Chapter I Preliminary

I.1 Background

PT. Aditec Cakrawiyasa is one of household manufacturing industry in Indonesia. The products are gas stove, gas regulators, blender, juicer, rice cooker, super fan and cart. Each product is produced in different plant, Plant 1 is producing all type of gas cooker, and it located in Cikupa. Plant 2 is located in telesonic (bitung), it produce gas regulator and cart. And plant 3 for producing rice cooker, blender, juicer and super fan that located in Cikupamas.

The main focus of this research is PT. Aditec Cakrawiyasa Plant 2 which located in Telesonic (Bitung). In this Plant, it produced gas regulator and cart. Gas regulator is produced based on made to stock category and the cart is produced based on made to order category. In this research, the product that will be the main focus is gas regulator, because the whole production process and layout describe more about the gas regulator. For gas regulator, the plant has many different types of gas regulator, namely gas regulator (QRL-XX), gas regulator with flexible hose (QRL-XXX), and flexible hose (QPH-XX). Among these product types, the gas regulator with flexible hose (QRL-032) takes the highest demand for 2014, it can be seen in Figure I.1. Although the QRL-03 get the second highest demand that below the QRL-032, but in this research QRL-032 will be the main focus because it represent the whole production process.

For gas regulator with flexible hose, the plant has already divided the product into three types, like QRL-032, QRL-042 and QRL-062. The differences of this product are the specification of each product. QRL-032 is equipped with manometer, QRL-042 does not equipped with manometer, and QRL-062 is equipped with manometer and double safety lock system. Actually, the production process among these three products is same. But in assembling process, containing part will fit to each product. Layout type of PT. Aditec Cakrawiyasa Plant 2 is process layout because in this plant,

machine and equipment layout has same function and become clustered in one department.

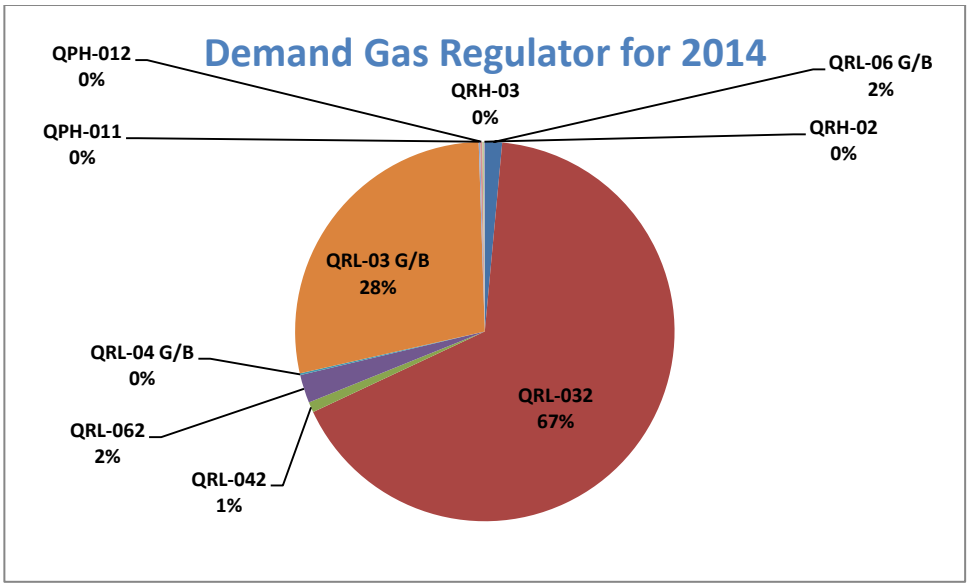

Figure I. 1 Gas Regulator Demand for 2014

Source : PT. Aditec Cakrawiyasa Plant 2

PT. Aditec Cakrawiyasa Plant 2 has 9 departement for producing gas regulator with flexible hose. The departments are Raw Material Warehouse, Die Casting, Sub Assembly, Machining, Treatment, Oven Powder Coatings, Assembly, Packing, and Rubber Hose Production. The production process starts from the raw material warehouse sent rubber hose to the rubber hose production. The raw material sent zinc alloy to be smelted and become upper and lower part. And the raw material warehouse also sent small part to sub-assembly department to produce membrane set, switch regulator assy, valve spindle, and lock piece. This part called inner part of the gas regulator. After die casting department, the upper part and lower part are sent to machining department. In machining, the upper and lower part will be tapped, reamed, trimmed, drilled, and grinded. And then, the lower and upper part will be degreased in treatment department. Next, the lower and upper part will be dried, and painted in oven powder coatings department. After that, each part sent to assembly department. In assembly department, the lower and upper part will be fitted and then it will be equipped with the

inner part. And the last, the gas regulator will be packaged with the flexible hose in packing department. The flow process of this QRL-032 production can be seen in Figure I.2.

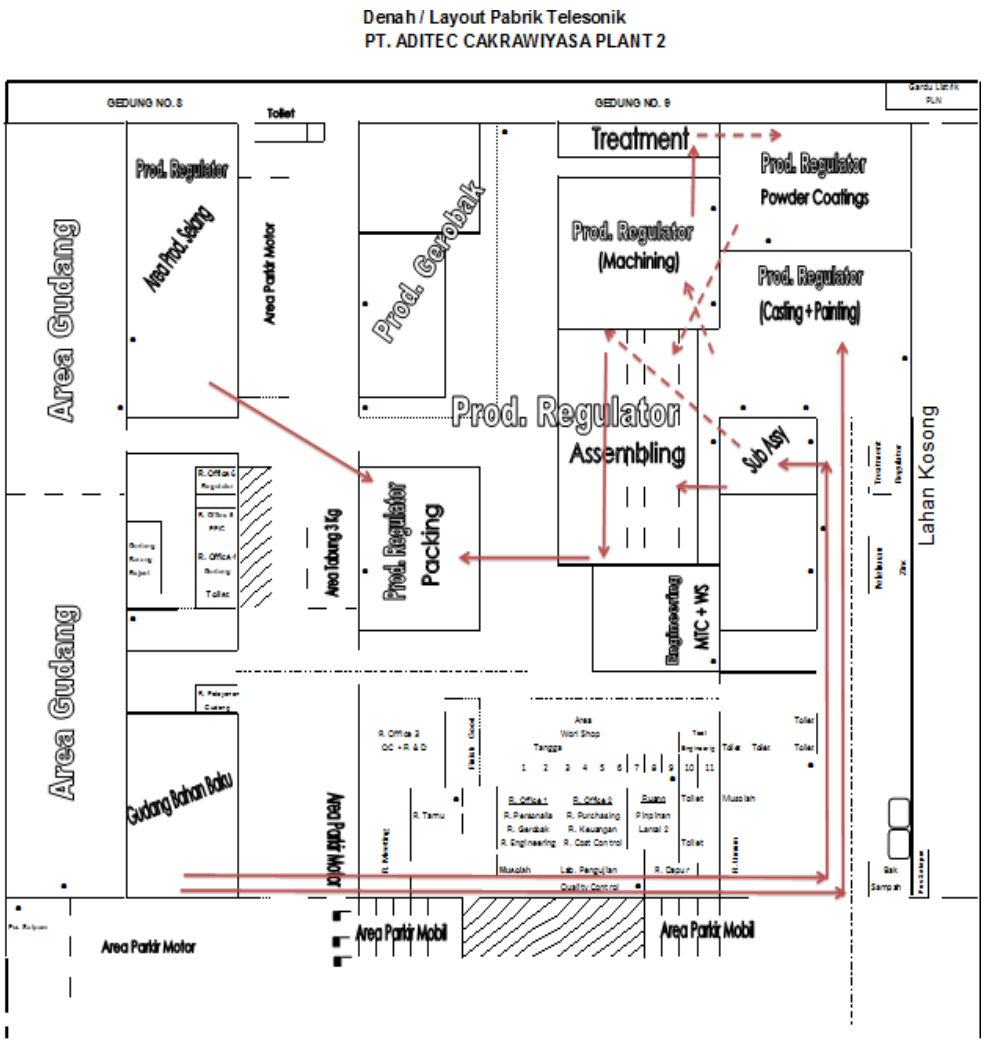

Figure I. 2 Flow Process of QRL-032

From the Figure I.2, it can be seen that the flow process of QRL-032 takes a long way and become complex. After having an interview with the supervisor, there are some problems that related to the layout :

- Backtracking and Cross-tracking happened from the sub-assembly to machining, machining to treatment, treatment to oven powder coatings, and oven powder coatings to assembly.
- The plant has a strategic planning to overcome highest demand of QRL-032 by adding some machine.

Backtracking and cross-tracking will cause the total material flow become higher. This condition can make production cost increasing due to the material movement activities in a company that can reach about 50% to 70% of production process not 20% or 10% (Apple, 1990). Planning to add machine, the plant will do re-layout facility from the existing production floor. This additional machine directly affects the production floor area so it will affect the moment of material flow in production (Susteyo, et al., 2010).

Based on the supervisor, the plant plans to add some machine in the die casting department. Die casting department is the most critical process because zinc alloy will be smelted and it will become the lower and upper part. If the lower and upper part cannot be produced, so the production process of gas regulator will be delayed for the whole process. Actually, in this department, there are 3 machines called 1 machine for Injection 150 T and 2 machines of Injection 160 T. Both of these machines are not performed well and cause a defect around 10-15% even though the process time of this machine is around 3.2 and 3.75 seconds shown in Table I.1.

Table I. 1Process time and Machine Capacity in Die Casting Department

Department	Part	Machine Name	Machine Quantity	Demand	Process Time	Machine Capacity	Bottleneck
Die Casting	Upper	Inject 150 T	1	20333	3.75	20000	333
	Lower	Inject 160 T	2	20333	3.2	10000	333

It can be seen that, die casting department cannot handle the demand because there are around 333 products are bottleneck, so plant should take an action to add some machine in this department to overcome the demand. Adding some machine in one area will affect the length of the area. If the department will become bigger from the previous one, so it can give an effect to the next department. The calculation if the plant should add machine shown in Table II.2. If the additional machine will make more crowded and does not fit this department area, so the plant should re-layout

the facility because of the department enlargement. And in this research, the machine layout for each department will not be considered. If each department should be moved because the department that right next to the other department is being affected, so it can possibly move to make the layout more efficient. Effective planning facility will reduce the material handling cost about 10% to 30% (Purnomo, 2004).

Table I. 2 Die Casting Department Size

Department	Department Size (m)		Machine Name	Machine Size (m)		Existing Machine Total	Existing Machine Size		Machine Size Needed (Adding 2 Machine)	
	L	W		L	W		L	W	L	W
Die Casting	7	16	Inject 160 T	4.5	2.20	2	9	4.4	13.5	6.6
			Inject 150 T	4.5	2.20	1	4.5	2.2	9	4.4
			Total Area				13.5	5.7	22.5	11

To solve those problems, the proper method to do re-layout is using SA-CRAFT Algorithm. SA-CRAFT algorithm comes under for heuristic algorithm for layout improvement. Heuristic algorithms can solve layout problems with the computational time is quite short but the resulting solution is sub-optimal solution (Purnomo, 2004)This method requires initial layout and relationship activity data between facilities as input data. This method will improve the existing facilities resulting with smaller material handling cost.

SA-CRAFT is a development algorithm of CRAFT which is used to optimize the previous layout. The solutions from CRAFT are still for local optimization. For increase the optimization, simulated annealing (SA) approach can be used. The basic criteria of Algorithm SA-CRAFT is the algorithm used to minimize material handling cost, these costs are described as a linear function of the distance of displacement to produce optimal layout or can be called the material handling moment.

I.2 Problem Identification

Problem identification in this research is :

How is the facility layout design of PT. Aditec Cakrawiyasa Plant 2 using SA-CRAFT algorithm in order to minimize material handling moment?

I.3 Research Obejectives

The objectives of this research is :

Designing facility layout of PT. Aditec Cakrawiyasa Plant 2 using SA-CRAFT algorithm in order to minimize the material handling moment.

I.4 Research Benefit

The benefit of this research are :

1. The plant can get an efficient layout to minimize material handling moment.
2. Become an improvement reference for PT. Aditec Cakrawiyasa Plant 2.
3. Can support the term of adding machine that will affect to the layout by giving the suggested layout.
4. Suggested layout can be used by PT. Aditec Cakrawiyasa Plant 2 for re-layout the production area of gas regulator.

I.5 Research Boundaries

The research boundaries are :

1. Gas regulator with flexible hose (QRL-032) is the main focus on this research because QRL-032 production process represents the whole process.
2. Calculating distance using rectilinear method.
3. The machine layout for each department will not be considered.
4. Material handling system and cost will not be considered.

I.6 Systematics Writing

This study described the systematic writing as follows:

Chapter I	Preliminary This chapter contains a description of the background research, the formulation of the problem, the purpose of the study, limitation of the study, the benefits of research, and systematic writing.
Chapter II	Review of Literature This chapter contains the literature that will be relevant to the problem under study and the research method used is SA-CRAFT.
Chapter III	Research Methodology In this chapter the conceptual model described in any study variables and systematic problem solving to investigate issues perusal. Stages traversed: the preliminary stages of research, data processing stages, and the stages of analysis and proposals.
Chapter IV	Collecting and Processing Data In this chapter, there will be some data such as existing layout that will be collected first. And then these data will be processed to calculate the space requirement and get the alternative layout using SA-CRAFT Algorithm.
Chapter V	Analysis In this chapter, the alternative layout will be analyzed to get the suggested layout for the plant and then the space requirement will be analyzed too

Chapter VI Conclusions and Suggestions

In this chapter, the conclusion will be determined after analyzing the suggested layout. And there will be some recommendation for the plant and next researcher.