from the object and extend 3 mm from the last dimension line.
- A leader is a thin line used to connect a dimension with a particular area (figure 2.1.17).

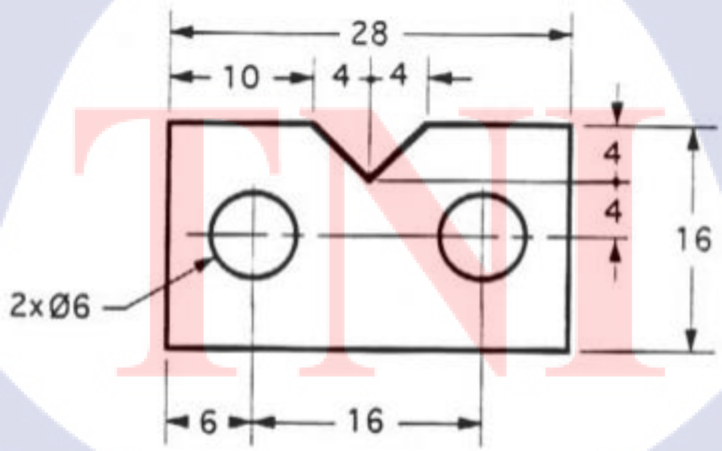

Figure 2.1.17Example drawing with a leader

Steps in Dimensioning

There are two basic steps in dimensioning objects, regardless of the type of object.

STEP 1: Apply the size dimensions. These are dimensions, which indicate the overall sizes of the object and the various features, which make up the object.

STEP 2: Apply the location dimensions. Location dimensions are dimensions, which locate various features of an object from some specified datum or surface.

Where to Put Dimensions

The dimensions should be placed on the face that describes the feature most clearly.

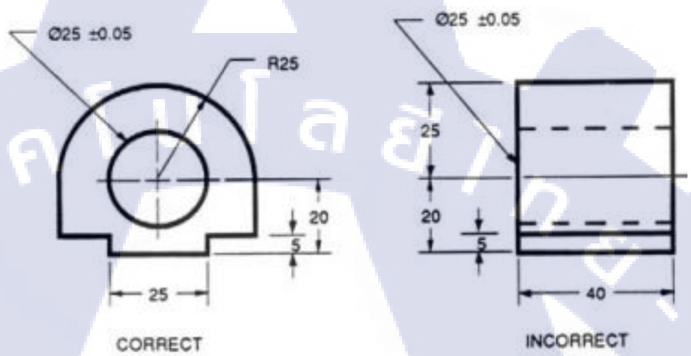

Figure 2.1.18 Example of appropriate and inappropriate dimensioning

In order to get the feel of what dimensioning is all about, we can start with a simple rectangular block. With this simple object, only three dimensions are needed to describe it completely (figure 2.1.19). There is little choice on where to put its dimensions.

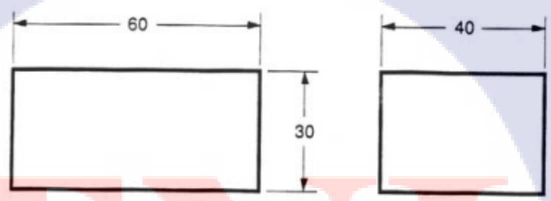

Figure 2.1.19 Simple object

We have to make some choices when we dimension a block with a notch or cutout (figure 2.1.20). It is usually best to dimension from a common line or surface. This can be called the datum line of surface. This eliminates the addition of measurement or machining inaccuracies that would come from "chain" or "series" dimensioning. Notice how the dimensions originate on the datum surfaces. We chose one datum surface in figure 2.1.20, and another in figure 2.1.21. As long as we are consistent, it makes no difference.

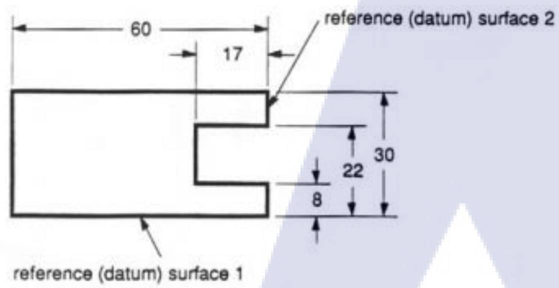

Figure 2.1.20 Surface datum example

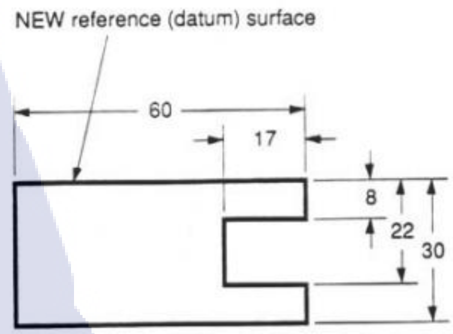

Figure 2.1.21 Surface datum example

In figure 2.1.22 we have shown a hole that we have chosen to dimension on the left side of the object. The Ø stands for "diameter".

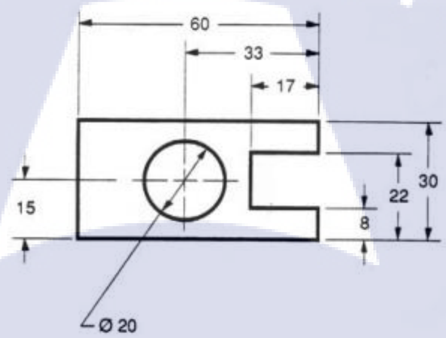

Figure 2.1.22 Examples of a dimensioned hole

When the left side of the block is "radiuses" as in figure 2.1.23, we break our rule that we should not duplicate dimensions. The total length is known because the radius of the curve on the left side is given. Then, for clarity, we add the overall length of 60 and we note that it is a reference (REF) dimension. This means that it is not really required.

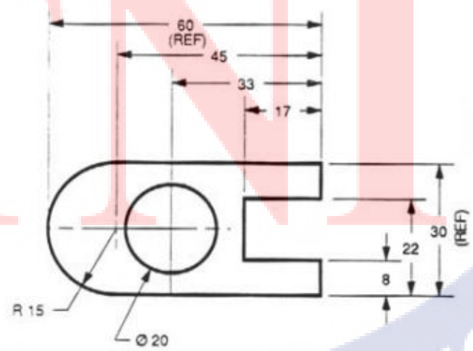

Figure 2.1.23 Examples of a directly dimensioned hole

2.2 5S System

2.2.1 What is the 5s system?

The 5S system is a lean manufacturing tool that improves workplace efficiency and eliminates waste. Managers and workers achieve greater organization, standardization, and efficiency—all while reducing costs and boosting productivity. The core principles of 5S involve creating and maintaining:

- Visual order
- Organization
- Cleanliness
- Standardization

With these goals in place, the workplace becomes organized, work is done efficiently and safely, and problems are quickly found and eliminated.

2.2.2 What is the 5s system?

2.2.2.1 SEIRI : Sorting

It means to sort through everything in each work area. Keep only what is necessary. Materials, tools, equipment and supplies that are not frequently used should be moved to a separate, common storage area. Items that are not used should be discarded or recycled. Don't keep things around just because they might be used, someday.

2.2.2.2 SEITON : Set in order

This is the second step in a 5S program: organize, arrange, and identify everything in a work area, as well as throughout the facility, so that items can be efficiently and effectively retrieved and returned to their proper storage location.

The basic focus of this part of 5S is to create efficient and effective storage systems such that anyone can find the tools, materials, and supplies they need, and anyone can return those tools, materials, and supplies to their proper storage locations.

A second key principle of Set in Order is that the most commonly used tools should be readily available. Those items that are not frequently used should be kept out of the way by storing them in a remote location.

2.2.2.3 SEISOU : Shine

SEISOU in English word is Shine or Sweep. It means to keep clean, involves more than pushing a broom around a work area once a week. It involves regular, usually daily, cleaning. The work area should be returned to the condition it was in when the day started - including putting away all tools, materials and supplies used that day.

While cleaning it's easy to inspect the machines, tools, equipment, and supplies you work with. Having a clean work area has many advantages. One of the more significant is that it makes it easy to spot fluid leaks and equipment that needs maintenance. When a work area is clean machine operators can notice malfunctions such as fluid leaks, vibration, and misalignment, and breakages. These problems, if not addressed, can result in equipment failure, safety hazards, and loss of production.

2.2.2.4 SEIKETSU : Standardize

This is the process of ensuring that what we have done within the first three stages of 5S become standardized; that is we ensure that we have common standards and ways of working. Standard work is one of the most important principles of Lean manufacturing.

2.2.2.5 SHITSUKE : Sustain

5S Sustain is defined as: on-going training and maintaining the established 5S standards. Training is crucial for 5S success. People need to be reminded about the requirements of the established 5S standards. When there are changes that will affect your 5S program -- such as new equipment, new products, new work rules -- make the needed changes in the standards to accommodate those changes, and provide training on the new standards.

Chapter 3

Work plan and procedures

3.1 Work's plan

Table3.1 Shows work Schedule weekly

Work		April			May					June				July				Aug				Sep		
		3	4	5	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Training	Sales group																							
	System design group																							
	Procurement group																							
	Material design group																							
	Production control group																							
	Materials group																							
	Assembly group																							
	Quality control & inspection group																							
	Construction group																							
Product inspection																								
Product Assembly																								

Table3.2 Show Project Schedule daily

Date	Project's Plan
12-Jul	Notify the project's title to work advisor
22-Jul	Orientation of my project : Title and information
25-Jul	Searching informations and start to design shelf
27-Jul	Orientation of my project :Subject of my first design
01-Aug	Orientation of my project :Subject of my design and shelf materials
05-Aug	Orientation of my project :Subject of my design
10-Aug	Orientation of my project : Manufacturing and Assembly Plan
11-Aug	Simulation shelf drawing
19-Aug	Shelf manufactuing
22-Aug	Shelf assembly
26-Aug	Project are done

3.2 Work's detail

3.2.1 Work's detail

3.2.1.1 Training in Sales group

-Study about the company's product andassembly process

- To learn about how to create customer requirement checksheet

- To learn about how to create quotation form

3.2.1.2 Training in System design group

- To learn about work flow in the company and design process

- JWCAD program training

- Using JWCAD program to design customer's slippersbox

3.2.1.3Training in Procurement group

- To learn about how to create payment form

- To learn about how to create shipping check sheet and construction check sheet

- Cost of Sales Manage Program training

- To manage inventories andpart’s informationby using Cost of Sales Manage Program

3.2.1.4 Training in Materials design group

-CADPAC-CREATER 2D program training

- Using CAD-CREATER 2D program to design customer’s slippersbox for production process

3.2.1.5Training in Production control group

- To study about Container-type package unit assembly process

- Goods receiving and shipping Schedule

- Joined the KYT training

3.2.1.6 Training in Materials group

- Leaning about Computer-aided manufacturing(CAM) by Amada AP100 software and using it to simulate customer’s slippers box’s drawing

- Using Turret punch machine and press brake machine to manufacture customer’s slippers box

-Studyabout Dimensions extend calculation and Materials cost calculation

Figure3.2.1 customer’s slippers boxwhich made in work training

3.2.1.7 Training inAssembly group

-To practice how to usetools and machines that important in assembly group

- Packing Small package units and prepare products before shipping

3.2.1.8 Training inQuality control and inspection group

-To practice how to use measurement tools

- Practice the Quality Control Proficiency Test

3.2.1.9 Training in Construction group

- Study difference between assembly in factory andassembly outside

- To practice how to use construction tools

3.2.1.10 Product Inspection

- External dimensions inspection.

- Performance test

- Electrical continuity test

- Caulking inspection

- Final inspection (Before shipping)

- Received parts Inspection

3.2.1.11 Part Assembly

-CCTV package units assembly

-Cleaning package unit's wall

- Packing

- Enclosure-type package unit's panel assembly

3.2.2Project's detail

3.2.2.1Project's background

The company will order Heat Insulating Styrofoam only when there need to assemble Enclosure-type package unit's panel. In each round of composing, Heat Insulating Styrofoam will be used in various sizes which make it difficult to build shelves and find storing space. As a result, the company could not find the exact storing space. Normally, the Heat Insulating Styrofoam will be placed in a disorganized way on the factory floor where the company use to put work-in-process parts. Moreover, in the near future, the company have a plan to use this space for storage materials. Consequently, I have come to a decision to do 5S System to the Heat Insulating Styrofoam storage, change some layout andmoveHeat Insulating Styrofoam storing space to be near the Assembly's tools shelves.

Figure3.2.2Shows the recent Heat Insulating Styrofoam storing area

3.2.2.2Objective

To use inventories area to get highest performance andfind the exact Heat Insulating Styrofoam storing space.

3.2.2.3 Solutions

Move unused parts storing shelf out and use that space tobuildshelves for storage Heat Insulating Styrofoam.

Figure3.2.3 In red square is unused parts storing

3.3 Procedures of work or project

3.3.1Define the Problem

1. Because the companywill redesign package unit according to customer's need, the number and type of the foam used will be various depending on the design in each order.

2. Heat Insulating Styrofoam has very various sizes. There are 20-35 different types of the foam.

3. Each sizeare different amount.In one size, the number can be various from 1 piece or up to 60pieces.

3.3.2 Gather information

1. User's requirements: After consulted with Assembly group leader aboutassembly mechanic's need, the shelvesshould be clearly classify the size of the Styrofoams. Also, the shelves should be flexible for the differences in number and size of the foam in each order.Moreover, once order of Styrofoamare usuallyorderedfor two Enclosure's Assembly.

2. Material cost: Company can use metal plates in the stock to createtools and stuffs to use in company, company's main materials are Aluminum, Steel and Stainless.Because we would like to create light shelves and save cost, Aluminum plates and Steel plates are usedto create shelves. Cost of aluminum is 450JPY per kilogram and cost of steel is 100JPY per kilogram.

[Example3.3.1Material's cost calculation]

To calculate a cost of 1250 mm x 750mm Shelf's Tray which made with 1.5t aluminum plate

specific gravity of Aluminum is 2.73

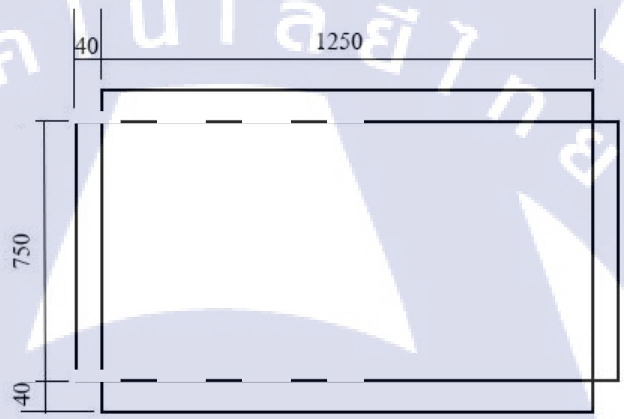

Figure3.3.1 Simulation ofAluminum plates which used to made shelf's tray

From Weight(kg) = thickness(mm) x area(m) x specific gravity

= 1.5mm x 1.0975mx 2.73

= 4.4942625 kg

Cost = 4.4942625kg x 450JPY

= 2022.418126JPY

3. Studyingorderingdocuments to know the amount of Heat Insulating Styrofoam used for anEnclosure-type package unit's assembly.Record and transfer information into the size and quantity tables.

Table3.3 ShowsA-Enclosure's Styrofoamordering document sorting by the largest number.

Number	W(mm)	L(mm)	H(mm)	Amount/ a Enclosure	Amount/ 2 Enclosure	%
2	220	780	45	54	108	35.06494
3	180	780	45	24	48	15.58442
5	180	70	45	9	18	5.844156
10	180	700	45	8	16	5.194805
8	180	740	45	6	12	3.896104
1	200	780	45	6	12	3.896104
11	220	560	45	6	12	3.896104
21	180	650	45	4	8	2.597403
15	240	630	45	4	8	2.597403
7	180	270	45	3	6	1.948052
12	220	430	45	3	6	1.948052
23	220	630	45	3	6	1.948052
13	220	730	45	3	6	1.948052
24	220	830	45	3	6	1.948052
22	220	880	45	3	6	1.948052
4	180	190	45	2	4	1.298701
9	180	600	45	2	4	1.298701
20	180	740	45	2	4	1.298701
18	200	630	45	2	4	1.298701
14	240	300	45	2	4	1.298701
16	240	730	45	2	4	1.298701
6	180	410	45	1	2	0.649351
17	200	300	45	1	2	0.649351
19	200	730	45	1	2	0.649351
Total				154	308	100

Table3.4 ShowsB-Enclosure's Styrofoamordering document sorting by the largest number.

Number	W(mm)	L(mm)	H(mm)	Amount/ a Enclosure	Amount/ 2 Enclosure	%
5	220	780	45	57	114	35.84906
9	190	780	45	25	50	15.72327
15	180	70	45	11	22	6.918239
18	180	740	45	8	16	5.031447
19	180	700	45	6	12	3.773585
1	200	780	45	6	12	3.773585
29	190	530	45	4	8	2.515723
24	240	630	45	4	8	2.515723
10	240	300	45	4	8	2.515723
13	250	780	45	3	6	1.886792
8	190	660	45	3	6	1.886792
6	190	300	45	3	6	1.886792
31	190	910	45	2	4	2.515723
30	190	320	45	2	4	1.257862
26	200	630	45	2	4	1.257862
25	240	730	45	2	4	1.257862
14	180	190	45	2	4	1.257862
2	220	300	45	2	4	1.257862
28	180	600	45	1	2	0.628931
27	200	730	45	1	2	0.628931
23	220	430	45	1	2	0.628931
22	190	430	45	1	2	0.628931
21	250	430	45	1	2	0.628931
20	180	590	45	1	2	0.628931
17	180	270	45	1	2	0.628931
16	180	410	45	1	2	0.628931
12	250	660	45	1	2	0.628931
11	250	550	45	1	2	0.628931
7	190	550	45	1	2	0.628931
4	220	660	45	1	2	0.628931
3	220	550	45	1	2	0.628931
Total				159	318	100

Table3.5 ShowsC-Enclosure's Styrofoamordering document sorting by the largest number.

Number	W(mm)	L(mm)	H(mm)	Amount/ a Enclosure	Amount/ 2 Enclosure	%
1	150	780	45	47	94	35.07463
2	180	780	45	31	62	23.13433
5	180	530	45	11	22	8.208955
20	180	430	45	6	12	4.477612
6	180	70	45	6	12	4.477612
4	180	270	45	4	8	2.985075
18	140	630	45	3	6	2.238806
9	180	740	45	2	4	1.492537
10	180	700	45	2	4	1.492537
17	180	630	45	2	4	1.492537
3	180	130	45	2	4	1.492537
19	160	430	45	2	4	1.492537
23	150	680	45	2	4	1.492537
25	150	200	45	2	4	1.492537
21	140	430	45	2	4	1.492537
22	190	680	45	1	2	0.746269
24	190	200	45	1	2	0.746269
8	180	660	45	1	2	0.746269
12	180	480	45	1	2	0.746269
7	180	410	45	1	2	0.746269
16	160	630	45	1	2	0.746269
11	160	480	45	1	2	0.746269
14	160	270	45	1	2	0.746269
13	140	480	45	1	2	0.746269
15	140	270	45	1	2	0.746269
Total				134	268	100

By studied from tables, the average number of Heat Insulating Styrofoamthat company usefor an EnclosureQuantity assembly is149 pieces.Besides, the largest number of size is about 50 pieces or it could be up to 60 pieces.Therefore, we would liketo create about 300 Styrofoams storing shelves for 2 Enclosure's assembly (one order).

Table3.6Categorize Heat Insulating Styrofoam into six groups according to its width

		A-Enclosure		B-Enclosure		C-Enclosure	
Group	Width(mm)	Amount	%	Amount	%	Amount	%
A	1-50	-	-	-	-	-	-
B	51-100	-	-	-	-	-	-
C	101-150	-	-	-	-	58	43.283582
D	151-200	71	46.1039	81	50.94339623	76	56.716418
E	201-250	83	53.8961	78	49.05660377	-	-
F	251-300	-	-	-	-	-	-
Total		154	100	159	100	134	100

The most of order,Styrofoam in E-Group (201-250 mm width) is the widest,their amount can be more than half of a lot. So we decide touse the widthof E-group to estimate shelf'slenght. Although the largest amount are in D-group(151-200 mm width).

Table3.7Categorize Heat Insulating Styrofoam into five groups according to its length.

		A-Enclosure		B-Enclosure		C-Enclosure	
Group	Length(mm)	Amount	%	Amount	%	Amount	%
A	1-200	11	8.441558	13	6.918238994	11	8.2089552
B	201-400	6	7.792208	12	3.773584906	6	4.4776119
C	401-600	12	8.441558	13	7.547169811	25	18.656716
D	601-800	119	77.27273	119	74.8427673	92	68.656716
E	801~	6	1.298701	2	3.773584906	0	0
Total		154	100	159	100	134	100

Length of Styrofoam is used to estimate shelf's depth.From the table, we know the most Styrofoam is in D-group (601-800 mm length), so we decided the range of shelf' depth are between 601 to 800 mm.

4. Checking area for sizing new shelves. We plan to place shelves between tool's shelf and blue bin, the length is 2500 mm and from wall to yellow line is 900 mm.

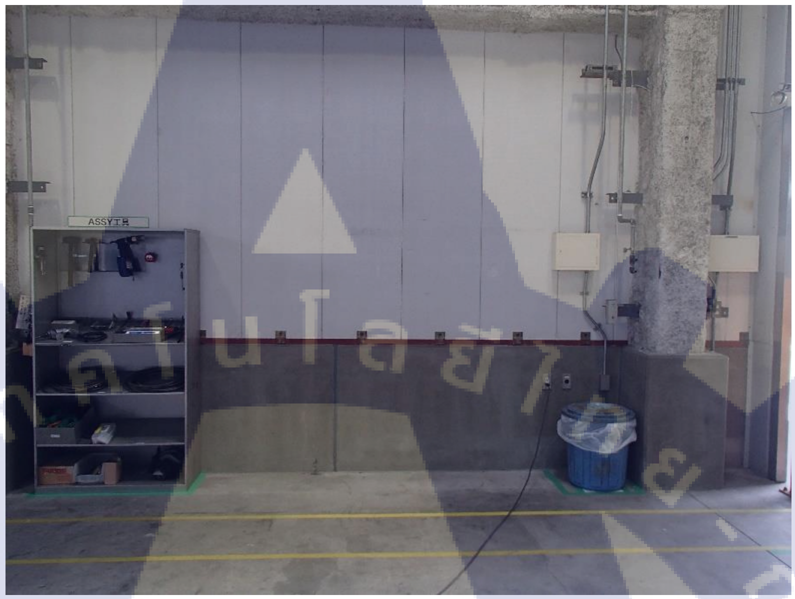

Figure3.3.2Areawhereplace Heat Insulating Styrofoam shelves

3.3.3Design

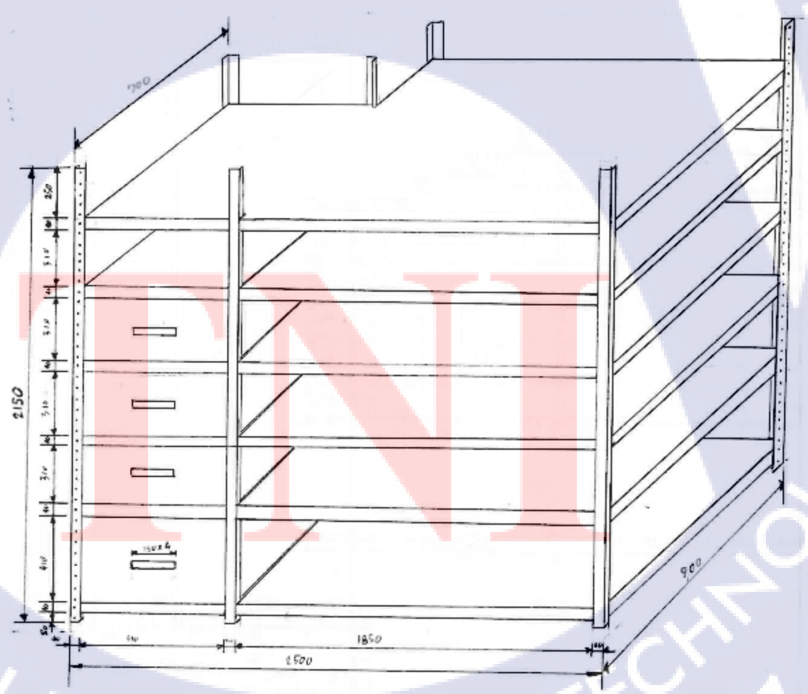

Figure3.3.3First model of Heat Insulating Styrofoamshelf's draft

Table 3.8The first model's material cost Calculation

		Model1	
Part	Materials	Amount	Cost(JPY)
Tray	Aluminum(450 円/kg)	6	27651.57
Bar	Steel(100 円/kg)	7	1086.911
Drawer	Aluminum(450 円/kg)	4	6266.808
Slide rail	(4000JPY/piece)	4	16000
Total			51005.29

Definition of first design

- Shelf's size(Length x Height x depth) is 2500mmx 2150mm x 900mm. Shelf can storage 360 pieces of250mm wide Styrofoam, if we lay out and stack in a horizontal way.
- Shelf has 6 rows, the right side for storage big size Styrofoam and the left side have drawer to storage small size of Styrofoams.
- Shelf's bars are drilled the adjust 20mmsquare holes along the length of bar(displacement 5mm pitch).Shelf's tray can be move byremoving and hanging onanother hole.
- Aluminum is the lightest materials in the stock, so we decide to create shelf's trays with aluminum plates and use steel plate to create shelf's bar for save cost.

Disadvantage of First model

- Trays are difficult to move, because of big size.
- Shelf is so high that difficult to store and pick the Styrofoam up.
- It is a big shelf, so difficult to manufacture.
- Expensive cost.

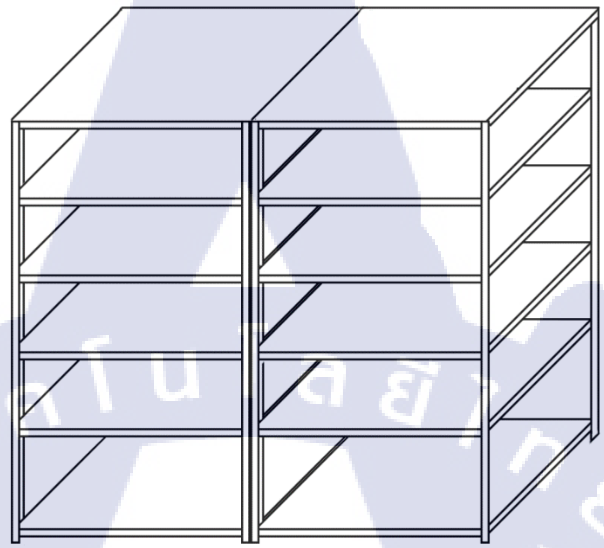

Figure3.3.4The second model of Heat Insulating Styrofoam shelf's draft

Table 3.9Thesecond model's material cost Calculation

		Model2	
Part	Materials	Amount	Cost(JPY)
Tray	Aluminum(450 円/kg)	12	28680.65
Bar	Steel(100 円/kg)	8	1120.854
Fixtures	Steel(100 円/kg)	16	2987.151
Partition Boards	Aluminum(450 円/kg)	30	7813.629
Total			40602.28

Definition of second design

- The shelves are separated in to two same shelves,theirsize(Length x Height x depth) are1250mm x1940mm x 900mm. The Shelves can storage 300 pieces of 250mm wide Styrofoam, if we lay out and stack in a horizontal way.
- Shelf has 5 rows, each row have same height except the lowest row are higher than other. Because we would like to make it easy to pick up.
- Shelf's bars are drilled the adjust 20mm square holes along the length of bar(displacement 5mm pitch).Shelf's tray can be move byremoving and hanging onanother hole.

Disadvantage of second model

- Expensive cost.

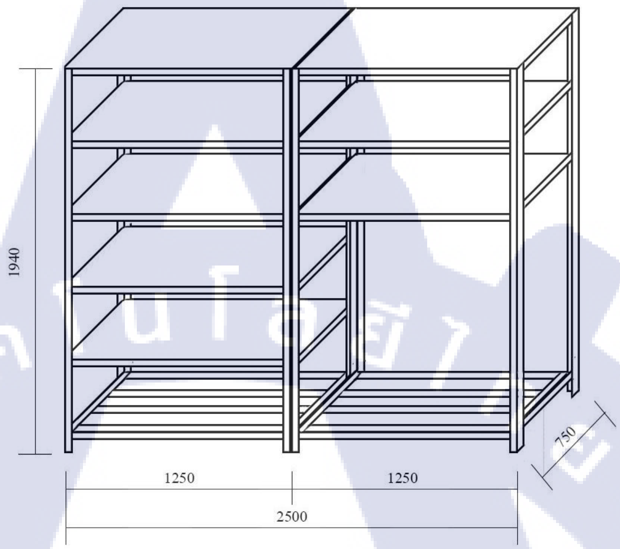

Figure3.3.5 The last model of Heat Insulating Styrofoam shelf's draft

Table 3.10The last model's material cost Calculation

		Model3	
Part	Materials	Amount	Cost(JPY)
Tray	Aluminum(450 円/kg)	6	12134.51
Bar	Steel(100 円/kg)	8	1120.854
Fixtures	Steel(100 円/kg)	12	1189.06
Partition Boards	Aluminum(450 円/kg)	30	10641.88
Angle bar	Steel(100 円/kg)	4	3726.552
Total			28812.85

Definition of second design

- There are to two same size shelves (Length x Height x depth are 1250mm x 1940mm x 750mm). Shelf can storage 330 pieces of 250mm wide Styrofoam, if we lay out and stack in a horizontal way.
- The left shelf has 5 rows, each row have same height except the lowest row are higher than other. Because we would like to make it easy to pick up. And the right shelf have only 3

rows. The lowest row of right shelf was made in a wide size because of the convenience for storing foams which have the highest amount.

- Shelf's bars are drilled the adjust 20mm square holes along the length of bar(displacement 5mm pitch).Shelf's tray can be move byremoving and hanging onanother hole.
- The lowest and highest tray of both sidesare made with steel angle bar to save cost.

3.3.4Drawing

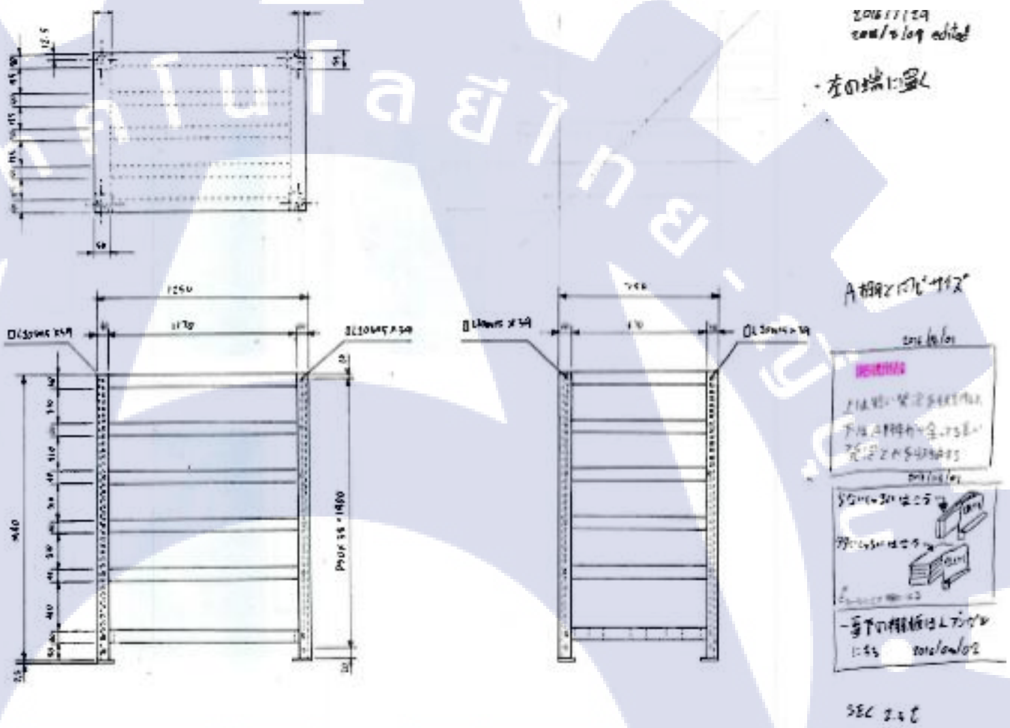

Figure3.3.6 The last model of Heat Insulating Styrofoam shelf's drawing (The left side)

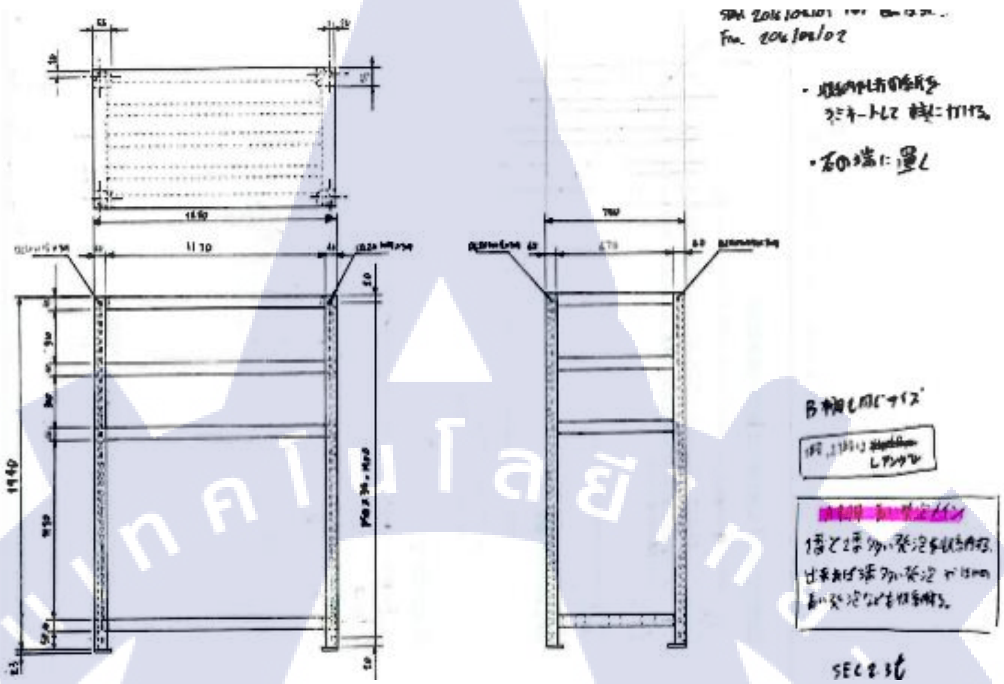

Figure3.3.7 The last model of Heat Insulating Styrofoam shelf's drawing (The right side)

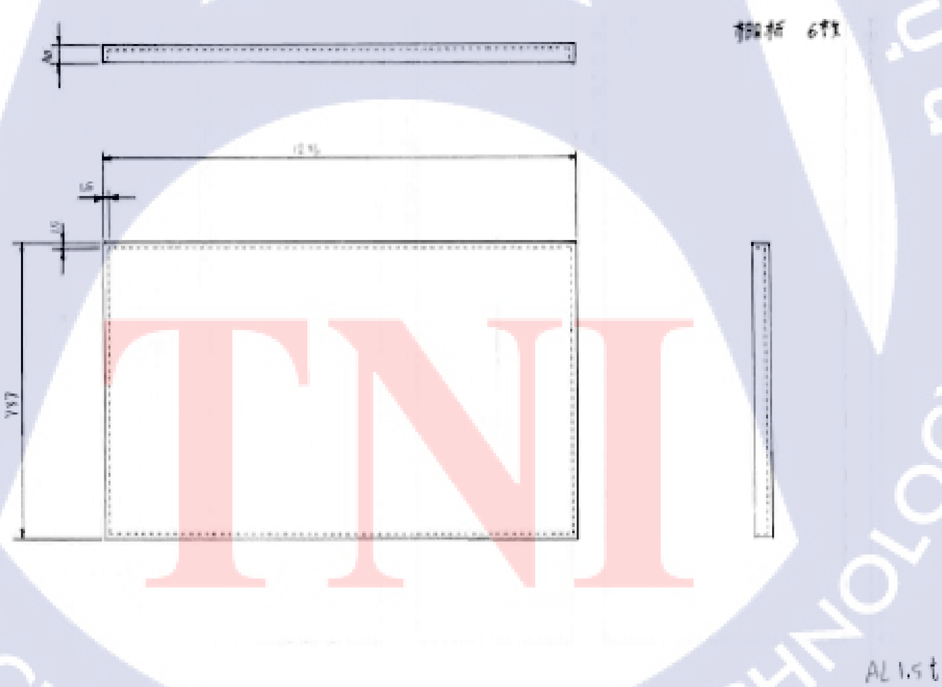

Figure3.3.8 The last model of Heat Insulating Styrofoam shelf's drawing (Shelf's tray)

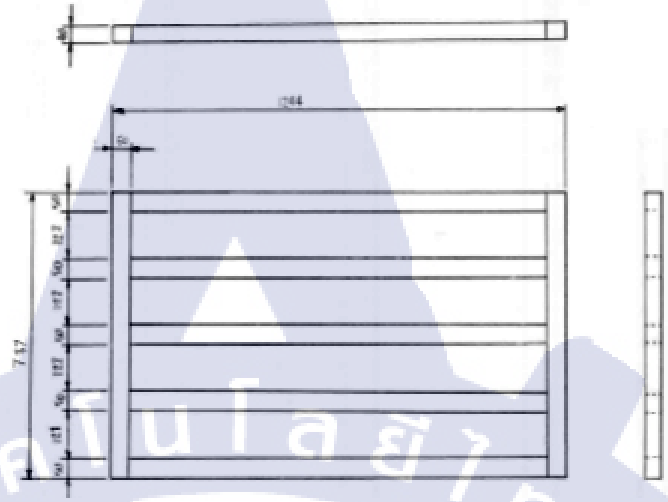

Figure3.3.9 The last model of Heat Insulating Styrofoam shelf's drawing (Steel Angle bar)

Aluminum is the lightest materials in the stock, so we decide to create shelf's trays with aluminum plates and use steel plate to create shelf's bar for save cost.

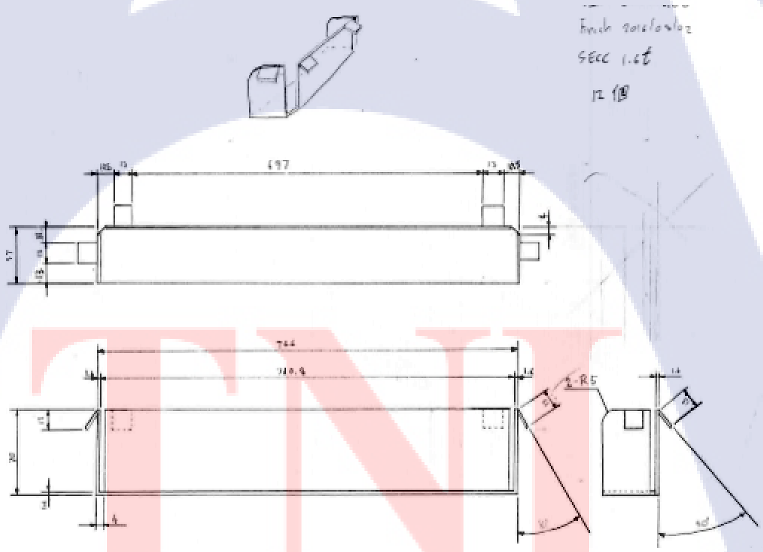

Figure3.3.10The last model of Heat Insulating Styrofoam shelf's drawing (Shelf's tray Fixture)

Hang Shelf's tray Fixture on the bar which were drilled adjust holes and put tray on fixture to assemble Shelves.

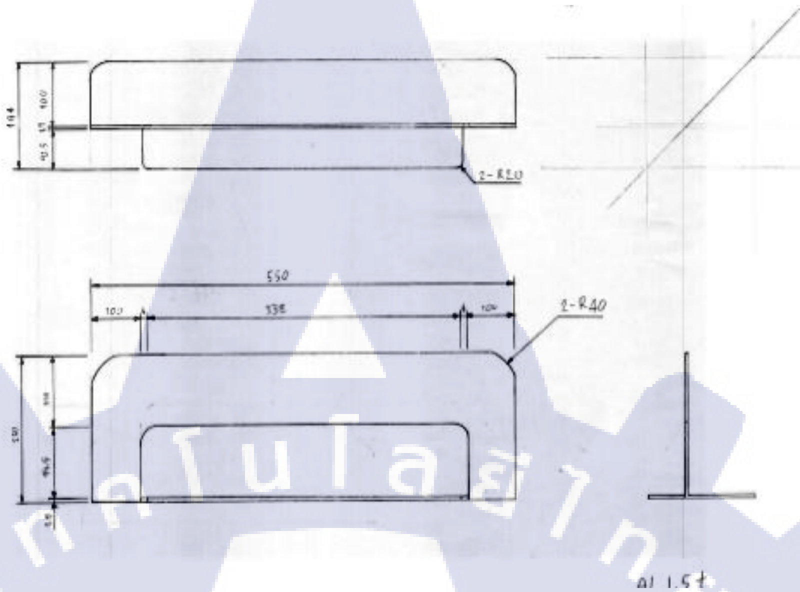

Figure3.3.11 The last model of Heat Insulating Styrofoam shelf’s drawing (Partition board)

We will create partition boards like bookend for classify Styrolfoams that have difference size.

3.3.5 Manufacturing

1. Simulated drawings by Amada AP100 software.

2. Sent simulated informationintoTurret punch machine and Press brake machine.

3. Cutting materials by Turret punch machine.

Figure3.3.12 Operated Turret punch machine to cut materials

4.Pressing and Rolling cut materials byPress brake machine.

Figure3.3.13 Operated Press brake machine to press materials

5.Welding steel parts.

6. Painting.

7. Assembly.

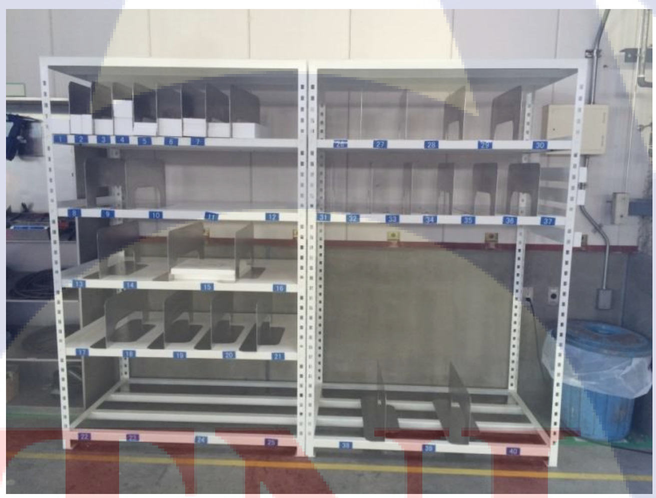

Figure3.3.14Assembled Shelves.

Moreover we set a rule for the convenience and the most benefit to storage Heat Insulating Styrofoam. User will paste labels at the front of shelve to notice Styrofoam's type and remove them after using or when the new lot came.We set the right side for storage big size and large amount of Styrolfoam, the left side for storage small size and amount. If the size just has one or two pieces we can lay out in a vertical way.

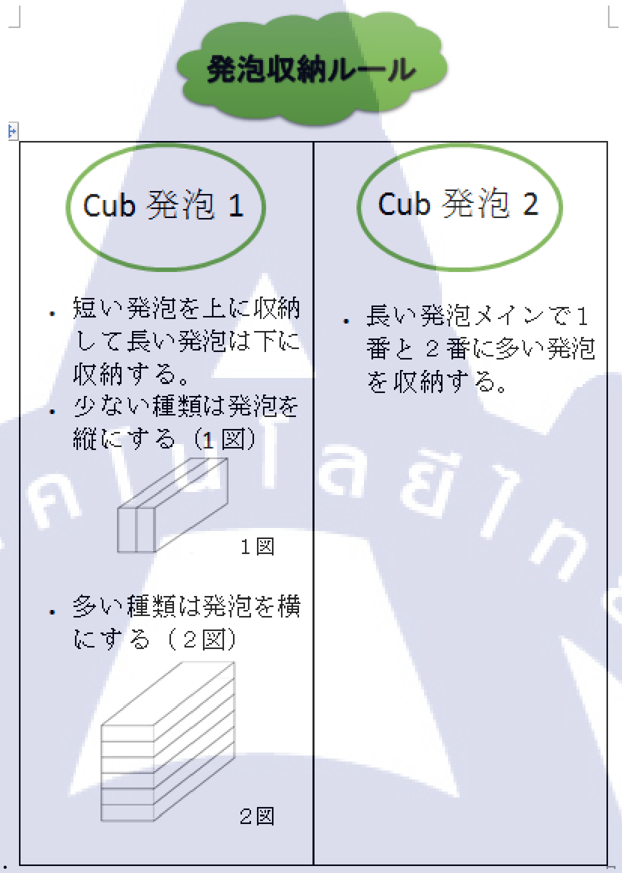

Figure3.3.15Poster ofHeat Insulating Styrofoam storage rule.

Chapter 4

Working Procedure and Analyze

4.1Procedure and result

After we identified the problem and analyze ordering information, we used that to design shelves according to user’s requirement.Then, we manufacturing, assembly andmaketask toindicating the usage in order to achieve the highest level of effectiveness.

Figure4.1.1 Recent Heat Insulating Styrofoam storage space

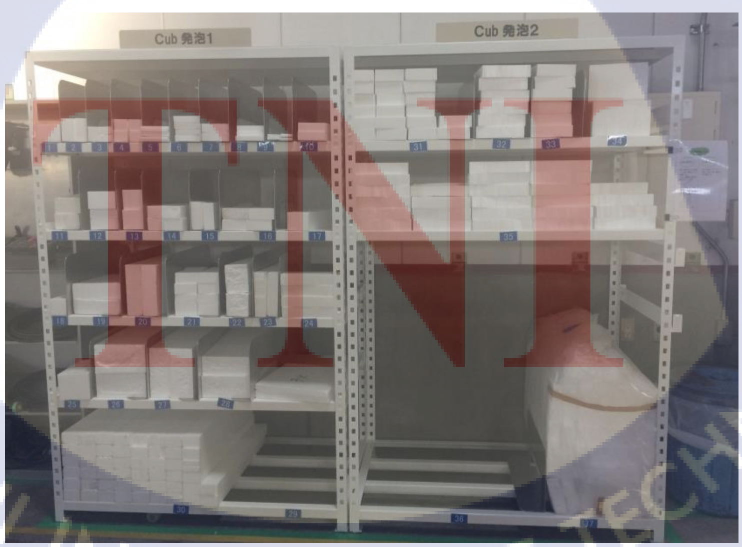

Figure4.1.2 New Heat Insulating Styrofoam storage space

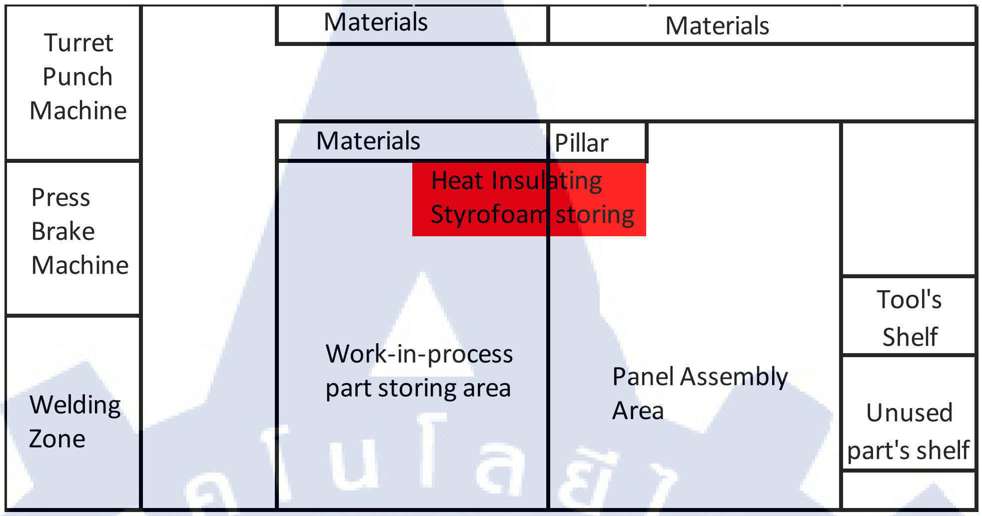

Figure4.1.3 Factory layout before do KAIZEN

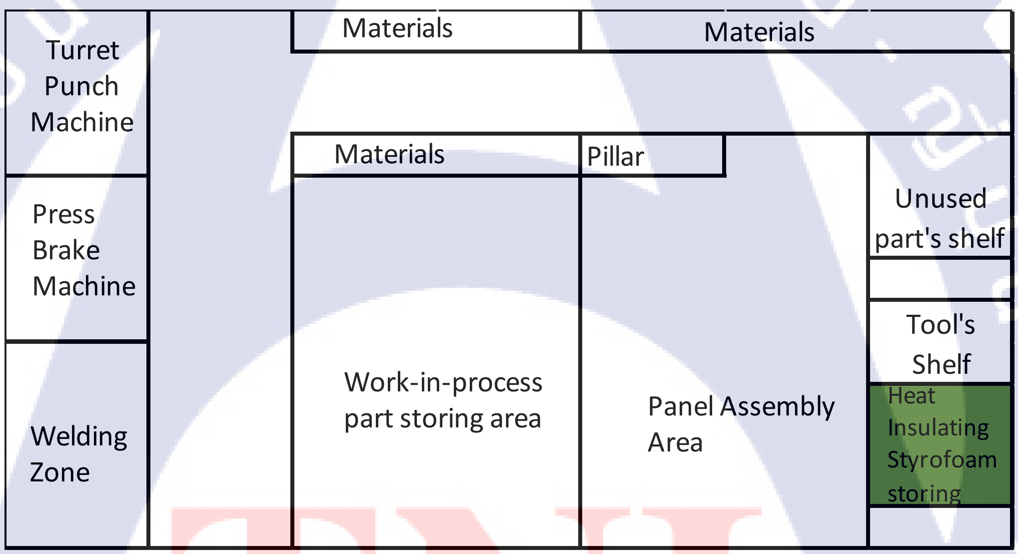

Figure4.1.4 Factory layout after do KAIZEN

4.2 Result frominformation analysis

Table 4.1Analyzed information and design

Analyzed information	Designed shelves
The company usually assembles two Enclosure-type package units in one	Size forstorage Styrofoam of two Enclosure's Assembly

Average amount of Styrofoam in one Enclosure is 149 pieces	300 pieces of Styrofoam storing shelves
The widest Styrofoam which be used are 250mm.	Suppose that 300 pieces of 250mm Styrofoam are storage when design shelves
The most of Styrofoam which be used are 601-800 mm length.	The range of shelf' depth are between 601 to 800 mm.
Area of space to place shelf is 2500x900mm	Total Shelf's size are in 2500x900mm
All of Styrofoam have 45mm thickness.	The height of row to stack 6 pieces Styrofoam.

4.3 Result and comment data by comparing with the result which areexpected and adjective or purpose of work.

The results of this project turned out to be as expected, I was able to make use of and analyze given information to design Styrofoam shelves. This also includes limitations in terms of cost and space. Therefore, whenever the company receives the ordered foam, they will not have to put it on the floor between assembly space and W.I.P parts inventory area. Instead, they can put to the shelves in the inventory area.In the quantitative result, during the internship period, since there was no composing panel process, the practical result cannot be measured e.g. timing how long it takes in order to find the Styrofoam.

Chapter5

Conclusion and Suggestion

5.1Conclusion

We created shelves for storageHeat Insulating Styrofoam of two EnclosureAssemblies. And shelves are able to move shelf's trays flexibly for support the difference in each order. Sonow companyhas exact Heat Insulating Styrofoam storing space.

5.2 Solution

As soon as the stryofoam arrive, (we) place them on the shelf

5.3 Suggestion

To make the usage of the shelf at its most efficiency, the Styrofoam should be placed according to the suggestion on task which pasted on shelves bar. Also, the way of placing Styrofoam can be change flexibly depending on different of each lot of Styrofoam the company have received. If the company used the shelf in the right way, it would help decrease the time needed for searching and pick up the Styrofoam.

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AppendixA

Vocabulary Index

Vocabulary Index

Japanese		Thai	English
作業	さぎょう	งาน	Work
企画	きかく	การวางแผน	Planning
開発	かいはつ	การพัฒนา	Development
生産	せいさん	การผลิต	Production
営業	えいぎょう	การดำเนินธุรกิจ	Business
見積もり	みつもり	การเสนอราคา	Estimate
見積書	みつもりしょ	ใบเสนอราคา	Written estimate
依頼	いらい	การขอร้อง	Request
販売	はんばい	การขาย	Sale
応じる	おうじる	ตอนสนอง	To respond
値段	ねだん	ราคา	Price
利益	りえき	กำไร	Profit
購買	こうばい	การซื้อ	Procurement
発注	はっちゅう	การสั่งสินค้า	Ordering
注文	ちゅうもん	การสั่งซื้อ,การสั่ง	Order, Request
支払い	しはらい	การชำระเงิน	Payment
原価	げんか	ต้นทุน	Cost
売上	うりあげ	ยอดขาย	Proceed
棚卸し	たなおろし	การเช็คสต็อกสินค้า	Stock taking
設計	せっけい	การออกแบบ	Design
図面	ずめん	แผนผัง,แปลน	Drawing
三面図	さんめんず	แบบฉาย3มิติ	3 views drawings
作図	さくず	การสร้างแผนผัง	Drafting
移動	いどう	การเคลื่อนย้าย	Movement
謄写	とうしゃ	การคัดลอก	Copy

Japanese		Thai	English
貼り付け	はりつけ	การวาง	Paste
切り取り	きりとり	การตัดแปะ	Cut
変更	へんこう	เปลี่ยน	Modification
正面	しょうめん	ด้านหน้า	Front
背面	はいめん	ด้านหลัง	Back
側面	そくめん	ด้านข้าง	Side
方向	ほうこう	ทิศทาง	Direction
寸法線	すんぽうせん	เส้นกำหนดขนาด	Dimension line
動線	どうせん	สายการผลิต	Line flow
道具	どうぐ	อุปกรณ์	Tools
機械	きかい	เครื่องจักร	Machine
使用	しよう	การใช้งาน	Use
止める	とめる	หยุด	To stop
動く	うごく	เคลื่อนไหว	To operate, To run
切断	せつだん	การตัด	Cutting
溶接	ようせつ	การเชื่อม	Welding
板金	ばんきん	แผ่นเหล็ก	Sheet metal
材料	ざいりょう	วัตถุดิบ	Materials
鉄	てつ	เหล็ก	Iron
鋼	はがね	เหล็กกล้า	Steel
アルミ	アルミ	อะลูมิเนียม	Aluminum
断熱材	だんねつざい	ฉนวนกันความร้อน	Insulation
発泡	はっぽう	โฟม	Foam
成形	せいけい	การขึ้นรูปชิ้นงาน	Casting, Molding
組み立て	くみたて	การประกอบ	Assembly

Japanese		Thai	English
品質	ひんしつ	คุณภาพ	Quality
管理	かんり	การควบคุม	Control
段取り	だんどり	แผนการดำเนินงาน	Program
検査	けんさ	การตรวจสอบ	Inspection
試験	しけん	การทดสอบ	Test
導通	どうつう	การนำ(ไฟฟ้า, ความร้อน)	Conduction
計り	はかり	การวัด	Measurements
防水	ぼうすい	กันน้ำ	Waterproof
確認	かくにん	ยืนยัน	Confirmation
梱包	こんぽう	การบรรจุหีบห่อ	Packing
出荷	しゅっか	การส่งออก	Shipping
納期	のうき	ระยะเวลาขนส่ง	Lead time
塗装	とそう	การเคลือบสี, การทาสี	Coating, Painting
会議	かいぎ	การประชุม	Meeting
危険	きけん	อันตราย	Danger
安全	あんぜん	ความปลอดภัย	Safety
製品	せいひん	สินค้า	Product
収納	しゅうのう	การจัดเก็บ	Storage
錆びる	さびる	ขึ้นสนิม	To be rust
情報	じょうほう	ข้อมูล	Information
要求	ようきゅう	ความต้องการ	Demand
仕様書	しようしょ	เอกสารระบุรายละเอียด	Specification document
調整	ちょうせい	การปรับปรุง	Adjustment
太陽光発電	たいようこうはつでん	พลังงานไฟฟ้าแสงอาทิตย์	Solar photovoltaics
残業	ざんぎょう	การทำงานล่วงเวลา	Overtime

AppendixB

Weekly Report

Profile

Name - Surname	Ms. RujarparPongboonchoo
Birth of day	2 March 1995
Graduate Education	
Primary school	Primary school in 2006
	PiyajitVittayaschool
High school	High school in 2012
	TriamudomsuksaNomkloaschool
Bachelor's Degree	Faculty of Engineering, Industrial Engineering (4th year studying)
	Thai-Nichi Institute of Technology
Scholarship	-No-
Seminar	Faculty of Engineering student committee