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SUPPLY MANAGEMENT OF A CONTRACT MANUFACTURER

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วิทยานิพนธ์นี้ได้ปรับปรุงการบริหารการจัดหาของบริษัทรับจ้างผลิต ซึ่งเคยมีปัญหาการจัดส่งสินค้าไม่ทันตามกำหนดเวลาส่งและมีค่าใช้จ่ายที่เพิ่มขึ้นจากการเร่งของขบวนการจัดซื้อวัสดุ โดยมีสาเหตุมาจากความต้องการของลูกค้าไม่เสถียรมีการปรับกำหนดการและปริมาณส่งอยู่ตลอดเวลา ทำให้มีผลกระทบต่อประสิทธิผลรวมของบริษัทและยังเป็นสาเหตุที่ทำให้ลูกค้าไม่พึงพอใจในการบริการของบริษัทอีกด้วย.

ระบบที่ปรับปรุงนี้เริ่มจากการพิจารณาปัญหาของระบบการทำงานที่เป็นอยู่ แล้วนำแผนผังก้างปลา และเทคนิคการวิเคราะห์ข้อบกพร่องและผลกระทบ (Failure Mode and Effect Analysis, FMEA) เข้ามาช่วยในการวิเคราะห์สาเหตุของปัญหาทั้งหมด การวิเคราะห์ข้อบกพร่องและผลกระทบช่วยให้วางแนวทางในการจัดทำพัฒนาระบบการจัดหาแบบใหม่ ซึ่งแบ่งออกเป็นสองส่วนหลักๆคือส่วนที่เกี่ยวข้องกับภายนอกกิจการและส่วนกระบวนการภายในกิจการ ส่วนที่เกี่ยวกับภายนอกกิจการเน้นเรื่องแหล่งการจัดหาวัตถุดิบภายในประเทศและประเทศใกล้เคียง ในส่วนของการพัฒนากระบวนงานภายในบริษัทได้ปรับปรุงระบบการวางแผนและการลดเวลาการสั่งซื้อวัตถุดิบ

ในการนำระบบที่ปรับปรุงไปใช้ทำให้มีประสิทธิผลของการจัดหาดีขึ้นกล่าวคือ การขาดแคลนวัตถุดิบและค่าใช้จ่ายเพื่อที่เร่งวัสดุลดลงอย่างเห็นได้ชัด กล่าวคือการขาดแคลนวัตถุดิบสามารถลดลงได้มากกว่า 60% และค่าใช้จ่ายเพื่อที่เร่งวัตถุดิบลดลงประมาณ USD 67,000 การส่งมอบสินค้าให้กับลูกค้าได้ตามกำหนดดีกว่าเดิม เนื่องจากได้ทำความตกลงกับลูกค้าที่ทำให้ความต้องการจากลูกค้าในระยะกระชั้นมีความเสถียรพอที่จะจัดการได้ ระยะเวลาส่งมอบสินค้าส่วนใหญ่ลดลงได้อย่างน่าพอใจด้วยการเปลี่ยนแปลงแหล่งวัตถุดิบมาใช้ในประเทศ อย่างไรก็ตามระยะเวลาส่งมอบของสินค้าบางรายการลดเวลาลงได้ไม่มากเนื่องมาจากลูกค้ายืนยันให้ใช้วัตถุดิบบางรายการจากแหล่งที่ใช้เวลาในการจัดหานาน

ภาควิชาศูนย์ระดับภูมิภาคทางวิศวกรรมระบบการผลิต ลายมือชื่อนิสิต.....
สาขาวิชาการจัดการทางวิศวกรรม ลายมือชื่ออาจารย์ที่ปรึกษา.....
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KEY WORD: SUPPLY MANAGEMENT / FMEA / LOCALIZATION PROJECT / FROZEN ZONE / DEMAND MANAGMENT

AEKARIN BURAPACHAYANONT : SUPPLY MANAGEMENT OF A CONTRACT MANUFACTURER. THESIS ADVISOR : ASST. PROF. MANOP REODECHA, Ph.D., THESIS CO-ADVISOR: MS. MONTICHA SANGVORANIT, 162 pp.

This thesis concerns the improvement of the supply management system of a contract manufacturer. Originally, the studied company had problems of untimely deliveries and high cost of material expedition. The problems were caused by unstable demands from customers in term of time and volume. These problems affected the overall performance of company as well as customer dissatisfaction.

The improvement began with an extensive investigation of the existing system. Fish bone diagrams and Failure Modes and Effects Analysis (FMEA) were used to analyze problems and their causes. The analyses led to the development of a new system which can be divided into two areas: external and internal areas. The external area concerns mainly with localization of supply sourcing. The internal area involves the improvements of material planning and purchasing lead time reduction.

The implementations of the improved system shows improvements of supply management system, Material shortages, and expediting costs, are reduced significantly. The material shortages could be reduced by more than 60% and the expediting costs could be decreased by approximately USD 67,000. There is also significant improvement of keeping delivery promises some due to the agreement on the suggested frozen-order time zone which makes order stable enough to manage. Lead time of most products and shortened satisfaction by localizing sources of suppliers. However, lead time of some products can not be shortened significantly because the customers insist on using some items from sources with long purchasing lead time.

The Regional Centre for Manufacturing Systems Engineering
Field of Study Engineering Management
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Student's signature.....
Advisor's signature.....
Co-advisor's signature.....

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CHAPTER 1

INTRODUCTION

This thesis presents a supply management policy for the improvement of time delivery, material shortages, and the reduction of expediting costs. The Material Requirement Planning, purchasing procedure, and the supply management policy are all utilized in order to achieve customer satisfaction.

1.1 THESIS BACKGROUND

The case study company is a contract manufacturer (CM) in optical communication products. The company manufactures for top-tier original equipment manufacturers, OEMs, and emerging companies alike with manufacturing service of the highest order. The optical communication industry has a dynamic structure and is always at a rapid change. Due to the dynamic change of the optical market, all CMs have to apply several strategies in order to achieve customers' requirements in terms of service and pricing. Currently, the case study company has to face with many competitors particularly new players from China, who usually provide very competitive prices. In general, the optical industry generates high profitability, but the complication of optical technology affects quality issues. Hence, the case study company has to acquire more experience, expertise, and high investment to develop its organization in order to compete in the marketplace.

In the CM business, the key problem that all companies probably encounter is having to meet all of clients' requirements, for example new product development, flexibility of production, and demand uncertainty. Customers' demand fluctuates which means that all companies should have a good system to handle fluctuating demand. This problem is being focused as a major problem since it certainly affects delivery performance. To solve this problem, many companies increase their inventory in order to protect uncertainty in demand and lead time. Nevertheless, increasing inventory is not the most appropriate solution since high inventory is

costly. An efficient model must be able to manage such uncertainty demand by using effective supply management. Developing an advance model for effective supply management is becoming one of the most interesting topics of discussion in the case study company.

Thus, the technology of optical communication products has been rapidly changed overtime in order to correspond with future requirements and technologies. High profitability is an attractive factor that sustains all CM to invest in their business including the case study company. Demand fluctuation and competitive competitors are adding more pressure to the case study company to come up with an effective solutions as well as tactical executions. The objectives of this thesis are to meet customer requirements, improve on time delivery, eliminate material shortages, and reduce expediting costs. In order to accomplish these objectives, the case study company would have to establish an effective supply management system which would make it competent in terms of uncertainty demand management.

Figure 1.1: Products Example

1.2 PROBLEM IDENTIFICATION

Currently, the case study company has more than ten clients that have transferred their products to be manufactured by the case study company. In the initial stage of product transferring, customers will transfer technological knowledge and other necessary tools to the case study company, such as equipments, techniques, and

necessary information. Once all products are completely transferred, the customers have to verify readiness before allowing the company to start manufacturing. Typically, the product must be produced under the license or customer brand only. It means that all products must be dispatched back to the customer and restrict to disclose any products or formation to others unless authorized to do so. Once the case study company delivers its products to its customer, they sell their products to their end customers. Typically, end customers are communication service provider companies who construct communication network by using light technology to transit data. Although, optical products are unique, there are many manufacturers in the market. Thus, end customers have an opportunity to select a CM that has the capability to achieve their requirements. Time delivery is a crucial criterion for today's business which significantly influences the case study company to concentrate on improving delivery agility. Agility in delivery does not only refer to dispatching of correct quantity, but also on delivery schedule.

Typically, a customer will provide demand to complete finish goods to the case study company. The case study company's planner will then upload the demand into the Bill of Material (BOM) which has been set up in the system early, in order to distribute demand information to components' level (level 1, 2, 3… etc) as can be seen in Table 1.1.

Table 1.1: Example of Bill of Material (BOM)

Dom: 0 - 40002740 Power Node Active
Customer: XXXXXX

Level 1	Level 2	Level 3	Level 4	Part No.	Description	Usage per Bom	UOM
●				0+40003676-003	125x150, Cover, Sku 635	1	EA
	●			0+40002610	GFF, single, standard, L-Band,G2	2	EA
	●			0-40002627	PCBA Siemens V660-V690	1	EA
		●		0+4UUU3525	STANDOFF M-F .156DIAX.138L	4	EA
	●			0+4196	Pump, 974.5+/-0.5nm, 200mW, JDSU	3	EA
	●			0+40002721	GFF, Alcatel Metro 28/9 Booster,New 1/06	3	EA
	●			0+40002844	FO ADAPTER LC DPLX 45 DEG SCRW MNT	5	EA
	●			0-40003634	GFF, G39 (ILA)	2	EA
		●		0+4UUU285U	Voa, Mems, Epoxy Free, RoHS	0.45	gm
	●			0+40002851	SWITCH, MEMS OPTICAL, 1X2, LATCHING RoHS	1	EA
	●			0+40002860	Jumper, Lc Measurement 900 Micron 5M	3	EA
		●		0+40003775-003	Screw, M3x6mm, phillips, flathead, ss	4	EA
	●			0-40002861	Pigtail, #3 White, Length 102.5 Cm	2	EA
	●			0+4UUU2861UU1	Pigtail,E2UUU,9UU Red,Zema C	2	EA
	●			0+40002861016	Pigtail Assy, 900Um, Sc, 1000Mm, Blue	2	EA
		●		0+40002612	Spacer, #2, OD 1/8"", 1/8"" LG	3	EA
	●			0+40002861005	Pigtail Assy, 900Um, Fc, 1100Mm, Blue	1	EA
	●			0-4620	PHOTODIODE, JDSU, C BAND	2	EA
	●			0+4UUU2861UU/	Pigtail Assy,9UUUm,Lc,1525Mm,Blue	1	EA
●				0+40003675-001	150x125, base	1	EA
	●			0+40002724	Heat sink, EDFA	2	EA
		●		0+40002849	SCREW 6-32 X 1/4 PLP PN SS W/NYL	4	EA

According to the material planning procedure, the planner of the company usually receives the forecast from customer quarterly, monthly and a one month firmed order. Nevertheless, due to the unstable order quantity of customers' demand, customers probably change their demand during the firmed order period resulting in the change of MRP that has been explored to purchase order system.

The demand of components depend on usage of component, for instance, if the demand of 0+40002740 is 50 pieces per month, the demand of 0+40002610 is then 100 pieces a month. Therefore, planners are able to comprehend the required items and quantity of each item which are needed to be purchased to support production line. Once requirement is uploaded into system, the buyer is held responsible to verify and issue purchase orders (PO) to suppliers. The current system which is employed in the company is Material Requirement Planning or *MRP* operating in the *Oracle system*. The system will alert the material requisition list to the buyers' team, so the buyers can comprehend when they will need to purchase the materials, and the number of pieces that will be required, meanwhile the business unit team provides a

submission date of completed products to customer. The purchasing procedure is conducted in a cyclical manner as shown in figure1.2.

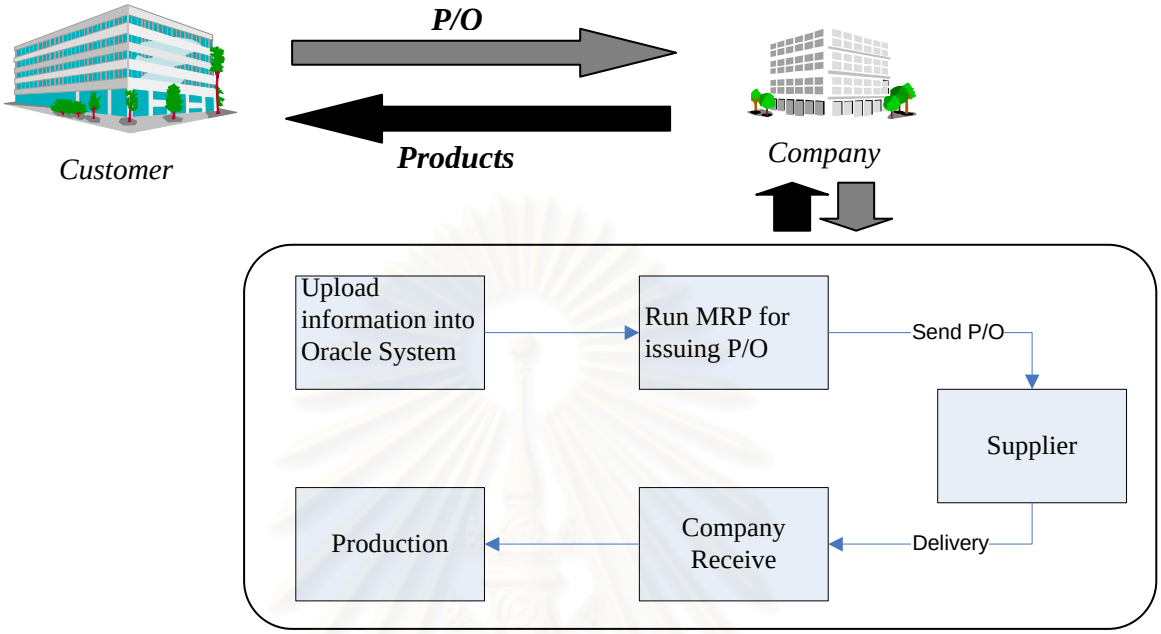


Figure 1.2: Ordering Flowchart

According to the current working procedure, the company utilizes a system to manage the dynamic requirements of customer which could not be managed properly. As mentioned prior, customer demand is uncertain and often changes every week. If the company utilizes the demand for material planning, the company can not deliver products as promised because demand is frequently revised while the purchasing material lead time is fixed. If the company would like to tackle material shortages, the company has to increase material stock level resulting in excess inventory. In order to minimize the severity of the problem, the company needs an efficient method to manage such demand uncertainty in order to satisfy customer requirements.

1.3 PROBLEM SPECIFICATION

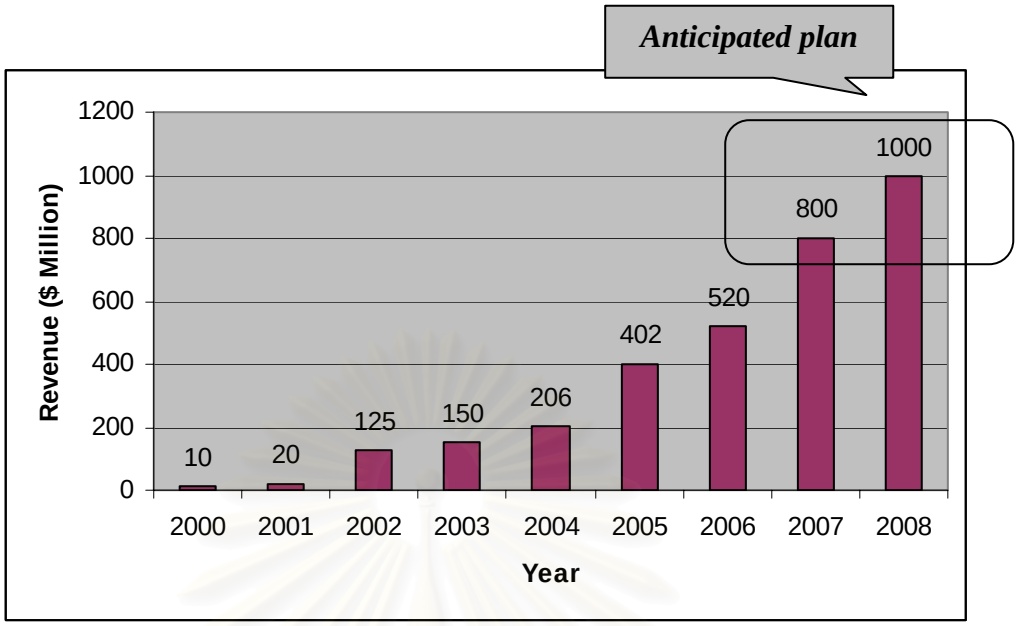


Figure 1.3: Company's Revenue between Year 2000 and 2008

The company has been growing every year continually since its first year of business and plans to be a billion dollar company in the year 2008 (Figure4). In order to achieve the objectives of its business plan, the company would have to acquire new businesses and customers. However, a well prepared supply management system is to be significantly considered in order to manage delivery on schedule and provide flexibility to customers, while balancing stock cost and service level.

The materials can be divided into four groups namely Mechanical, Electrical, PCB, and Optical. In each commodity, the complication of production and purchasing condition is diverse depending on part characteristic and production lead time. Due to different lead time, the company has to apply an appropriate method of control on material ordering in order to avoid any material shortages. The delay of delivery is caused by ineffectiveness of supply management. As mentioned earlier, customer demand for material purchasing is provided monthly and quarterly. Nevertheless, the particular demand from customer is intermittent and demand can change on a weekly basis. Obviously, the intermittent and demand uncertainty affects across the supply chain system because the company and suppliers are linked together via the downstream feed-forward flow. Moreover, each supplier echelon only has insight of

the demands of customers and not understanding the changing demand from end customers (S.M. Disney, D.R. Towill 2003). Therefore, the supplier is unable to supply the material on time due to lead-time, known as the “Bullwhip Affect”. Meanwhile, the customer always forces the company to dispatch products on schedule because they would need to sell their products to the end-customers on committed schedule. These are the reasons why the company is unable to deliver the products on schedule and resulting in bad service.

Currently, the company uses material requirement planning, MRP, which operates in the Oracle system. The MRP operates by applying the confirmed order from customers to purchase materials. To premeditate the effective ordering process, MRP should be planned and established in advance. However, the accuracy and integrity of MRP parameters are very important in order to decrease inaccuracy of the operative MRP. Today, material shortage is the company’s major problem. The reason is that the company must deliver all finished goods to client within 8 weeks, according to the normal lead time, or the commitment date.

As mentioned earlier, the company receives its forecast on a monthly and quarterly basis, but the firmed order only once a month. There is a fluctuation in advance forecasting, thus it is obvious that the company will place the order only when it receives the confirmed order to supplier rather than purchasing by refer to forecasting. Furthermore, some materials require a long lead time (L/T) for production, more than eight weeks, thus there are inadequacies in the materials required for the production lines. However, customers often change their mind about the quantity of firmed order during ordering materials after they have sent it in their first firmed order\ by expecting to have the products as schedule. Consequently, the company is unable to deliver the complete product to customers on time. In order to understand this more clearly, figure 1.4 illustrates this.

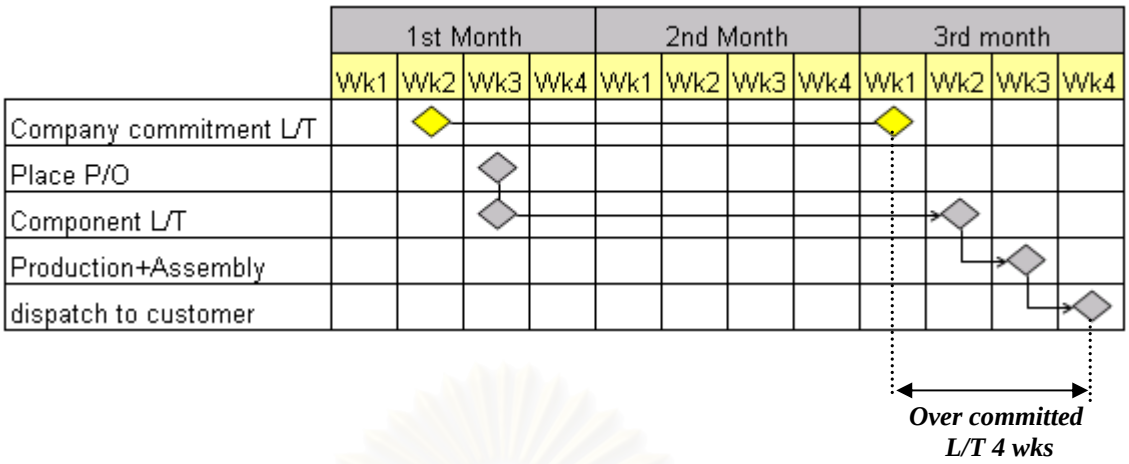


Figure 1.4: Comparison Chart between Company and Customer L/T

Currently, the company solves this problem by shortening suppliers' production L/T, but this activity typically requires extra payment, known as purchase price variance (PPV). For this charge, both the company and customer must absorb the incremented prices. The company has realized that PPV directly impacts company profitability. Hence, the company has attempted to solve this problem by operating the MRP frequently as once a week in order to adjust the demand according to the dynamic requirement, but it is not effective. An example of PPV is shown below.

Table 1.2: Example of PPV

PPV Request No.	Part no.	Description	Supplier Name	MOQ	PO Q'TY	Std Cost	PO Price	Charge (%)	PPV
JAN10-178	0+4367	Coupler, 98/2 1X2 S-C	AOFR PTY LIMITED	250	470	9.30	19.51	110	-4800.00
JAN10-178	0+4368	Coupler, 98/2 1X2 P-C	AVANEX CORPORATION-AEP	100	1051	10.80	13.47	25	-2808.00
JAN10-178	0+4784	Coupler, 90/10 1X2 S-C	AOFR PTY LIMITED	50	585	11.50	14.44	26	-1717.40
JAN10-179	0+4785	COUPLER, 99/ 01 1X2 S- C	AOFR PTY LIMITED	50	470	10.80	20.67	91	-4639.75
JAN10-182	0+40000638	HEAT SINK, W/ HEAT PIPES (MACHINE	AAVID THERMALLOY (S) PTE LTD	100	150	105.00	186.83	78	-12275.00
JAN10-183	5009160	Crystal 25.0 MHz 18pF SMT	DIGI-KEY CORPORATION	5000	363	0.59	2.24	280	-600.00
JAN11-181	5010493	VOA Broad Band Vertical	LIGHTCONNECT, INC	1	268	279.00	305.22	9	-7027.68

Obviously, the system does not match the company's business, thus the company requires a system that will enable them to improve their productivity, service level, reduce PPV and so on. The supply management concept will be applied in this thesis in order to enable the company to cope with demand uncertainty, reduce PPV, and increase the level of customer service.

1.4 PURPOSE AND OBJECTIVES OF THE STUDY

The purpose of this study is to develop a system to manage supply for a contract manufacturer with the following objectives:

1. To reduce material shortage
2. To reduce expediting costs
3. To improve on time delivery

1.5 SCOPE AND ASSUMPTIONS OF THE STUDY

1. Analyze current supply chain workflow to propose a method in compressing lead-time of supplying components.
2. Generate material shortage risk management
3. Originally, the study would focus on the customer's class A and B items of the customer with the most business volume. However, the actual study also includes class C items.
4. The proposed solution would be validated by simulating the historical data.

1.6 METHODOLOGY

The methodology of this thesis is to compress lead time for supply which consists of three phases as shown in figure 1.5. Its details are as follows:

Phase 1: *Problem Investigation and Identification*

- Study the existing work flow along the supply chain.
- Gather significant information on demands and supplies and relevant decisions on supply management from internal and external sources.
- Analyze causes of problems on material availability and supply lead time.

- Apply risk management in order to understand the significance of problem.

Phase 2: *Generating solutions to solve the problem*

- Analyze and create appropriate solutions to solve the problems in both areas (Internal and External)
- Clarify methods and techniques for each area

Phase 3: *Validation Phase*

- Validate the solutions by simulating with historical data and comparing the results before and after applying the solutions.
- Refine the solution, if necessary.
- Recommend implementation approach.

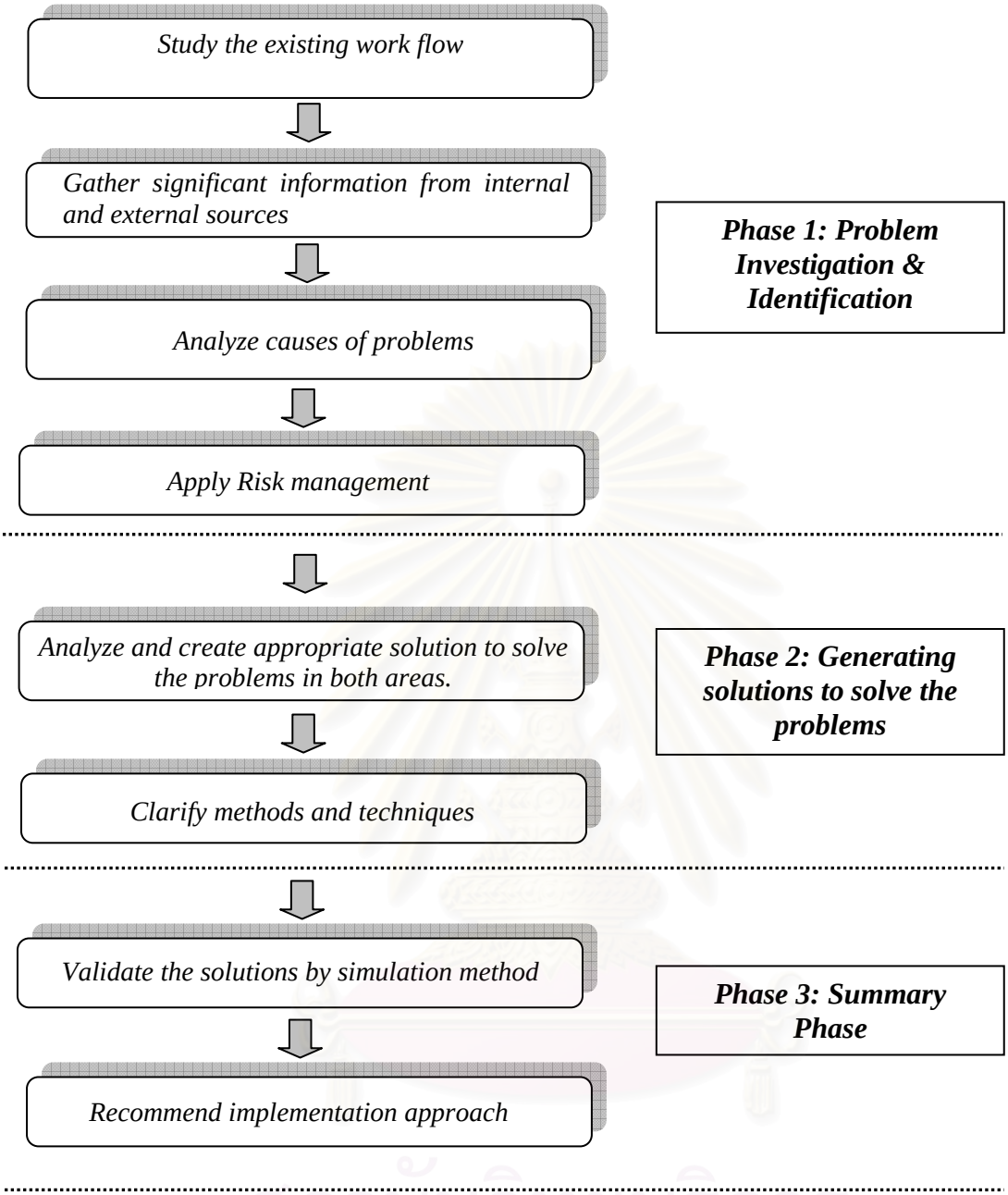


Figure 1.5: Thesis Methodology

1.7 EXPECTED BENEFITS

The expected benefits from this study are shown below:

1. Shortening lead-time to customer
2. Provide on time delivery schedule to customer.
3. Reduce the purchase price variance from materials expediting cost.

CHAPTER 2

BACKGROUND AND PROBLEM ANALYSIS

2.1 COMPANY BACKGROUND

The case studied company has been established on 2000 focusing on optical product business. Currently, company is the joint venture company among company, XXX and employees with share 51%, 29%, and 20% respectively. Case studied company is an EMS (Electronic Manufacturing Services) company and a manufacturer of opto-mechanical and sophisticated products. The case studied company currently employs more than 3,200 staff, who manufactures millions of SMT printed circuit cables and arm assemblies per month. The company's annual revenue reached over US$ 206 million in the fiscal year 2004 and expecting to reach US$ 1 billion by fiscal year 2008. The company is expertise in the manufacturing of optical technologies. The company's portfolio is complicated technologies, process improvement, and quality systems are unparalleled in the optical manufacturing services industry. Moreover, company expects to be the largest manufacturer of optical transceivers, producing approximately 4 million units a year. Due to the high reputation of the company in the EMS industry, therefore the customers worldwide such as from U.S.A., Japan, France, England, Australia has chosen the company to be their supplier.

2.1.1 Quality System

According to quality systems, company has been applied Lean Manufacturing principle and Six-Sigma strategies in all activities from supply chain management to manufacturing and engineering. Its core concentration is to provide the best quality of product with the rigorous process certification of the international standard (ISO) as:

ISO 9001: Version 2000	Manufacturing Quality System.
ISO 14001	Environmental Management Systems.
TS 16949	Automotive Industry QualityCertificated.

TL 9000 Telecommunication Quality System.

Furthermore, company comply the Six Sigma Strategy for entire processes for instance supply chain management, manufacturing, and engineering. This strategy enables company to ensure that their products have been controlled by the highest feasible quality control and be able to achieve quality satisfaction of products and processes. Therefore, entire clients believe that products quality which produced by company is able to achieve the quality requirement from their end customer.

2.1.2 Market

As mentioned before, company has worldwide customer such as Australia, Japan, Europe, England, France, Italy and USA. Main customers are USA based companies which are 60%-70% of total revenue. Due to high market share in this area, company decided to establish international sales offices in specific regions as below:

North America - California; USA
Europe - Barcelona; Spain
- Mommemheim; Germany

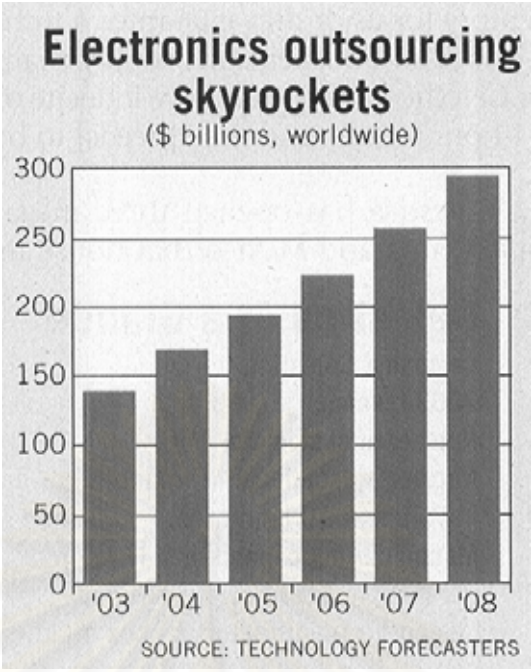
According to high labor and production costs in oversea, most customers such as European, American, and Australian decided to move their manufacturing facilities and/or suppliers to Asian countries particularly China, Malaysia, and Thailand. EMS in Thailand has advantages comparing to other countries in this region due to Thai government is more stable and transparent than Chinese government especially policies concerning to public. Thailand has immense of workforce approximately 34 million peoples and they are considering as hardworking, clever, and loyal people. The infrastructures in term of communication, energy, transportation are quite good specially the new Thailand airport which is the biggest airport in Asia. Moreover, labor wage of Thailand is competitive compare to China; however, the Thai labor competence is remarkably higher than Chinese labor.

In fact, company prefers turnkey manufacturing product or localization project because company has an advantage in supply chain management. The supply chain engineering team has a high capability in sourcing, managing and quality controlling. Supply chain team consists of professionals and engineers expertise in various areas such as mechanical, optical and electrical components. As a consequence, all clients were convinced that turnkey project will help them safe their capital investment while getting component quality as purchased from their suppliers.

2.1.3 Business Orientation

Nowadays, business world has radically changed from the last decade. Entire companies attempt to gain more competitive advantages in order to survive in their businesses. CM is a one business that is notably affected by the changed of business circumstances. Typically, CM does not have their own product; they employ the design, know-how, expertise, and equipments from client to manufacture the product same as the purchasing order. Growth in electronic business marketplace is fuelled by continuous innovation and replacing technologies as well as launching the new product into marketplace faster than ever.

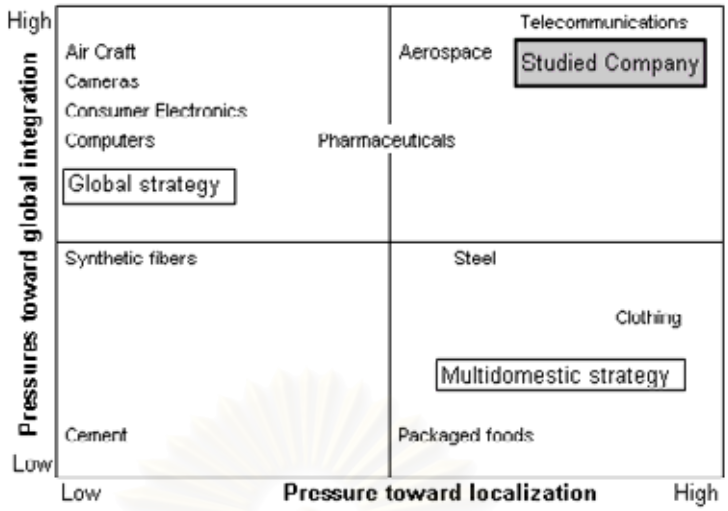
According to the electronic outsourcing of OEMs, it has dramatically growth since year 2003 and expected to reach $300 billion in year 2008 (figure 2). Consequently, there are a lot of new CMs in the electronic market, particularly Chinese Companies. Therefore, entire CMs have to establish strategies to response OEMs requirements meanwhile offer low costs, good quality, cost reduction program, and flexibility.



Source: Jim Carbone, How Celestica keeps costs down, Feb 17,2005, pp. 46

Figure 2.1: The Electronic Outsourcing Trend

Currently, there are more than hundred CMs in the optical communication business. The value proposition of larger solution providers lies in their ability to reduce the time to market significantly, resulting in substantial cost benefit to the OEM and increases their market penetration over their competitors. In order to achieve these criteria, CMs must have a profound understanding of various factors that influence OEMs assessment on CM selection. Obviously, CMs are now facing a lot of pressures. However, if CM truly understand own status and market, CM can definitely gain competitive advantages. Typically, the pressures can be categorized into two sets namely pressure toward globalization and pressure toward localization. (Beamish et al, 2000) However, the pressure of each company is diversity since it depends on location. The company pressure is analyzed by adopting a matrix below.



Adapted: International Management, Allen J.Morrison, 2000

Figure 2.2: Company Pressure

According to the figure 2.2, it is obvious that company is identified in telecommunication group. Therefore, impact to the company will be from both pressures; pressure toward localization and pressure toward global integration. In order to create the strategy effectively, company must deliberate take both pressures into consideration. These pressures can occur in the business any time, for example Trade barriers, Cultural Differences, Nationalism, Technology, Global competitor, etc, and they might reflect to strategy of organization. The company requires Global Strategy and Multidomestic Strategy to cope with all pressures. Fortunately, the company is the only CM in Thailand that produces optical communication product, so the company can disregard domestic pressure. Furthermore, government policies encourage foreign investors to establish the businesses in Thailand. In term of international business, the company has established a strategy to serve a global pressure by targeting to be a world class contract manufacturer within year 2010 as well as enlarge the revenue. However, in order to achieve the targets, the most important point that has to be considered is to accomplish and fulfill customer requirements.

2.1.4 Supply Chain Management Overview

Supply chain management is the process of planning, implementing, and controlling operations in order to ultimately fulfill customer requirements. Typically, supply chain encompasses all parties involved such as manufacturers, supplies, transporters, warehouses, retailers, and customers. Supply chain activity begins with a customer order and end when customer satisfies to purchase products. Supply chain management covers all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption. The supply chain process of company can be illustrated in figure below.

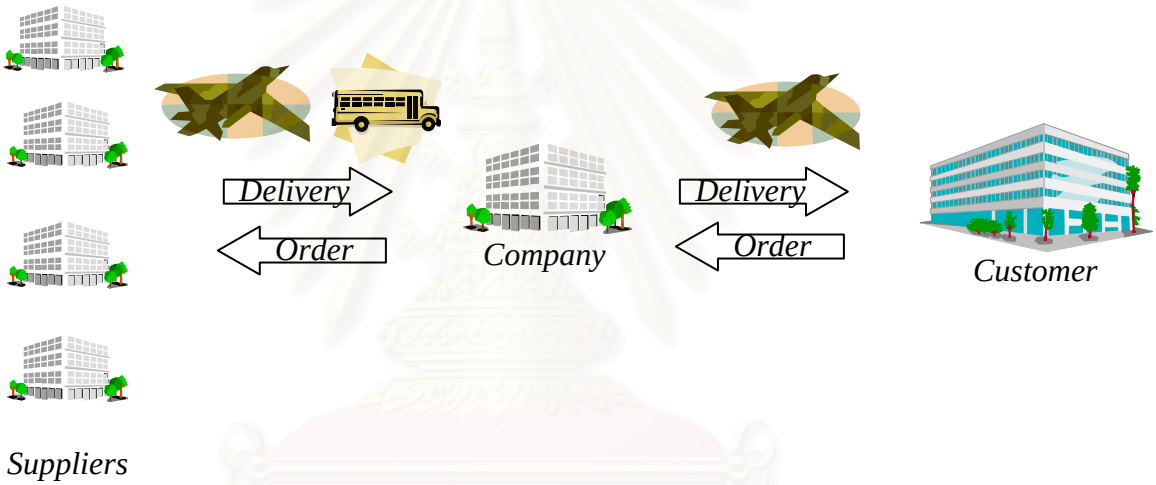


Figure 2.3: Supply Chain Flow of the Studied Company

1. Suppliers: According to the suppliers of company, they can be separated into two major groups namely local suppliers and oversea suppliers. Suppliers will start manufacture once they receive purchase orders from the company, and then will confirm delivery date to buyer team. Company have to be aware of lead time of part since oversea suppliers usually take longer lead time, from manufacturing until delivery to the company, than local suppliers, particularly the critical parts such as optical products.

2. Company: Once materials dispatched to company, all of materials have to go through inspection process by incoming quality assurance team in order to prevent

any quality problem in production line. Materials that pass inspection process will be sent to store waiting for issuing to production. Typically, each product has its own production process and lead time; it depends on the initial design of each product. Quality of product is the most significant point which top management of company concentrates on. Company has applied a lot of quality tools into the production process such as statistical process control, SPC, as well as has fully utilized the six-sigma program. Thus, company can ensure to client that the product will achieve quality level as customer standard.

3. Customer: The finished goods will be kept in store waiting for shipping process. Once shipping documents are ready, shipping broker proceeds customs clearance and deliver through air freight.

According to the figure 2.2, apparently supply chain network of company is not complicated, but it is dynamic which can be changed all the time especially demand. Uncertainty demand impacts supply chain system, for example, if demand is increased during manufacturing process at suppliers, they will have to adjust their production plan in order to meet delivery schedule. Sometimes, company has to pay a special charge (PPV). Although paying additional charge means more expenses to the company, company does not allowed to keep inventories according to company's policy. Therefore, the company requires system or strategy to facilitate this problem such as just in time, policy management, and effective material requirement system.

2.2 PROBLEM ANALYSIS

2.2.1 Current Status

Company should start to analyze the current status which can be separated into two major topics which are:

1. General Information

The general information is the regular information of the material which company purchased from supplier. This information consists of six significant parameters to be checked:

1.1) Part No: Usually, company does not create its own part no, but employ part no from customer. Part no is indicated customer and customer's location. Furthermore, using customer part no encourages company to purchase material from approved vendor list easily due to supplier already recognized customer part no.

1.2) Part Description: This information describes a characteristic of material. Some occasion, this information can be used as a material specification to perform second source activity particularly hardware items.

1.3) Supplier: Typically, this information usually prepares by customer since transferring product from customer. Supplier information has to be correct and up to date, otherwise production line probably encounters material shortage problem.

1.4) Commodity: Commodity represents homogeneous of items which are assigned for apprehending within the company. Currently, there are four commodities in company namely mechanical, electrical, PCB, and optical.

1.5) ROHS (Restriction of Hazardous Substances directive): It is a regulation that enforces electronics equipment to eliminate or reduce any substances that endanger for environment. The control substances consist of Lead (Pb), Mercury (Hg), Cadmium (Cd), Hexavalent chromium (Cr6+), Polybrominated biphenyls (PBB), and Polybrominated diphenyl ether (PBDE). This regulation has been affected since July, 1, 2006. These regulations have impact on many CMs because they have to take a vast time to research and formulate the substances and/or processes in order to compliance with the regulations.

1.6) Possibility to source locally: It illustrates the feasibility of each item to source new local supplier. This is a valuable project not only for company but also for customer due to it facilitate lead time, minimum order quantity, and product cost.

2. Purchasing Information

2.1) Standard cost: It is a price that company currently purchases material from supplier. Typically, pricing can be changed all the time due to various factors such as oil pricing, material pricing, and so on. Changing of pricing directly affect to the cost of product and profitability, so company requires a strategy to cope with this change such as contract pricing agreement.

2.2) Lead time: Lead time can be divided into two terms namely purchasing lead time, and production lead time. Purchasing lead time is the time that supplier receives a purchasing order until deliver material or product to company. Typically, the total purchasing lead time of company consists of three significant elements, which exist in Oracle system, pre purchasing lead time, purchasing lead time, and post purchasing lead time as figure below.

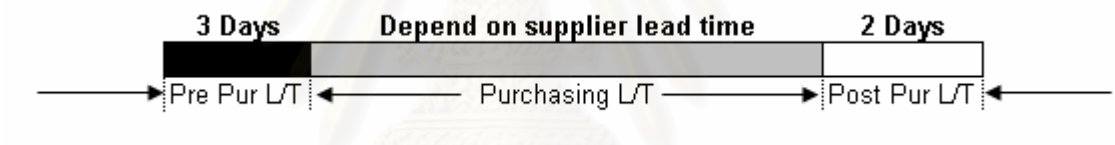


Figure 2.4: Purchasing Lead Time

2.3) Pre Purchasing Lead Time: It represents time for creating purchasing order, PO, as well as verifying all information before sending PO to suppliers. The current lead time in the system is set 3 days

2.4) Purchasing Lead Time: It represents actual manufacturing lead time from supplier; from receiving order to deliver product to company. Typically, this information has to be up to date due to it impinges on establishing master production schedule (MPS). Therefore, case studied company has a high possibility to encounter shortage problem, if this information in system is incorrect.

2.5) Post Purchasing Lead Time: According to the company's quality policy, all incoming material must be inspected by incoming quality assurance team (IQA). If IQA finds any critical problem, they will collaborate with supplier to solve the problem; either repair or replace. Time of preceding this activity is called Post

purchasing lead time. Presently, Post Purchasing Lead Time in the system has set to 2 days.

2.6) Order Size (MOQ): For minimum order quantity (MOQ), company aims to purchase in the lowest volume possible. MOQ is usually linked to pricing since higher volume should be cheaper than lower volume. However, purchasing in high volume does not mean company will gain benefits since company might face the excess inventory. Therefore, to purchase at an appropriate MOQ is a very important task for the company.

2.7) NCNR (Non cancellable, non returnable): NCNR is considered as important information since it's a contract between customer and supplier. NCNR represents item that unable to either cancel or return.

2.8) Shipping mode: Shipping method defines the details of shipping method of each item such as by air, by sea, and so on. This information must be allied with Inco term.

2.9) Delivery Term (Inco Term): This information demonstrates the term of shipping that company has agreed with each supplier. Delivery term affected to the overall cost of products significantly. For example, if supplier defines delivery term as ex-work means that material costs exclude shipping cost. Therefore, customer has to pay for the entire shipping cost.

2.10) Consolidated Demand: In CM business, demand information normally comes from customer. Fluctuation of demand has a direct impact on MPS to become less effective as well as difficult to optimize purchased price. For effectively supply chain management, company requires a system or a policy to manage demand in order to increase profitability, and gain more advantage on overall purchasing strategies.

2.2.2 Causes and Effects Diagram

The Ishikawa Diagram, causes and effects diagram, or fish bone diagram was established by Kaoru Ishikawa who is an expert in quality management, and it was first used in 1906. Currently, it is considered as one of seven tools for statistical process control (SPC) including the histogram, Pareto chart, check sheet, control chart, flowchart, and scatter diagram. The Ishikawa diagram is a simple fish bone picture illustrates possible causes which create a problem. Typically, causes in the diagram are often analyzed by adopting 4M, 8P or 4s:

4 M: 4M consists of Machine, Method, Materials, and Man. These criteria are suggested for manufacturing industry.

8 P: 8P consists of Price, Promotion, People, Processes, Place, Policies, Procedure, and Product. These criteria are recommended for administration and service industry.

4 S: The last criterion is 4S which consist of Surroundings, Suppliers, Systems, and Skills. It is typically recommended for service industry.

Table 2.1: Current Status Check Sheet

Consolidated Part List
Customer: AAA

No.	Part no.	Description	Supplier	Commodity	Consolidated demand	Plt	Moq	Std Cost	Rohs	NCNR	Possible to do locally	Delivery Term
1	40003550	SD BB TBuffer F 1.5x1.5x3 SM BlP	FUJIKURA ASIA LTD.	OPTICAL	1451	28	100	1.18	No	NO	No	Ex Work
2	40003642	SD Plug Tube Flash Tifi	AVANEX FRANCE S.A	MECHANICAL	2902	28	150	1.29	No	NO	Yes	FOB
3	550000204	Epoxi-Stycast 2057 + catalist 9	CHEMTEC INDUSTRIAL PRODUCTS CO.,LTD	SUBDIRECT	0.07255	14	1	0.045	Yes	NO	No	Door to Door
4	550001017	Loctite thread lock 270 conf. da 10ml	CHEMTEC INDUSTRIAL PRODUCTS CO.,LTD	SUBDIRECT	2.902	14	3	0.021	Yes	NO	No	Door to Door
5	550306201	THERMOP. RESINE STAYSTIK MONO COMP._	ESCO-THAI CO.,LTD	SUBDIRECT	4.353	14	2	0.04	Yes	NO	No	Door to Door
6	551004601	Wire 52In48Sn	DCE HOLNE (R&D) LIMITED	SUBDIRECT	145.1	28	1	0.06	Yes	NO	Yes	Ex Work
7	551010101	Etichetta neutra 76 x 25 Bar Code	LASER PRINTING (THAILAND) CO.,LTD.	SUBDIRECT	2902	14	100	2.7	Yes	NO	Yes	Door to Door
8	551041001	Etichetta neutra 76 x 25 (caution)	LASER PRINTING (THAILAND) CO.,LTD.	SUBDIRECT	2902	14	500	2.7	Yes	NO	Yes	Door to Door
9	551041301	THT B423 101mm x 90 mt Y391593	LAIRD TECHNOLOGIES (SEA) PTE LTD	SUBDIRECT	43.53	14	300	0.003	Yes	NO	Yes	Ex Work
10	561002101	Insert Box for ""FLASH"" PE FOAM	AVANEX FRANCE S.A	SUBDIRECT	1451	28	500	0.03	Yes	NO	Yes	FOB
11	561002701	INSERT BOX TOP CONDUCTIVE PE FOAM	AVANEX FRANCE S.A	SUBDIRECT	1451	14	500	0.64	Yes	NO	Yes	FOB
12	611003701	GPO MALE FLANGE MOUNT A001-N33-05	CORNING GILBERT INC.	OPTICAL	1451	28	500	4.75	Yes	YES	No	FOB
13	631130701	COVER F10 GOLD LID	Hi-Rel Lids Ltd	MECHANICAL	1451	28	500	2.7	No	NO	Yes	Ex Work
14	791047301	12.5Gb/s_MODULATOR CHIP FLASH LD MET	CORNING INC.	OPTICAL	1451	14	300	0.032	No	NO	No	FOB
15	400006280001	WINDOW, BULKHEAD, SC DUPLEX, BLACK	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	4507	21	100	24.1	No	No	Yes	Door to Door
16	400007460001	FACEPLATE, SMALL, BLACK, NO LOGO	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	4507	21	100	12.28	No	No	Yes	Door to Door
17	400007470001	BASEPLATE, SMALL, BLACK, 19in DCM RACK	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	4507	21	100	13.4	No	No	Yes	Door to Door
18	400007480001	COVER, SMALL, BLACK, 19in DCM RACK	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	4507	21	100	5.8	Yes	No	Yes	Door to Door
19	7590010042027	Pump, 974.5+/-0.5nm, 250mW, JDSU, 2700	JDS UNIPHASE CORPORATION	OPTICAL	2180	28	1000	389	No	YES	Yes	FOB
20	7590010043045	Pump, 980Nm, 450Mw	JDS UNIPHASE CORPORATION	OPTICAL	2090	42	10	610	No	YES	Yes	FOB
21	7590010090001	Photodiode, JDSU, C-Band	JDS UNIPHASE CORPORATION	OPTICAL	4360	42	100	35	No	YES	Yes	Ex Work
22	7590200010001	Standoff, M-F .156 Round #2-56 .236 Lg	BOSSARD (THAILAND) LTD.	HARDWARE	2090	21	1500	0.13	Yes	YES	Yes	Door to Door
23	7590210090001	LABEL, REMOVABLE, ESD WARNING	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1045	14	3000	0.11	Yes	NO	Yes	Door to Door
24	7872710150001	Ring, Fiber Management, Molded	LANNA LAMPHUN PRECISION LTD.	MECHANICAL	1045	21	3000	1.21	Yes	NO	Yes	FOB
25	75825521450001	Screw, Buthdcap #2-56X.156L Blkoxide Fin	COFFER INDUSTRIAL SUPPLIES	HARDWARE	6270	21	2000	0.31	No	YES	Yes	Door to Door
26	0+0347	Pump, Thermal Shim	HENKEL (THAILAND) LTD.	MECHANICAL	75388	30	1500	0.3468	No	NO	Yes	Ex Work
27	0+0364	Screw, 4-40 BSC x 1/4 SST	BOSSARD (THAILAND) LTD.	HARDWARE	21538	28	1	0.0112	Yes	YES	Yes	Door to Door
28	0+0784	Screw, 2-56 X 1/8 Bsc, Ss	HARDWARE SPECILATY CO.,INC	HARDWARE	248938	30	1000	0.02	Yes	NO	Yes	FOB
29	0+0907	Label, Dcm 4 X 1.75 Zebra (3000/Roll)	ADAMPAK (THAILAND) LTD.	SUBDIRECT	8682	14	1000	0.0284	Yes	NO	Yes	FOB
30	0+0962	Lc Dust Caps - H-132 - Wadm	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	56796	28	1	0.06	No	NO	Yes	Ex Work
31	0+1061	Jumper, Fc/Upc Measurement, 900 Micron	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	5804	21	1	17.36	No	No	Yes	Ex Work
32	0+1097	Lc Bulkhead Cleaner	AVANEX CORPORATION-AEP	SUBDIRECT	2902	21	50	152	No	NO	Yes	Ex Work
33	0+1178	Pump, 1487nm, 150mW	FURUKAWA AMERICA, INC.	OPTICAL	10769	42	20	14.85	No	No	Yes	FOB
34	0+1204	FOAM, COMPONENT, MOSAIC	FOAMEX ASIA CO.,LTD	SUBDIRECT	427406	14	10000	0.1	Yes	NO	Yes	Door to Door
35	0+1218	1465/1487 Pump Combiner	AVANEX CORPORATION-AEP	OPTICAL	10769	42	20	27.5	No	NO	Yes	Ex Work
36	0+1227	Cover, Eeprom Connector	UNITED PRECISION	MECHANICAL	8682	28	3000	1.88	Yes	YES	Yes	FOB
37	0+1290	Bag, Static Shield Esd 6X8	SPECIALTY TECH CORPORATION LIMITED	SUBDIRECT	4341	21	4500	0.1739	Yes	NO	Yes	FOB
38	0+1292	SCREW, 2-56x3/16, FLAT SOCKETHEAD, ALLOY STEEL, BLACK	COFFER INDUSTRIAL SUPPLIES	HARDWARE	30387	28	1000	0.0527	Yes	YES	Yes	Ex Work
39	0+1382	Wdm, 980/1550 P-C	AOFR PTY LIMITED	OPTICAL	21538	21	10	36	Yes	No	Yes	Ex Work
40	0+1493	Plate, Coil Top	EAGLE METALCRAFT., INC.	MECHANICAL	4341	21	100	3.25	No	NO	Yes	Ex Work
41	0+1495	Spacer, Coil	RIMCO PLASTICS CORP.	MECHANICAL	4341	28	100	0.07	Yes	NO	Yes	Ex Work
42	0+1720	SPLICE PROTECTOR,MINI HEAT SH	AVANEX CORPORATION-AFM	MECHANICAL	9014	28	1	0.4	No	No	Yes	Ex Work
43	0+1959	Label, Void (Tamper Resistant)	ADAMPAK (THAILAND) LTD.	SUBDIRECT	34360	14	5000	0.1702	Yes	NO	Yes	FOB
44	0+1984	Screw, M2.5X8 Phh,Flthd Ss W/Lock Patch	BOSSARD (THAILAND) LTD.	MECHANICAL	4784	14	1000	0.08	Yes	No	Yes	Door to Door
45	0+1986	Screw, M 2X6, Shcs, Ss W/ Locking Patch	BOSSARD (THAILAND) LTD.	MECHANICAL	2392	14	1000	0.03	Yes	No	Yes	Door to Door
46	0+1989	Screw, M3X6 Phh-Flthd Ss W/Lock Patch	PENINSULA COMPONENTS, INC. (SINGAPORE BRACH)	HARDWARE	70828	14	1000	0.0085	No	NO	Yes	FOB
47	0+2073	15dB C-Band 1x1	AVANEX CORPORATION-AEP	OPTICAL	4341	21	1	274.91	No	NO	No	Ex Work
48	0+2078	Label, Dcm In Process	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	7176	21	1500	0.27	Yes	YES	Yes	CIF Bangkok

Beside the suggested criteria above, it can also apply another criterion for problem analyzing purpose. Currently, there are numerous companies using this tool due to it helps to indicate possible causes in process. Moreover, it's easy to understand. It can be used as a tool to create failure mode, error analysis as well as encourage people to work synergically. Below figure is Ishikawa Diagram for problem analysis of cased studied company:

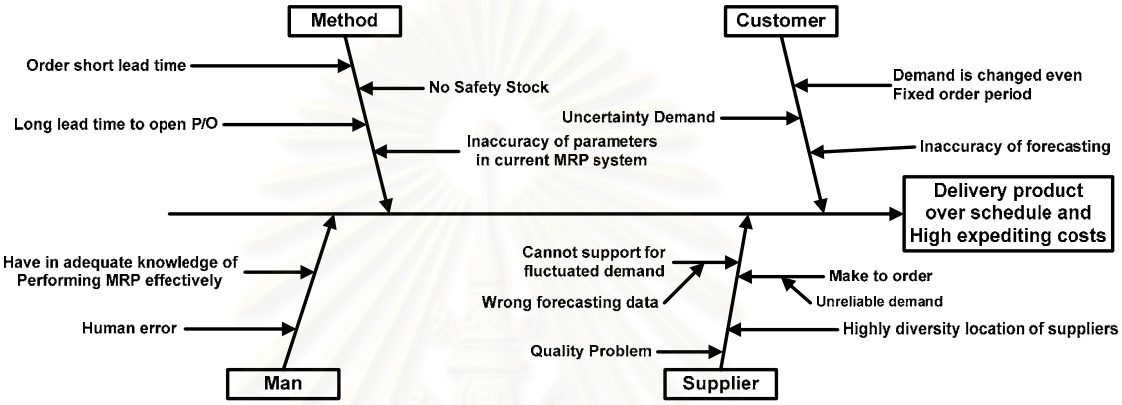


Figure 2.5: Fish Bone Diagram

1. Causes and effects summary

According to the fish bone diagram above, main causes of problem can be divided into 4 categories: supplier, customer, man, and method.

1.1) Supplier: This is one significant factor that affects availability of material. According to the fish bone diagram above, there are various causes which influence main problem.

- Cannot support the fluctuated demand: Demand fluctuation is the obstacle to create effective production plan. Typically, supplier plans production based on company purchasing order. After that supplier will confirm delivery schedule back to company. However, once demand is changed by the company, supplier has to adjust production plan to support the change of demand. Consequently, supplier is unable to cope with the change and as a result it directly

impacts on delivery schedule. In order to have material available as plan, company must pay an expediting cost.

- Make to order: Typically, make to order is the technique which assists company to reduce inventory as well as increase customization capability. However, this technique is not appropriate for all types of products and businesses particularly the case studied company due to a long lead time of production.

- Quality problem: Quality problem is considered as one factor that creates longer lead time of materials due to long lead time in rework process and reproduction. Nevertheless, quality problem is not a key concern point.

- Various locations of suppliers: According to the business of case studied company, they do not have their own product but produce according to the customer design. Initial stage of transferring product, client typically transfer entire equipments, machines, stocks including all significant information such as supplier database to case studied company. Therefore, existing suppliers are mostly located in the same country as customer such as France, USA, and so on. The diversity is not only location but also time difference. So, this creates the problem to case studied company especially on contacting with supplier and controlling delivery schedule.

1.2) Customer: Information from client is the most important thing which affects master production schedule and MRP system of case studied company.

- Uncertainty of demand: As mentioned, case studied company receives the demand from clients on monthly and quarterly basis, then creates MPS and runs MRP. Due to the change of demand, it absolutely affects to MRP system and material purchasing process. Historical data shows that uncertainty demand creates part supply shortage particularly the shortage which occurs within the short term of the planning horizon.

- Demand is changed even fixed order period: Currently, MRP runs in every Friday by using demand from fixed order. Fixed order is a demand confirmation from customer to purchase the products. Once MRP runs completely, purchasing order (PO) will be sent to supplier and part will be produced according to supplier's production lead time. After completion, material will be delivered to company correspondence to purchasing lead time. However, during this period, customer still send demand adjustment to case studied company. Therefore, planner has to revise demand in the system in order to re-run MRP and resend revise part requirement to suppliers. Obviously, the change of demand during fixed order period generates the shortage of materials particularly when changed demand is dramatic higher than original demand.

- Inaccurate Forecast: Forecasting is the process to predict future demand by analyzing historical data, current activity levels, and planning assumption. Obviously, precise forecast assists case studied company on preparing material and managing inventory level. However, inaccuracy of forecast also creates problem to case studied company particularly for long purchasing lead time component. By the way, forecast is usually generated by customer. Therefore, any change has to be defined by customer.

1.3) Man: In reality, man is the key factor to drive the company. Thus, any error causing by man will definitely affect delivery of product and incur material expediting costs.

- Have inadequate knowledge of performing MRP effectively: Man or workforce is an element that drives the system either efficiency or inefficiency. Some positions are required specialist to implement the system such as planner. As mentioned prior, planner's responsibility is to create MPS and MRP for case studied company. If the planner has inadequate knowledge, then MPS and MRP cannot be performed effectively.

- Human error: Typically, this is an intangible problem that might occur any time. Human error might cause the delay of product delivery and incur of expediting cost, although company has a good supply management system.

1.4) Method: Currently, there are various methods which impact on material lead time and products. The key main problems are illustrated below.

- Short lead time ordering: This is a main problem that company is now facing. This problem was created by many factors. According to the study of case studied company, we found that adjustment of demand during fixed order period is the major cause of problem. Furthermore, company does not have forecasting system. Thus, they cannot predict feasible demand in each period of time.

- No Safety Stock: Zero inventory is the ultimate concept that every company are desired including case studied company, but sometimes safety stock is needed particularly for item that has long purchasing lead time. Safety stock facilitates company to reduce lead time of ordering and manufacturing as well as guarantee availability of material. Nevertheless, inventory means expenditure so once company decides to keep inventory, they must make sure that it is worth to do.

- Long lead time to open purchasing order (PO): According to the study of case studied company, entire PO must go through approval process by purchasing manager. Average lead time for approval is approximately two to three days. Apparently, long lead time of issuing PO impinges on delivery lead time of material. The current flow is shown in figure 2.6.

- Inaccuracy of Parameters in current MRP system: This problem is the biggest problem that company has to elaborately investigate in details. Currently, some of parameters are inaccuracy such as Production yield, material lead time, and so on. However, once analyze the whole parameters, the parameter that affect directly to the lead time of products are manufacturing yield, material lead time, production lead time, and capacity. The parameters which are applied in current system are demonstrated below:

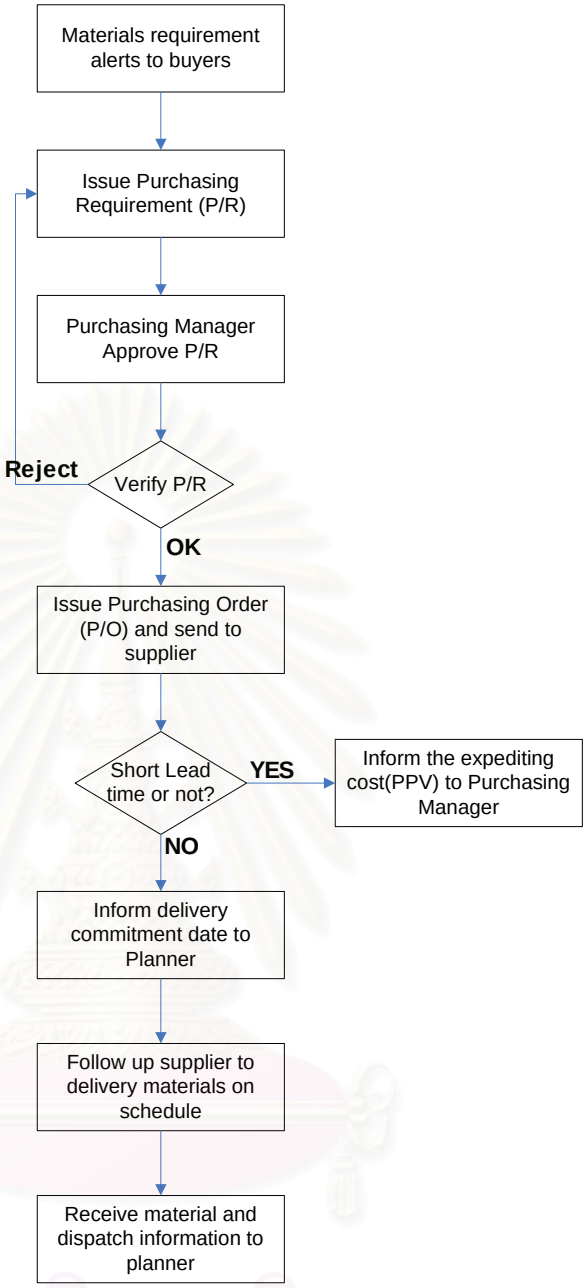


Figure 2.6: Issuing Purchasing Order Flow Chart

Table 2.2: MRP Parameters

Parameter Name	Set in system
Manufacturing Yield	95% of all products
Material Lead time	30 days
Production lead time	7 days
Capacity	According to product

Apparently, these parameters affect directly to entire elements of MRP system such as MPS and capacity planning. These are the causes of shortage and delay of materials delivery.

2.2.3 Supply Chain Workflow Analysis

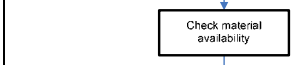
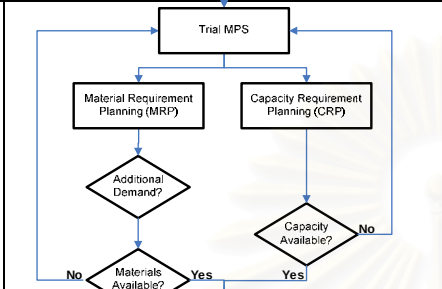
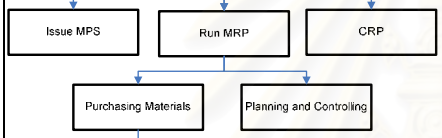
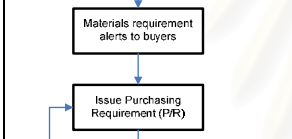
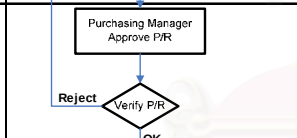
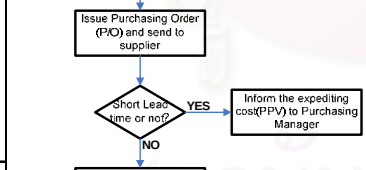
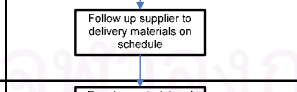
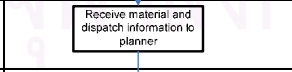
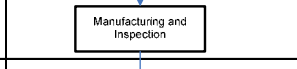
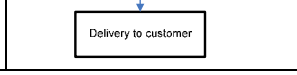
1. Study current supply chain workflow

In order to effectively analyze the problem, factor that cannot be ignored is workflow evaluation since it comprises of all activities from receiving purchasing order from customer until delivery products to customer. This flow is called “Supply Chain Workflow”. Workflow analysis means observation of how this process takes place. The analysis also involves evaluating the process and improving the workflow in order to gain efficiency and effectiveness. The current supply chain workflow of company is demonstrated in table 2.3.

According to the table, it comprises of 12 significant processes and accumulated lead time is approximately 19 days including supplier lead time and production lead time which is product dependency.

Table 2.3: Supply Chain Workflow Chart

Supply Chain Workflow Chart

Step	Work Flow	Process	Lead time	Task	Responsibility
1		Receiving demand and forecasting from customer	2 Days	- Receive demand and order from customer.	Program Coordinator
2		Check Availability of material		- Verify the material availability status for using in generating MPS	Planner
3		Master Production Schedule Trial	2 Days (Running in every Friday)	- Trial MPS - Generating MPS, MRP and CRP. - Checking Capacity	Planner
4		Generating MPS, MRP, and CRP			
5		Creating purchasing requirement	1 Day	- Issue P/R and send to PUR MGR for approval.	Buyer
6		Approve Purchasing requirement	2-3 Days	- Approving P/R	Purchasing Manager
7		Send purchasing order to suppliers	3 Days	- Issue P/O and send to suppliers - Inform expediting cost if happened. - Inform delivery date to planner	Buyer
8		Inform delivery commitment to planner			
9		Follow up supplier to delivery material	Corresponding to supplier lead time.	- Follow up supplier to send the material on schedule.	Buyer
10		Receiving material and incoming inspection	2 Days	- Receive material and keep them in warehouse	Buyer Incoming Quality Team
11		Manufacturing and Inspection	Corresponding to manufacturing lead time of each product.	- Manufacture product - Final inspection.	Production Engineering, Quality Assurance engineering
12		Delivery product to customer	3-5 Days (By Air)	- Packing as standard pack - Contact frieght forwarder to send product to customer	Traffic Team

Step 1 Receive demand from customer: Demand is usually send to case studied company by customer with two weeks of confirmed order. Demand

granularity is in monthly and yearly. Program coordinator is responsible to receive these order from customer.

Step 2 Check availability of material: Once the order sent to planner, planner then verifies the availability of material in stock in order to understand number of material that company has to order from supplier.

Step 3 Master Production Schedule Trial: In this stage, MPS will be generated for feasibility study by using MRP and CRP. If these schedules are feasible, MPS can now be implemented. However, if the MRP and CRP result are unable to match with MPS, MPS is required to be modified.

Step 4 Generating MPS, MRP, and CRP: The MPS, MRP, and CRP are generated in this step. MRP operating by using computer programming to generate new part requirements which usually are computed by following formula

$$\text{Net Requirements} = \begin{matrix}\text{Gross}\\ \text{Requirement}\end{matrix} - \left[\begin{matrix}\text{Inventory}\\ \text{on hand}\end{matrix} - \text{Safety Stock} - \begin{matrix}\text{Inventory allocated}\\ \text{to other uses.}\end{matrix} \right]$$

CRP is developed since initial stage of MPS. CRP utilizes planned order from MRP result and assigns work order to work centers according to routing plan. Then, capacity load data is converted by adopting all parameters such as labor, machine, and etc. Routing plan is the sequence of production processes which are required for each work order. Consequently, if there is sufficient capacity, MPS will be approved for implementation.

Step 5 Creating purchasing requirement: MRP alerts buyer to create Purchasing Requirement (PR). After that, entire PR must be sent to purchasing manager for approval before issuing purchasing order to supplier.

Step 6 Approve purchasing requirement: PR is verified by purchasing manager and if there is any rejection in approval process, PR will be returned to creator in order to modify and re-issue PR again. Once PR is approved, official PO will automatically create and submit to supplier.

Step 7 Send purchasing order to supplier: PO will be send to supplier by either email or fax. Lead time for this step is generally based on assigned lead time in system; however, case studied company is required to confirm actual delivery date from supplier in order to comprehend actual lead time and expediting cost if any. By the way, supplier should realize that actual lead time has to be synchronized with defined lead time in quotation.

Step 8 Inform delivery commitments to planner: The delivery commitments of every item have to be recapitulated and notified to planner. If there is any item that cannot be delivered as supplier lead time, production plan has to be adjusted. Typically, suppliers must deliver the materials according to lead time in the system.

Step 9 Follow up with supplier to delivery material according to schedule: In order to assure that materials will be available on time, buyer has to follow up the supplier to submit the material on committed schedule.

Step 10 Receiving materials and incoming inspection: Prior to receiving material from supplier, incoming inspection team must inspect material according to the drawing and inspection procedure. Once material passed incoming inspection, it will be kept in warehouse.

Step 11 Manufacturing and inspection: Material will be called into the production line once work order released. In order to guarantee that the defect product will not be delivered to customer, quality assurance engineering team must inspect product according to the quality inspection standard.

Step12 Delivery to customer: After product dispatches from production line, product will be packed according to packing procedure; controlled moisture by silica gel, and attached sticker corresponded to packaging standard. Typically, product is delivered to client by air which takes around three to five days depends on regional.

2. Supply Chain Workflow Examination

Once diagnose the entire process through out the supply chain, there are four significant steps which lead time can be decreased; step 6, step 7, step 9 and step 11.

Step 6 Approve purchasing requirement: Regarding to the supply chain workflow chart, it currently takes approximately two to three days which are quite long. Refer to cause analysis; it is obvious that long lead time came from the error of manager. Therefore, lead time reduction can be done for this step.

Step 7 Send purchasing order to suppliers: As mentioned earlier, total purchasing lead time comprises of three elements: Pre-purchasing L/T, Purchasing L/T, and Post-purchasing L/T. According to analysis, it is obvious that the pre purchasing lead time can be decreased. Pre-purchasing lead time takes around three days which is quite long since this PO can be generated within one day. Thus new lead time can be demonstrated as figure 2.7:

Before: Accumulated Lead time: 5 days + Supplier lead time

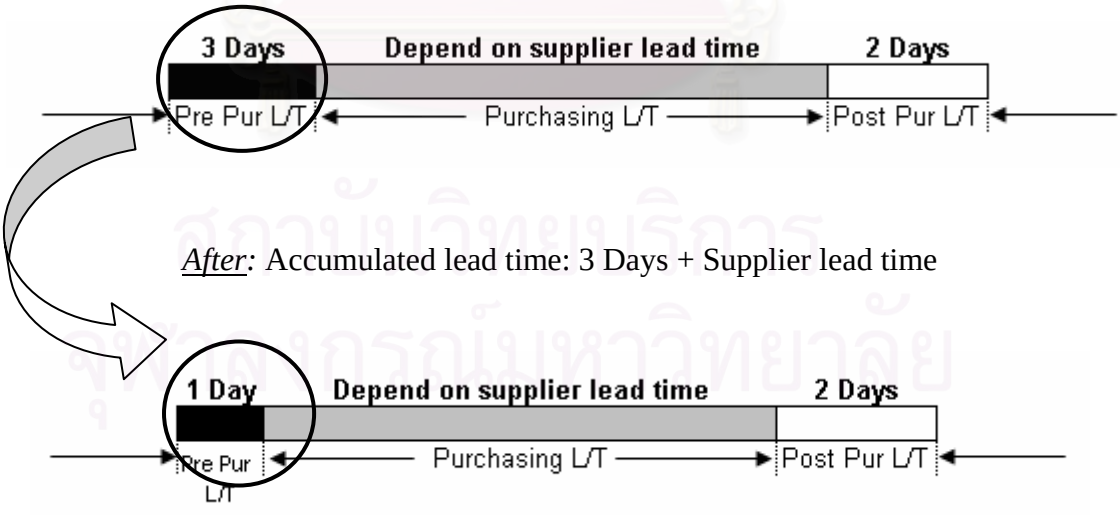


Figure 2.7: The Reduction of Total Purchasing Lead Time

In order to assure that pre-purchasing lead time is reduced, purchasing manager was assigned to monitor and manage buyer to issue PO within one day.

Step 9 Follow up with supplier to delivery material according to schedule: Lead time of this step is dynamic because it relies on the lead time from supplier; produce part and delivery to company. In order to reduce lead time in this step, it is required effective methodology.

Step 11 Manufacturing and inspection: Solution that can be applied to reduce lead time of this step is lean manufacturing concept.

In conclusion, there are four potential steps that have high possibility to reduce lead time. However, lead time of step seven can only be reduced in this chapter. The remaining step will be elaborately study in the chapter four.

CHAPTER 3

THEORETICAL CONSIDERATION AND LITERATURE REVIEW

3.1 THEORETICAL CONSIDERATION

3.1.1 Supply Management

During of World wall I and II, most of companies concentrated on the purchasing function primarily as a critical activity. Entire firms faced problem about the ability to obtain material from suppliers, supplies, and services effectively. Moreover, as the decade of the 70s, all organizations encountered with material shortage problem particularly basic raw materials, as well as dramatically increasing of raw material pricing. Consequently, company emphasized on improving supply ability and worked with suppliers in order to obtain a realistic pricing. Moving to the next decade, supply management became to be a strategic business process. Doubler and Burt (1996) identified the supply management as a process which was responsible for development and management of a supply system for a firm in both, internal and external, areas.

1. Objective of Supply Management: The typical objective of supply management has been stated that company should acquire the right materials (material must achieve defined quality standard), in the right quantity, for delivery in the right time and place. However, Leenders and Featon have identified the objective of supply management in nine basic objectives as details below:

1.1) To support operation without any interrupt flow of materials and services: This is a general basic of supply management concept since the material must be available when operation is required by facilitating coordination and managing of the supply activity.

1.2) To gain more bargaining power: In current decade, pricing is becoming a significant factor to gain more advantage than other rivals. The supply management concept sustains company to purchase material in the competitive price by understanding of supplier's cost structure.

1.3) To manage inventory: In order to insure availability of material, inventory might be required, but inventory assets require use of capital which inventory carrying cost is approximately 20 to 50 percent of the purchasing value. Therefore, company must concentrate on inventory level and keep only the necessary items.

1.4) To maintain and enhance quality level: The quality of product is the one of significant criteria for business nowadays due to it affects with the attitude to clients decision to purchase products or services. Typically, the quality of products and services are not defined or determined by the manufacturing companies but it is determined by customers, thus it can say that quality is the requirement of customers. *"Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs"* said Dr. Deming. The quality must be improved at the initial state of life cycle (design state) and continuous improvement, CI, until end of life of product. Company should concentrate not only end product, but also material which is delivered from supplier. Moreover, CI includes selection and allocation people as well. Education is the one that management can not ignore to encourage employee due to it is able to escalate the quality level. In order to effectively improve, management must be responsible and get involve in leading and encouraging the employee to participate improvement within organization. Therefore, quality and productivity are continually improved and permanently while costs are decreased.

1.5) To select and develop relationship with competent suppliers: Developing a relationship with supplier is a significant part for business nowadays since none of company can do everything by themselves. Each company must help each other. However, company must select only appropriate suppliers and then working with those suppliers to attain continuous process improvement. There are a lot of benefits from this strategy such as low material cost, good quality, flexibility,

and so on. The concept of competent supplier or strategic supplier can help organization to (Chadwick, Rajagopal, 1995):

- Achieve world class quality standard
- Reduce lead times and increase flexibility for supporting fluctuation market.
- Diminish inventory and administration cost
- Improving planning system
- Reduce downtime of production line and increase capacity
- Reduce time to market
- Reduce risk of purchasing

1.6) Standardization: Within an organization, there are various components that are used for assembling process. If purchasing enables purchase a material for one item to do the job that two or three diverse item, company may gain more advantages to negotiate with supplier in term of pricing and delivery. Furthermore inventory cost can be reduced without lower service level.

1.7) To enhance competitive position of organization in the market: Nowadays, the key criterion that company can gain more advantage than competitors is efficiency of supply chain management such as pricing, on time delivery, inventory, and non value added activity reduction.

1.8) To develop cross functional relationship: Nowadays business rapidly changed, every firms attempt to move follow dynamic market. The traditional team is unable to response market or customer needs particularly time and quality which have become key competitive elements in every business because it distinguishes from the traditional team in functional diversity, competing identities, integration in the organizational structure, and performance expectation. Company currently does not have time for error due to they have to compete with rivals for acquiring more market share for their products and services. Therefore, company attempts to move toward from the traditional to Cross functional team. Cross functional team l team is a team

which composed of members at least 3 members from diverse functional job working together as a team, and has a common purpose (figure 3.1).

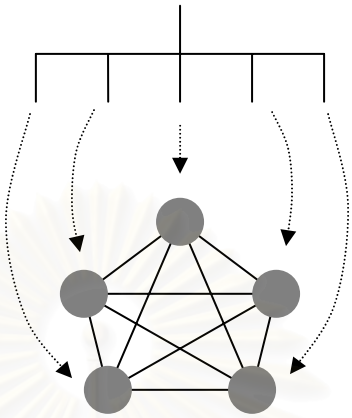


Figure 3.1: Cross Functional Team

Using cross functional team is a great benefit to organizations particularly working with complexity job which require expertise from a number of different members. Owing to the figure above, it illustrated that every department is working as a network which is required any supporting each other since operating MRP, sending PO, receiving material until making payment to supplier. These activities are required cooperation from entire member in cross functional team in order to have the material to support production on schedule, no of bad quality of material, and making payment to supplier on time.

1.9) To diminish administrative costs of purchasing department: Administrative cost is a cost which is ensue from operating of purchasing department such as salaries, telephone call, travel costs, computer costs, and other overhead cost. These are intangible cost which is hard to control unless have an appropriate or efficient procedure. The company must concentrate on these costs and adopt a proper method for continuous improvement. For example, purchasing paper work must be eliminate and replace by computer software or electronic data interchange (EDI).

3.1.2 Sourcing Strategy

Sourcing is often used for discussion in purchasing activity. Currently, various companies are determined strategic sourcing to be a plan of developing company's business. Strategic sourcing is the method which encourages company to find the highest value, service as well as the lowest of total cost of ownership; meanwhile enables convince availability of materials and services in order to achieve customer satisfaction mostly. Typically, strategic sourcing takes the process further, focusing on developing channels of supply at the lowest total cost to an organization in order to increase revenue and profit. There are three key principles which are involve with sourcing namely total cost of ownership (TCO), fact-based negotiation, and supplier relationship management (SRM). (Gattorna, 2003)

1. Total cost of ownership: Total Cost of Ownership, TCO, is an approximately financial which help company to manage costs. Basically, it does not relate only the cost of purchasing, but also manufacturing cost, and non manufacturing cost (Hines, 2004). TCO consists of a key element which is called total acquisition cost, TAC. TAC is a sum of all costs which occurs from initial design concept to production and delivery to clients. In Supply Chain Management, TAC is applied as a tool for analysis the costs for either purchasing material or finished product. The main objectives of TAC are to identify, eliminate all non value added activities in supply chain which is estimated around 40 percent of all cost, and concentrate in opportunities to reduce cost by analyzing in cost driver and source of waste. Basically, the TAC can be separated for analyzing into two groups: Part Purchase Price, and Internal Acquisition Cost.

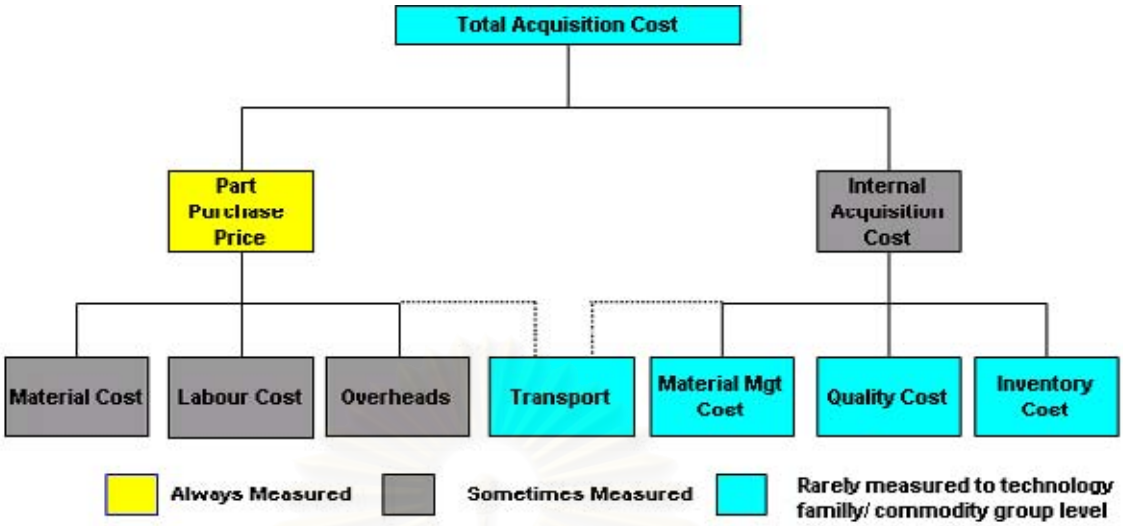


Figure 3.2: Total Acquisition Cost

Initially, we must understand the meaning of TAC. Total Acquisition Cost is a sum of all costs which occurs from initial design concept to production and delivery to clients. The typically elements of TAC consist of a lot of costs which mentioned in figure 3.2. In Supply Chain Management, TAC is applied as a tool for analysis the costs for either purchasing material or finished product. The main objectives of TAC are to identify, eliminate all non value added activities in supply chain which is estimated around 40 percent of all cost, and concentrate in opportunities to reduce cost by analyzing in cost driver and source of waste. Basically, the TAC can be separated for analyzing into two groups: Part Purchase Price, and Internal Acquisition Cost.

1.1) Part Purchase Price**:** This is an invoice price which company pays for materials, services, and products. The part price usually includes material costs, labor costs, overhead costs and transportation costs. Theses costs, which include in invoice, depend on negotiation prior agreed the prices. Negotiation is a process of formal communication for the specific purpose, and it is a vital skill for purchaser. The effective negotiation encourages organization to purchase the product with the cheapest price in a good quality. The three elements, material costs, labor cost, and overhead costs, are variable cost which change proportionally with activities of production. Furthermore, these are dynamic costs and affected by surrounding

situation. Particularly, the oil price which is a major concern and directly affect to the entire costs. Consequently, part purchase price is the cost that company can not ignore to measure frequently.

1.2) Internal Acquisition Cost: It is the costs that occur within organization in term of payment for manufacturing activities. The trend of manufacturing is increasing continually. The internal acquisition comprises of material management costs, quality costs, inventory costs, and transportation costs. Quality is the factors that company can not ignore in order to compete with other competitor and enhance the reliability of product. The cost of quality is not only obtaining quality cost, but also the cost incurred from lack of quality and company must hold many stock as a safety stock so that incurs inventory cost. Inventory is a major asset of company which needs the effective method to control. Just in time, JIT, is the one technique which is applied for inventory management. JIT principle is the concept of available material coming when company needs in the production process (Weele, 2000). Material management cost ties up on the number of suppliers, thus this cost can control by supplier limitation which coincide with supply chain management principle.

2. Cost Driver: Cost Driver is a factor which creates activity's cost of products or services. Therefore, understanding costs driver is vital for organization to reduce the product costs. A lot of companies have attempted to reduce the costs by cut off any activities that might create any cost. For example, production manager wants to reduce production costs by having no improvement in activities related costs such as utility equipments, developing labor skills. Consequently, the production can not reduce the costs meanwhile the quality problem might be happened in the future due to reduce operation cycle time. Typically, quality is a major concern of company, thus cost reduction might affect with the quality of product. Therefore, costs reduction must be considered only the activity that does not impede with the efficiency of product. Within organization, purchasing is the department that involves with cost driver mostly. Weele (2000) provided an interested framework which might be helpful for purchaser to identify the important cost driver in table below.

Table 3.1: Cost Driver

Category	*Description*	*Cost Driver*
Design	Costs Attributable to product design trade-offs	Material Specification Product line complexity
Facility	Costs relate to the size of the facility, equipment and process technology employed	Facility Scale Degree of vertical integration Use of automation
Geography	Costs associated with the location of the facility relative to the customer	Location related wage rate difference Transportation costs if customer
Operations	Costs the differentiate a well run facility from a poorly run facility	Labor productivity Facility utilization Rejection rates

Source: Arjan J Van Weele, Purchasing and Supply Chain Management, 2000.

Once company can identify the cost drivers, they can be analyzed to discover the possibility causes which create high cost of product. Consequently, company can reduce or cut unnecessary costs, thus the profits will be escalated while effectiveness of organization does not change.

3. Fact-based negotiation: In order to succeed in strategic sourcing, it should rely on the ability to undertake fact-based negotiations. The fact based negotiation insists company to achieve a win-win outcome rather than win-lose result of relationship between buyer and supplier. The team should apply various information to assess supplier such as industrial report, reject history report, delivery performance report, and so on as well as concentrate on TCO rather than material price. The team must define the number of suppliers, the requirement. Communication between company and supplier is necessary; supplier should understand entire company requirements clearly. Therefore, once supplier is selected, the future problem will be reduced and can work smoothly. Performance appraisal is required on a quarterly basis in order to ensure that supplier enables maintain their performance as company's requirement and standard.

4. Supplier relationship management (SRM): Currently, SRM becomes to be criterion of a world-class company. SRM is establishment of long term relationship between supplier and buyer to develop overall performance and decrease total cost of supply chain. The SRM encourages supplier to invest in research and development in

order to improve technology, cost effectiveness, and high quality solution to the partner company. Typically, the method to implement SRM consists of three phases namely

4.1) Identify the targets of cost saving

4.2) Develop a detail of the relevance performance from bottom-up view.

4.3) Supplier and company have to validate and prioritize the areas which are able to encourage both parties to achieve the intended outcomes.

3.1.3 Material Requirement Planning (MRP)

Material requirement planning or MRP is a system which is used for controlling the demand of both dependent and independent demand. MRP is being used increasingly as manufacturing tool to reduce inventory level while increase profits, and increase production capacity. MRP is a computer based program which applied the demand of top level and explode into the required amount of components, raw material, subassemblies, and assemblies needed in each week of planning horizon. Primary profit of MRP is to encourage company to accommodate ordering strategies for both kinds of parts as independent and dependent profiles.

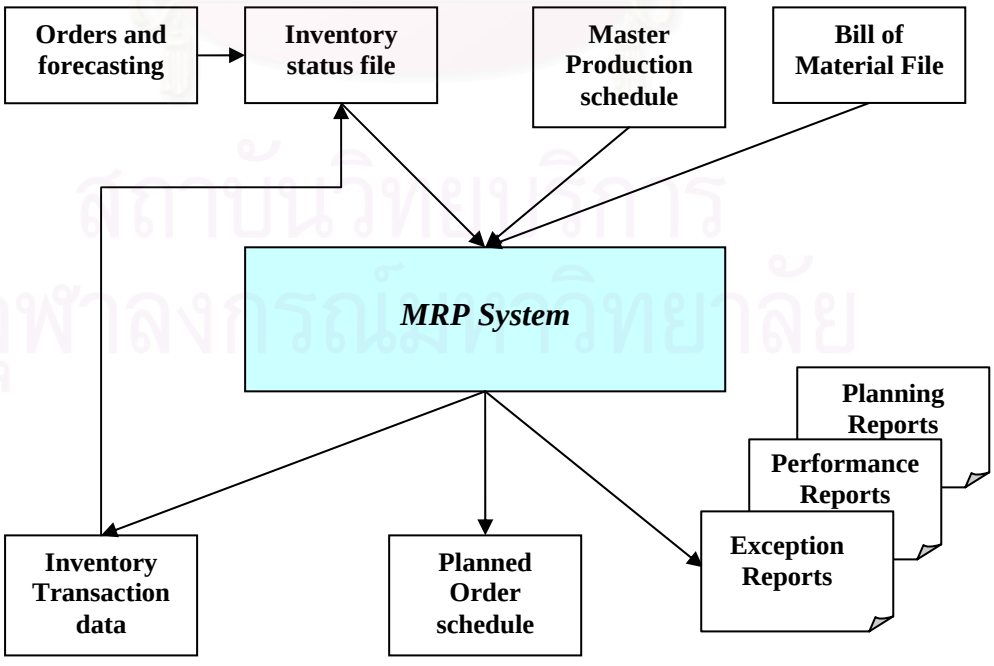


Figure 3.3: MRP System

The main objectives of MRP are to reduce inventory, to improve customer service level, to develop a schedule of purchasing material, and to improve plant operating competency. Before commencing to create MRP, every company should understand the essential information which is required for MRP:

1. The master production schedule (MPS): Production planning is the important part of planning and the significant tool that encourages effectiveness of production planning is Master Production Planning or MPS. MPS is able to interpret how efficiency of business plan, forecasting, and production planning for company. Typically, MPS is a short-range plan of production planning horizon, and it normally uses for driving production planning and control system. MPS is required necessary information such as weekly forecast, demand of finished goods, Customer's order; initial on hand quantity, back log, shipment schedule, and weekly lot size. Company enables to generate the good MPS by calculating from the initial OHQ and customer's order or forecast, and then planner will plan production quantity in each period that coincides with demand. Moreover, MPS encourages company to balance and consolidate the requirement and trend of marketing, finance, and all customers' requirement.

1.1) The objective of MPS: Gaither and Frazier (2002) mentioned about the objectives of MPS in two significant points

- To schedule end items to be completed promptly accordance of confirmed to clients
- To reduce over capacity or under capacity of production, consequently production capacity is efficiently utilized as well as cost of production is decreased.

Table 3.2: The MPS of 307030002

Bom No.	***Description***	***Jan'06***		***Feb'06***				***March'06***	
		Wk3	***Wk4***	***Wk1***	***Wk2***	***Wk3***	***Wk4***	***Wk1***	***Wk2***
307030002	Demand	*50*	*60*	*52*	*93*	*75*	*0*	*90*	*65*
	Production	60	60	60	75	75	60	60	35
	Inventory	10	10	18	0	0	60	30	0

1.2) Time fence in MPS: Typically, the MPS can be divided into four significant areas, and each area is determined by point of time which is called “Time Fence”. The four areas consist of frozen, firm, full, and open.

- Frozen: It means that the information of MPS in this area is prohibited except receive official authorization from top management levels. Changing in this area will affect to the performance of material planning, purchasing as well as production plan due to it would be costly and complicated. Furthermore, whenever MPS is changed, some item might have to pay a special charge which will affect to high product cost.
- Firm: Firm is an area that company can adjust any changing into MPS for only has endorsement from management, but it does not recommend to do so with the same reason as frozen.
- Full: It means all the available production capacity has been allocated to purchasing orders
- Open: it is an area that enables to receive new order from customer.

1.3) Type of MPS in industry: Typically, type of MPS can be divided into two types namely produce to stock and produce to order production system. Product to stock system is production by based on the demand forecasting from clients. Forecasting is the most important part which should precise in order to create MPS accurately. Obviously, this system is required a solid plan of demand management as well as the effective delivery plan, otherwise company might be suffered with liability problem. The ordering lot size of this product to stock system can not be fixed since it depends on the characteristic of product and demand. An appropriate ordering lot size is to balance between cost of material and product in determining economic lot size.

In produce to order system, customers’ current demand is focused more than the demand forecasting. The MPS is generated from a backlog of customer orders which are used for open production slots. The lot size of this system usually relies on demand, for example if customer’s demand is 500, company will produce 500 too. Hence, the appropriate lot sizing technique is lot for lot (LFL).

2. The inventory status of each item: An accuracy of inventory facilitates company to create MPS more effectiveness as well as enhance the efficiency of replenishment system. Moreover, the less of inventory information error is able to increase the accuracy of MRP, thus the inventory can be reduced.

3. Forecasting: Forecasting is to predict possibility of future demand by analysis from historical data, current activity levels, and planning assumption. The basic of forecasting can be classified into 2 Techniques as qualitative techniques and quantitative techniques.

3.1) Qualitative Technique: The qualitative technique is the forecasting method that is based on opinions of either experts or management view. It is very flexible and can be adopted in a wide range of circumstances. Typically, the qualitative technique uses for the new product which have historical demand, so this method is not reliability.

3.2) Quantitative of technique: Quantitative of technique is adopted a statistical to forecast the demand. The statistical forecasting has been developed radically. The area of forecasting provides techniques that range in level of complexity, difficulty of use, understanding required, as well as accuracy provided. This method sustains the company to enhance organization performance. However, appropriate implementing and managing the forecasting process is often met with plentiful barriers and problems. There are six problems that company usually encounters to (Sanders, 1995): Resistance to changed, Lack of forecast credibility, Forecast bias, Lack of recent improvements in forecasting, Lack of a base on which to build, and Lack of organizational support. Moreover, Sanders has proposed the solution strategies to solve each problem in figure 3.4.

4. Entire relevance bills of materials (BOMs): Bom is a list of materials or components which are required to produce in one unit of complete product. Typically, the items within Bom are dependent items, and the product can not be completed unless have all the item in Bom, thus Bom is an important component of MRP in order to purchase material correctly.

Organizational forecasting problems	Solution strategies
Resistance to change	Pre-emptive organizational resistance training
Lack of forecast credibility	Highlight effective utilization
Forecast bias	Changing rewards and incentives evaluation
Lack of recent improvements in forecasting	Counteracting inertia
Lack of a base on which to build	Counteracting inertia
Lack of organizational support	Develop co-operative strategies

Figure 3.4: Identified Organizational Problems and Associated Solution Strategies

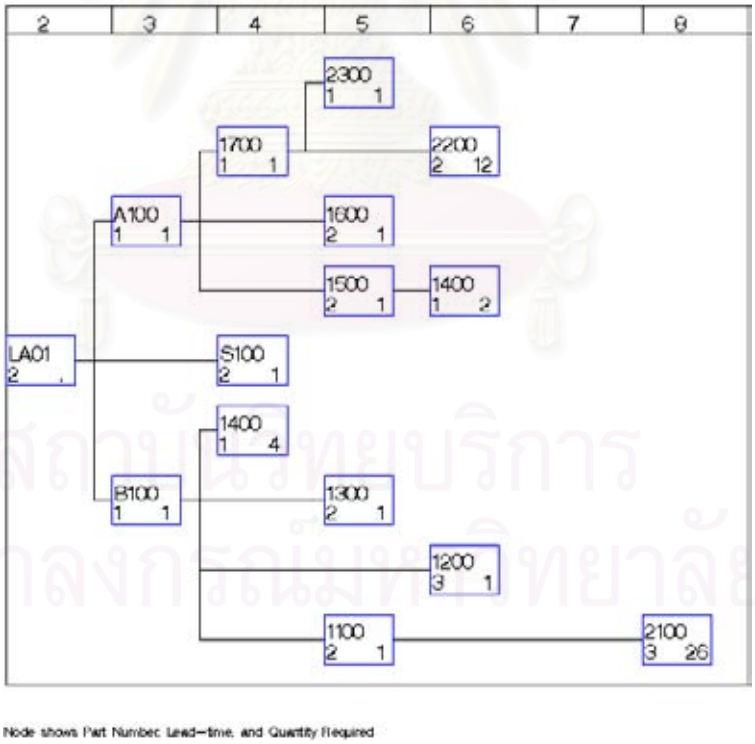


Figure 3.5: Example of Multilevel Bill of Material with Lead Time Offset

5. Effective capacity planning (CRP): CRP is a production capacity of each product which company can product within one period of time by a given or proposed master production schedule. The CRP can be divided into two stages as rough cut capacity check stage and uploading information to material planning stage. In the first stage, it encourages company to roughly check on the feasibility of MPS (against material availability, labor, and machines capacity standard). Once we find any error or mistake on the information, company must correct and adjust it before uploading. If capacity is enough, the MPS will be confirmed. If not, then it must be adjusted and re-planning again.

3.1.4 ABC Analysis

1. Definition of ABC: ABC analysis is the powerful tool for classifying inventory according to comprehend the level of important for inventory item. Furthermore, the ABC analysis encourages company to enhance performance of inventory replenishment system, improve customer service levels, and indicated potential obsolescence. Company enable concentrate details attention on the high value, criticality and important items by using Pareto analysis in order to create prioritization of item; sometime it is referred to 80:20 rule to group of items. Typically, somewhere on the order of 20 percent of the SKU's account for 80 percent of the total annual dollar usage. ABC analysis is applied in inventory management where it is used to classify group of item by based on annual requirement value, ARV, expenditure. The ARV can be calculated in the following equation:

$$\textit{Annual Requirement Value} = \textit{Annual Usage Rate} \times \textit{Dollar Value per unit}$$

The ARV is usually prioritized into three significant categories: A (most important, B (intermediate in importance and C (least important). The highest dollar volume is classified as A items, the next highest dollar volume is grouped as B items, and C items are the lowest dollar volume. Generally, A Class is approximately 70 to 80 percent of the ARV, but it will be only 15 to 30 percent of the total items. Meanwhile, C Class comprises 5 to 15 percent of ARV, and about 50 percent of total items. However, there is no explicit regulation about the division A and B class, or

between B and C Class. The percentage here is only for the average guideline. (Evans, 1993)

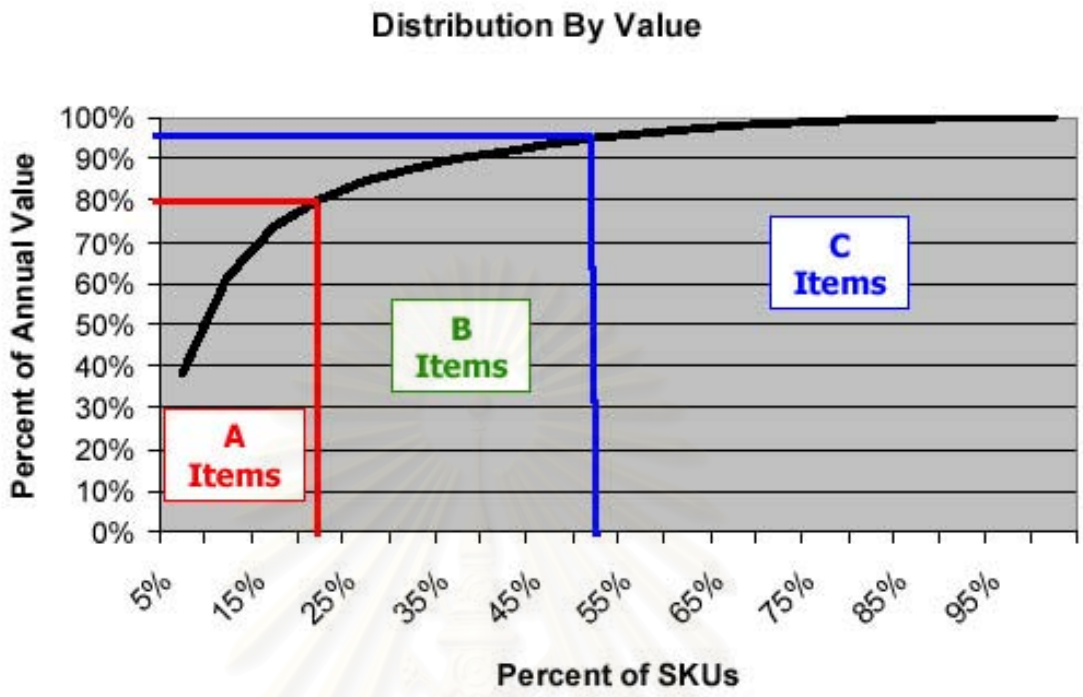


Figure 3.6: Pareto-ABC Analysis

2. ABC Calculation: The calculation method of ABC can be divided into 4 steps as follow:

2.1 Create the list of items including annual usage. And then renew ordering of annual usage in descending.

2.2 Multiply each item annual usage by unit cost in to determine annual dollar usage.

2.3 Rank the entire calculated item in descending order of annual dollar usage. The consequent of ranking is called annual requirement value.

2.4 Assign ABC rank into each group.

Table 3.3: ABC Analysis of 303660001 PG1500 D18

Part No.	Quantity	Demand	ARV ($)	Cum Value ($)	Pct Ann Value (%)	Class
7590010042027	1	15,428.00	6,556,900.00	6,556,900.00	29	A
0+40002140	1	15,428.00	3,625,580.00	10,182,480.00	45	A
0+6000187	1	15,428.00	3,626,580.00	13,809,060.00	60	A
0+40000809	1	15,428.00	1,816,801.28	15,624,861.28	68	A
0+4647	2	30,856.00	1,727,936.00	17,352,797.28	76	B
0+4389	3	46,284.00	1,436,655.36	18,789,452.64	82	B
0+4383	1	61,712.00	1,203,384.00	19,992,836.64	87	B
7875000030001	1	15,428.00	520,540.72	20,513,377.36	90	B
0+5000145019	1	15,428.00	339,261.72	20,852,639.08	91	B
0+5000145020	1	15,428.00	338,490.32	21,191,129.40	93	B
0+5000145021	1	15,420.00	338,490.32	21,529,619.72	94	D
0+40002446	1	15,428.00	284,407.47	21,814,027.19	95	B
0+4742	19	293,132.00	205,192.40	22,019,219.59	96	B
0+4368	1	15,428.00	182,050.40	22,201,269.99	97	B
0+4060	1	15,420.00	150,137.00	22,359,406.99	98	D
0+4873	1	15,428.00	149,651.60	22,509,058.59	99	B
7875000050001	3	46,284.00	90,253.80	22,599,312.39	99	B
C01070024	10	154,280.00	61,712.00	22,661,024.39	99	B
0+1359	2	30,856.00	30,856.00	22,691,880.39	99	B
0+5000116	1	15,428.00	30,856.00	22,722,736.39	99	B
0+5001285	8	123,424.00	27,153.28	22,749,889.67	100	C
0+6000367	2	30,856.00	26,388.06	22,776,277.72	100	C
C07030005	1	15,428.00	12,342.40	22,788,620.12	100	C
0+5001636	0.006	92.57	10,876.74	22,799,496.86	100	C
0+5080	2	30,856.00	9,256.80	22,808,753.66	100	C
C04060009	1	15,428.00	9,256.80	22,818,010.46	100	C
0+40002143	1	15,428.00	6,171.20	22,824,181.66	100	C
0+4816	1	15,428.00	6,171.20	22,830,352.86	100	C
C04050016	1	15,428.00	6,171.20	22,836,524.06	100	C
0+0704	16	246,040.00	4,936.96	22,841,461.02	100	C
0+0347	1	15,428.00	4,628.40	22,846,089.42	100	C
0+0962	3	46,284.00	2,777.04	22,848,866.46	100	C
0+5000184	1	15,428.00	1,542.80	22,850,409.26	100	C
C01040007	1	15,420.00	462.04	22,850,872.10	100	C
C02060007	0.3	4,628.40	92.57	22,850,964.67	100	C

3.1.5 Risk Management

Risk is a measurement of the probability and consequence of incompletion or not achievability a goal. The risk is a one significant factor which radically affect to potential of project and enables impede the whole performance of organization. Moreover, the risk is any factor that may potentially interfere with successful completion of the project due to it involves the notion of uncertainty. Typically, risk consists of two primary components: A probability (likelihood) of occurrence of that even and impact of the event occurring (amount at stake). Probability is the probability that the loss will occur and impact is the full consequence of that loss. For instant, not completely meeting the standard requirements, with a probability of occurrence of only 0.05, may present a much more serious situation than not meeting the targeted cost, with a probability of occurrence of only 0.20, if the consequences of not fully complying the IEC standard are more than fours times more severe than not meeting the targeted cost. Therefore, both components must be considered in risk management. Kerzner has illustrated the relationship of each component by figure below.

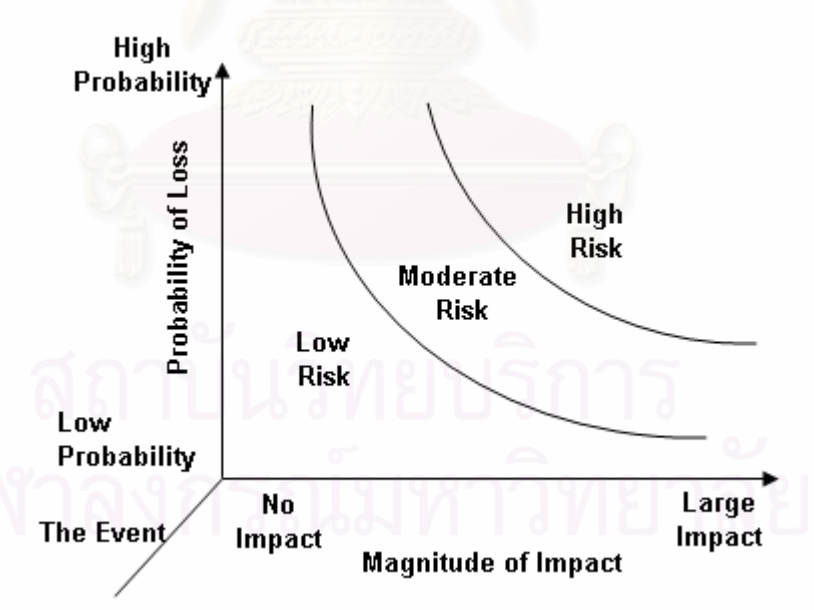


Figure 3.7: Overall Risk is a Function of Its Components

Obviously, risk management becomes to be an important criterion for business nowadays. Risk management is a method or practice of dealing with risk by including

four significant states as planning, assessing, developing risk handling, and monitoring risks. Typically, risk management is not a divide project, but should be closely coupled with key project management processes. Moreover, risk management should be performed as proactive rather than reactive because if the manager performs risk management as reactive, then no activity is occurred before problem happens. By that time, company will lose valuable time when contingencies could have been developed, thus the proper risk management encourages organization to reduce the likelihood of a problem occurring as well as decrease the magnitude of its impact.

1. Risk Management Process: The process of risk management involves in four significant processes as below:

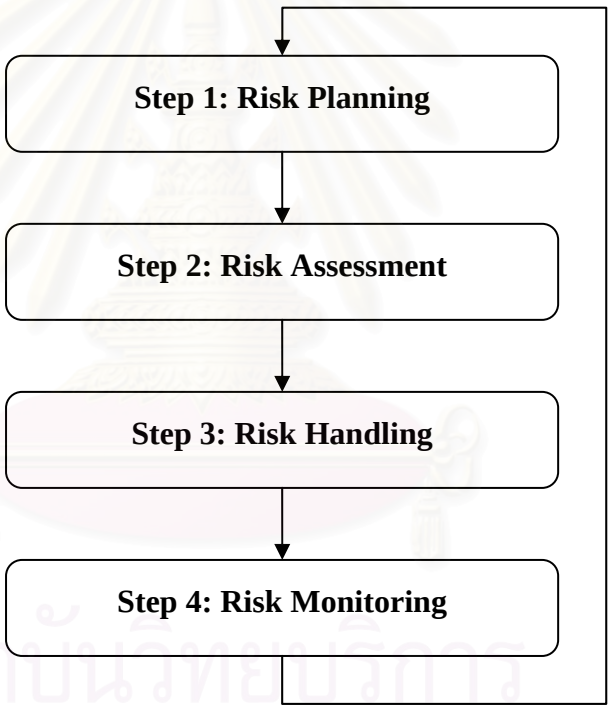


Figure 3.8: Risk Management Process

1.1) Step 1 Risk Planning: This is an initial step of risk management to identify and assess the risk, establish the purpose and objective, assign responsibility of each area, define a risk rating, define entire documentations, and also identify a method to develop risk management strategy which includes both the process and implementation approach. Moreover, this step encourages company to provide

training for involving team members particularly the members who has nothing experience in risk management.

1.2) Step 2: Risk Assessment: This is a step to identify entire problems and analyzes in term of probabilities and consequences, and other consideration areas. This step is usually hard to define the answer in short period of time, thus sometime evaluators need tools to help evaluating risk. However, the evaluators must clearly understand how to apply them and interpret the result in the proper way. Moreover, in this step is allowed company to identify feasible risks. The purpose of risk identification is to anticipate threats to success by generating a list of risk events. The risk event should precisely describe a happening that might occur with either an associated time component or condition. There are several techniques for identifying the number of the risks (Gregory D. Githens, 2002). Nevertheless, each technique has advantage and disadvantage point which usually relates to particular situation and project factors such as sizes, and resources involved.

The risk identification facilitates member in team to understand the risk which might be occurred. After that the entire risks must be analyzed in order to judge the likelihood of occurrence and cost, schedule and technique consequences if the risk is occurred. The consequences of analysis are typically converted into risk level. The risk level can be divided by the impact of each risk to a project. The level can be divided into three rating as high risk, moderate risk, and low risk.

1.3) Step 3: Risk Handling: This process involves identifying, evaluating, and selecting the strategy to cope with risks in order to set risk at acceptable levels given program constraints and objectives. Furthermore, it defines the responsible person and provides an estimation of cost and schedule to decrease risks.

Table 3.4: Identification Techniques

TECHNIQUE AND DESCRIPTION	ADVANTAGE	DISADVANTAGE
ASSUMPTIONS ANALYSIS - Assumptions are factors that, for planning purpose, are true, real, or certain. These assumptions may be invalid during implementation. Assumption are incremental altered, or totally invalidated, and the resulting impact is assessed	Can be supported with quantitative analysis (e.g., sensitivity analysis)	Vague and ambiguous
BRAINSTORMING - The cross-functional team generates ideas about project risk, often done with the support of a facilitator.	Energizing and creative; easy, familiar	Results may be perceived as ambiguous and difficult to organize
CHECK LISTING - Based on historical information and knowledge of the system, checklisting helps to make sure that past mistakes are not repeated.	Quick	Tedious, often overwhelming, and may result in uncritical "checklist mentality; not prospective
DELPHI - This technique is best used for complex, messy problems where there are numerous perspectives on the nature of the problem and the solution. For example, a question could be "What is the future for electric-powered vehicles?	Remotely extracts expert opinions and builds consensus	Time-consuming; results are often ambiguous
DOCUMENT REVIEW - Assemble and analyze documents for content (literal meaning) and context (application). Include initial plans, assumptions, past experience, statements of strategy, requirements specifications, and review.	Establishes common basis for further analysis and decisions	Tedious
DIAGRAMMING - A variety of techniques to make models of stock, flows, causality, decisions, and assumptions more explicit. (Diagramming techniques include fishbone, flow charts, influence diagrams, relationship mapping.)	Analytical; complements other techniques	Difficult to get agreement on accuracy.
INDEPENDENT ASSESSMENT - External assessors use a variety of techniques to inspect the project	More objective, comprehensive; domain expertise often required	Less ownership
INTERVIEWING - An analyst elicits knowledge from others through guided questions and probes.	Depth of inquiry and follow-up questions possible	Bias
TRIGGERS - A list of symptoms or warning signs that indicate a risk event has occurred or is likely to occur. Analogous to dummy lights on your automobile's dashboard.	Effective and efficient once implemented	Requires integrated understanding of system and tolerances

Adapted from Gregory D. Githens, 2002

1.4) Step 4: Risk Monitoring: This is the last step of risk management. The purpose of risk monitoring is to evaluate and track systematically the overall performance of risk handling actions in order to emerge the additional developing risk handling strategies in ineffective areas. The key of risk monitoring process is to generate cost, performance, and schedule management indicator system which facilitates member to evaluate the status of program. The good indicator system must allow member to understand the status of risk in early and inform member to prevent against the risk.

2. Failure mode and effects analysis (FMEA): The Failure Mode and Effects Analysis (FMEA) is an analytical method of the preventive assurance. It serves to find the potential failure of a product/process, to recognize and evaluate its importance and to identify appropriate actions to prevent the potential failure or to discover it in time. The systematic analysis and removal of weak points leads to the minimization of risks, to the reduction of failure costs and to an improved reliability. A FMEA is a good means to analyze risks caused by individual failures. The individual risks are weight against each other to recognize priorities. A FMEA does not provide a statement on the total failure risk. For the analysis of failure combinations, the fault-tree analysis is more appropriate.

2.1) Types of FMEA: Typically, there are different types of FMEA depending on the time, the depth and the object of the analysis. The entire FMEA types are identical in their procedure; the usages of the same form prove this.

- System FMEA: The system FMEA analyzes the correct functional interrelation of the system components and their connections. The goal is to avoid defects in system selection and layout and field risks. The system requirements are the basis for the analysis. The system development department is responsible for the system FMEA.

- Design FMEA: The design FMEA analyzes the design and layout of products/components according to the specification to avoid design errors

and process defects influenced by the design. The product/component design department is responsible for the design FMEA.

- Process FMEA: The process FMEA analyzes process planning and performance for products/components according to the drawing specifications to avoid planning errors and manufacturing defects. The product planning department is responsible for the process FMEA.

2.2) FMEA sequence step: The typical framework of developing FMEA comprises of six significant steps as figure follow:

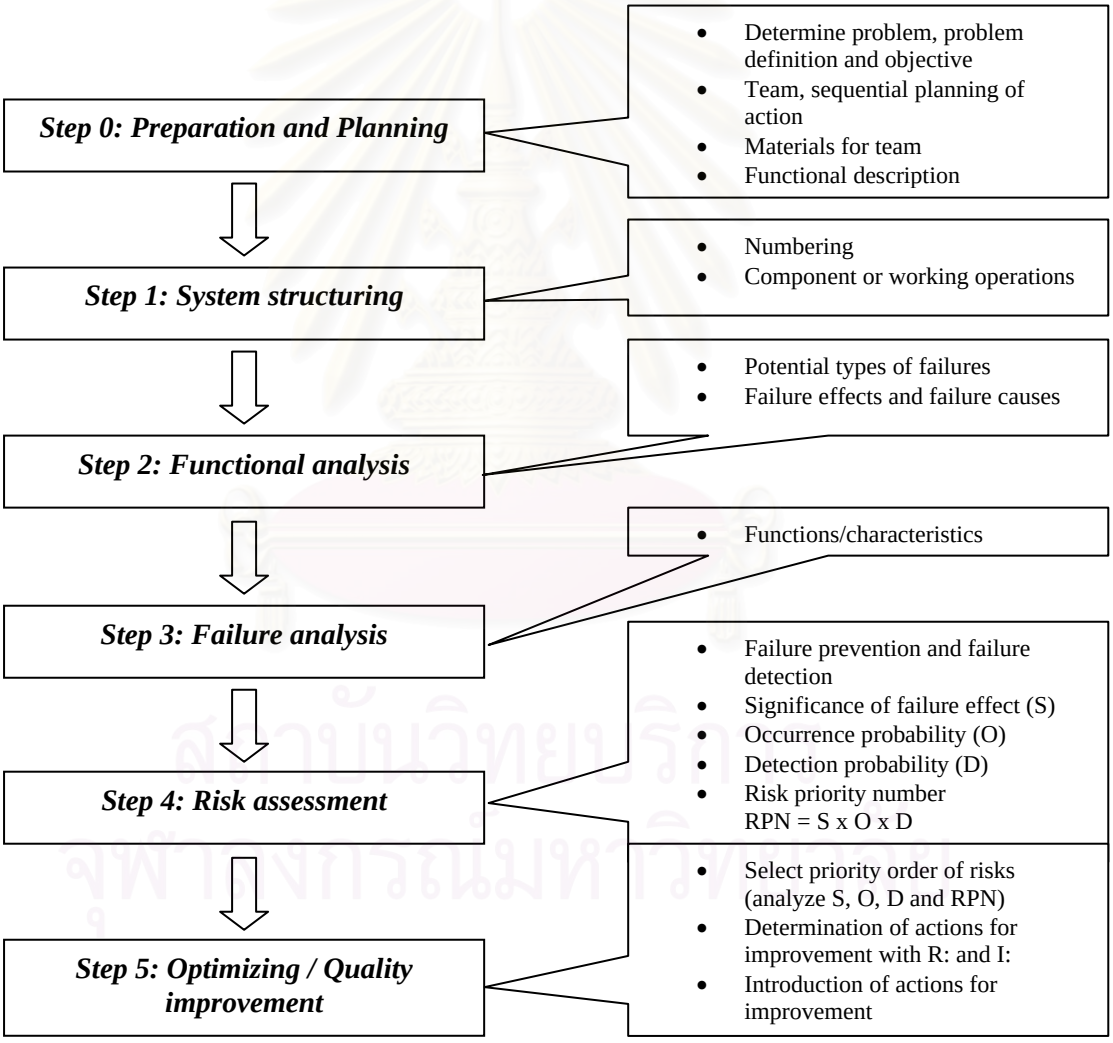


Figure 3.9: FMEA Process

2.3) FMEA Components: The components of FMEA will be distinguished by using criteria, but the most significant parts of FMEA are severity (S), occurrence (O), and detection (D) which is discussed later on.

Table 3.5: FMEA Template

No	Process	Function	Failure mode	Failure Effect	Failure Causes	Failure Prevention	Failure Detection	S	O	D	RPN	Action R:\:
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)

- Column 1 No: The numbering of the component or process.

- Column 2 Process: The system components, component groups to be analyzed are entered according to either block diagram/machine list or component/function-matrix. Software-modules/-functions can also be analyzed.

- Column 3 Function: The FMEA lists all functions of the system components on the basis of the system requirements. The scope of the FMEA is determined within a functional analysis. The more exact description of the functions and characteristics encourage company to create exact the potential failure types. The functions should be described either noun or verb.

- Column 4 Failure mode: In the failure mode column, it is described why a required function or characteristic could not be fulfilled. The system FMEA analyzes all potential malfunctions and functional deficits that are able to be inferred from the functions of the system components and from their connections.

- Column 5 Failure Effect: This column demonstrates a consequent which is caused by failure mode to effect on the highest system. This description should be done in different steps - direct, next, end.

- Column 6 Failure Cause: In this column, those failure causes are to be listed that might lead to the analyzed failure mode. The actual cause has to be described in such a way that any necessary measures for improvement can be directly introduced. The FMEA concentrates on failures of functional groups or components and their connections. Every operating conditions (lifetime, temperature, time acceleration factors etc.) and operating conditions have to be analyzed.

- Column 7 Failure Prevention: Failure prevention is a preventive action taken during the system design phase to prevent failure causes to occur or to complicate their occurrence. In a system FMEA (field and interpretation), the introduced actions are to be analyzed that minimize the risk of system interpretation failures, prevent or limit the failure consequences.

- Column 8 Failure Detection: In the FMEA, entire failures must be analyzed in to find the method to be detected any failures through the system.

- Colum 9 Severity of failure consequence (S): The severity level or S is an essential number to shoe the criticality of failure. Typically, the rating is scored from 1 to 9 or from low to high severity respectively. A typical severity rating table used to rate the FMEA is as follows.

Table 3.6: Severity Rating

S - Severity of Effect	***Rating***
Extremely serious failure, which affects safety and/or violates legal requirements, without previous warning.	**10**
Extremely serious failure, which possibly affects safety and/or violates legal requirements with previous warning or leads to “breaking down“.	**9**
Serious failure, failure of primary functions, e.g. product can not in running order.	**8**
Serious failure, reliability of product very restricted, immediate servicing required.	**7**
Moderately serious failure, failure of important operational and comfort systems; immediate servicing not required.	**6**
Moderately serious failure, limited functioning of important operational and comfort systems.	**5**
Moderately serious failure, little reliability restriction of operational and comfort systems; detectable by any users.	**4**
The failure is insignificant. The customer is only slightly bothered, and will probably only notice slight interference; can be noticed by the average users.	**3**
It is unlikely that the failure could have a noticeable effect on the behavior of the product; only noticeable by experts or experienced users.	**2**
No effect	**1**

- Column 10 Occurrence Probability: The occurrence rating is the score that corresponds to the failure mode probability which can be occurred due to the failure cause. In order to avoid the failure, the action will be introduced by analysis from the cause of failure. A typical occurrence rating is shown follows:

Table 3.7: Occurrence Rating

O - Occurrence probability	***Possible failure rate***	***Rating points***
Very high: It is almost certain that the type/cause of failure will be occurred very often.	1/10	**10**
	1/20	**9**
High: The type/cause of failure occurs repeatedly. Problematic, not perfect system.	1/50	**8**
	1/100	**7**
Moderate: The type/cause of failure occurs occasionally. Advanced system.	1/200	**6**
	1/1,000	**5**
	1/2,000	**4**
Low: The probability that the type/cause of failure occurs is low. Proven system design.	1/15,000	**3**
	1/150,000	**2**
Unlikely: The occurrence of the type/cause of failure is unlikely.	<1/1,500,000	**1**

- Column 11 Detection Probability: This rating is demonstrated the effectiveness of the design controls by evaluating the probability of the failure mode which is occurred due to the failure cause. A typical detection rating table found in most FMEA manuals is as follows:

Table 3.8 Detection Rating

D- Detection Probability	***Rating***
Unlikely: It is impossible or unlikely that a type and/or cause of failure is detected through test and analysis measures.	**10**
Very low: The probability is very low that the type and/or cause of failure are detected through test and analysis measures.	**9** **8**
Low: The probability of the type and/or cause of failure which are detected though test and analysis measures is low.	**7** **6**
Moderate: The probability of the type and/or cause of failure which are detected through test and analysis measures is moderate.	**5** **4**
High: The probability that the type and/or cause of failure are detected through test and analysis measures is high.	**3** **2**
Very high: It is certain that the type and/or cause of failure is detected	**1**

- Column 12 Risk Priority Number (RPN): Once all numbers are rating, the FMEA reveals team to understand the significant level of each risk by using RPN number. The RPN number is calculated by equation below:

$$RPN = S \times O \times D$$

Typically, the failure would be action if the RPN is over 125, as well as when the RPN is close to the set limited (between 50 and 125), it is also required the continuous improvement in order to insure that the failure will not be happened.

- Column 13 Action R:/I: Once the RPN is shown that this failure is required the action. The actions is necessitated to be written with responsible person (R:), and deadline of completion (I:). After perform action, the failure must be assessed once again, and fill in the new RPN to illustrate the consequent after improvement in ().The final assessment is done after the action has been taken and after testing its effectiveness. If a type of failure does not exist any longer because of the proposed action, the assessment numbers S, O, D are to be put equal zero. If a failure cause does not exist any longer because of an action, the assessment number for O and RPN are to be put equal to zero. Nevertheless, the cancelled failure type/cause can be documented. If an action is taken (e.g. change of the design draft or change of the production procedure), it has to be examined which new risks arise. If actions are found which lead to the canceling of a failure type/cause, the new actual state is to be analyzed. The old and new actual state has to be weight up.

2.4) Advantage and Disadvantages points of FMEA

- Advantage points: The advantages of a FMEA prove that the efforts to prevent failures from the beginning of the development process of a product are justified because the very much higher resulting costs are eliminated later. Advantages are, e.g.:

1. Prevention of failures in design and development.
2. Less subsequent product changes and thus reduction of costs.
3. Prevention of repeated failures through systematic consideration of expert/failure knowledge on the product or process.

- Disadvantage points: An argument which is often used against FMEA is its high expenditure. The following topics play an important role:

1. Complexity of the product
2. Level of analysis/type of FMEA
3. Methodological experience of moderator/team
4. Quality of preparations
5. Terms of reference/scope of analysis

3.2 LITERATURE REVIEW

3.2.1 Supply Management

Supply management, SM, is described about the process which is employed for managing materials and services of the supplier who support those input. SM is a well know tool for commodity price stabilization by relying on demand and insure available of material (Lines, 2007). Currently, supply management is the important strategy for an organization to acquire materials effectiveness, and reduce the problem from unreasonable customer demand, advances in technology, business challenging, and so on. (Eversbusch, Schimrock, 2003).

Shin et al (2000) mentioned that the excellence in supply management sustains organization to generate a better quality, high customer service rate, and good channel performance. Moreover, they mentioned that supply management is the driver to create the four keys performance areas namely: Long term relationship or partnership, supplier involvement in product development, reduced number of suppliers, quality performance is the number one priority in selecting suppliers.

3.2.2 Lead Time Reduction

In an increment of competitive environment, entire companies attempt to gain more their competitive advantages in existing and new markets by generating various strategy in order to achieve the target objectives. There are numerous methods to

attain the target such as reduce the cost, provide flexibility to customer, high quality, delivery reliability, customer service and delivery product on time. Actually, no companies can excel in all these factors simultaneously; thus it depends on the customer requirement of each business. Nevertheless, on time delivery or speed of responding to customer demand is becoming to be a significant criterion of all clients to have the business with any supplier. Reduction time does not mean reduce only the production time, but also all lead time in supply chain. Typically, time is consumed anywhere within the supply chain from placing order by customer until delivery product to client. To be reduced the lead time, an organization must reduce the entire chain by utilizing time compression activities (Blackburn, 1992).

Tersine et al, (1995) mentioned that the reducing time can refer to the ability of the firm to deliver product or service faster than ever. Reducing lead time is usually related to massive part of chain, and should attack all bottle neck process in the system. The bottle neck process is the step which is used longer lead time than other step. Tersine et al (1995) has proposed the method to diminish bottle neck process in three steps: Step one is to observe the entire chain from ordering until dispatching product to customer. Step two is to identify and attack to the bottle neck point. The final step is to monitor and improve the system.

Alderson (1954) proposed the lead-time reduction strategy by attacking the gaps. There are various gaps which are happened when production and consumption are temporally and spatially displaced (Figure 3.9). Stalk and Hount (1990) discussed in more details about the effects if lead time reduction of consumers and capability of reducing lead-time of gaps particularly production lead-time. Reducing lead-time encourages company to produce the smaller lot and more frequent in order support fundamental requirement of customer.

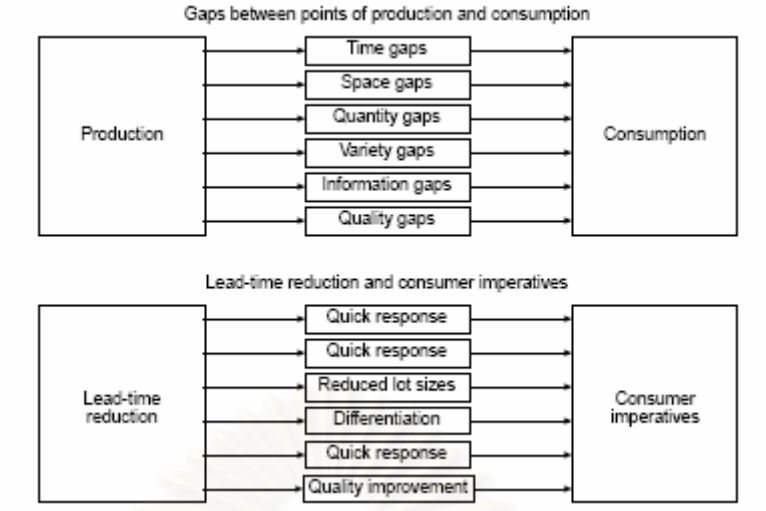


Figure 3.10: Lead Time Reduction

3.2.3 Localization Supplier

Purchasing locally is becoming to be a key strategic of entire company nowadays. A local supplier enable furnish smaller lot size of materials at lower prices than purchase material from distant suppliers. Furthermore, the local supplier encourages company to balance and control the inventory level better.

Dobler and Burt (1996) discussed about advantage points of purchasing locally as follow:

1. The buyer and seller are possible to work and cooperate more closely because of geographical proximity.
2. Delivery dates are more accuracy due to transportation is only a minor factor in delivery.
3. The price can be cheaper since the transportation cost is lower; moreover, supplier enables consolidate entire orders and delivery to various clients in the same shipment.
4. The lead time is shorter since company can order more frequently in the smaller quantities.
5. Urgent orders are likely to be delivery faster.
6. Arguments are able to be solved better and faster.
7. Implies social responsibilities to the community are fulfilled.

3.2.4 Ordering Policy

Ordering policy is the significant factor which enables to facilitate organization to control inventory effectively in order to minimize the total cost of the supply chain (Chan et al, 2006). Some literatures advise the typical method, that can minimize holding cost and stock out cost, is an Order-up-to-level. The order-up-to-level is a classical theory which widely used in inventory control (Axsater, Rosling, 1994). The order-up-to-level is determined as the product of the forecasting and lead time plus the review period in the defined period, and replenishment quantity is ordered whenever the level of inventory is reduced to reach a set level (Eaves, Kingsman, 2004). However, some literatures called the order-up-to-level to be re-order-point. Bonney (1994) said that the re-order-point is a traditional inventory control theory which is developed in order to understand when company needs to order. Moreover, he separated re-order-point into to systems as below:

1. The Re-Order Level (ROL) System
2. The Re-Order Cycle (ROC) System

3.2.5 Risk Management

According to the material shortage problem, the cause of problems enable occurs across supply chain. For example, if suppliers encounter with supply failure in any cases from sub-supplier, it will not only affect to suppliers only, but also affect to company. Hence, the material shortage risk management is the useful strategy to insure the availability of material.

Some literature mentioned that risk can refer to uncertainty that decreasing performance of predictability which impact to organization performance (Miller, 1992). Zsidisin et al. (2000) educated about how purchasing organization assess supply risk. In his research is described the key risk that is affected to supply risk: Business risk, Supplier capacity constrains, Quality, Production technological changes, product design changes, and disaster. Finally, he shown that risk assessment, contingency plans, process improvement, and buffer strategies are performed to reduce uncertainty and avoid supply risks. In order to analyze prevent risk effectively, the special tool is required. FMEA is a famous tool that is used widely. In the mid-

1960s, this method was developed within the Apollo-project in the USA. It has first been used by the aerospace industry and the nuclear technology and later by the automobile industry and also in other sections. In 1977, Ford motor Manufacturing Company launched the operation standard for analysis risk which was called Failure Mode and Effects Analysis (FMEA) and it was adopted by various automotive manufacturers (Yang et al, 2006). Nonetheless, there are various journals that adopting the FMEA in another areas as follow:

Teng et al. (2006) adopted FMEA in a collaborative supply chain environment. Their paper demonstrated that FMEA process is able to use in supply chain operation and encourage company to enhance manufacturing operations in all supply chain partners. Moreover, FMEA can develop the end product's design, quality, and reliability with lower cost and shorter development time. Yang et al. (2006) has used the FMEA to approve enterprise resource planning introduction. Rotondaro and Oliveira (2001) used the FMEA to improve service quality and service operation management. Within their journal, they defined the new rating from 1 to 5 in each item (S, O, D) and also they added recuperation value for calculating RPN.

CHAPTER 4

SOLUTION FORMULATING FRAMEWORK AND IMPLEMENTATION

4.1 SOLUTION FORMULATING FRAMEWORK

According to the study, the strategies would be proposed solution concept for improving on time delivery, reducing lead time to clients, and reducing of expediting costs. However, in this study will focus only on the products of AAA Company who is the biggest customer of the case studied company in term of last fiscal year revenue as shown in below figure;

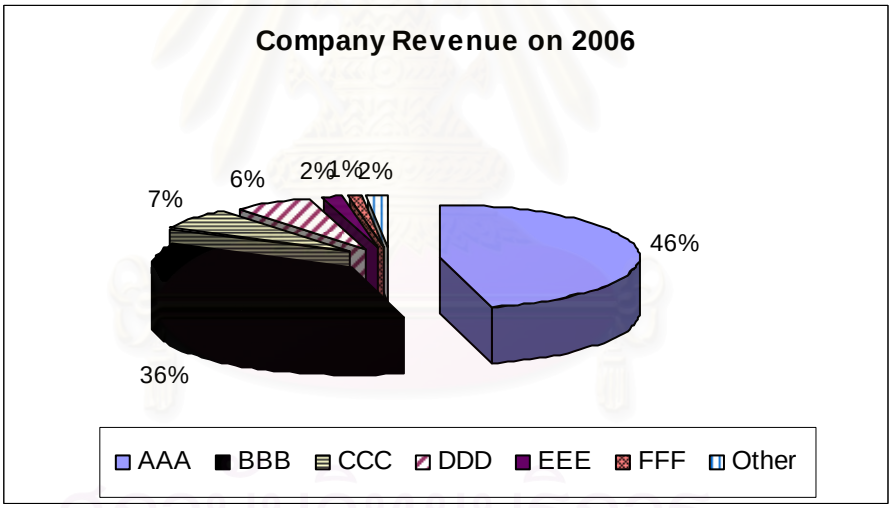


Figure 4.1: Company Revenue on year 2006

Owing to the fish bone diagram, there are various relevant causes and effects. Subsequently, entire causes and effects will be analyzed by using the FMEA tool. FMEA encourages company to find the potential failures also recognize and evaluate its importance. Additionally, FMEA help case studied company to identify appropriate actions in order to prevent the potential failure or to discover it in time.

Systematic analysis and elimination of redundant process/step leads to risk minimization, failure costs reduction, and reliability improvement.

4.1.1 Failure Modes and Effects Analysis (FMEA)

FMEA comprises of six significant steps as follow:

Step 0: Preparation and Planning
Step 1: System structuring
Step 2: Functional analysis
Step 3: Failure analysis
Step 4: Risk assessment
Step 5: Optimizing /Improvement

1. Step 0 Preparation and Planning: Team is consider as the most significant component of FMEA. The good team consists of members from various functions which is called multi functional team (MFT). The MFT contains Supply Chain Engineering, SCE, Production Planning Control, PC, Traffic, TD, Supplier Quality Engineering, SQE, Financial Control, FC, Business Unit, and RFQ Department as shown in below table:

No	Name	Department	Position	Year of Working
1	Ms. Monticha S.	SCE	Manager	3 Years
2	Mr. Aekarin B.	SCE	Engineer	3 Years
3	Mr. Chanyuth M.	SQE	Senior Engineer	4 Years
4	Mr. Sulert K.	FC	Manager	4 Years
5	Ms. Sunisa J.	PC	Senior Planner	2 Years
6	Ms. Rachada T.	TD	Senior Staff	8 Years
7	Mr. Tanarath S.	RFQ	Senior Staff	3 Years
8	Mr. Phuthipong K.	BU	Program Coordinator	2 Years

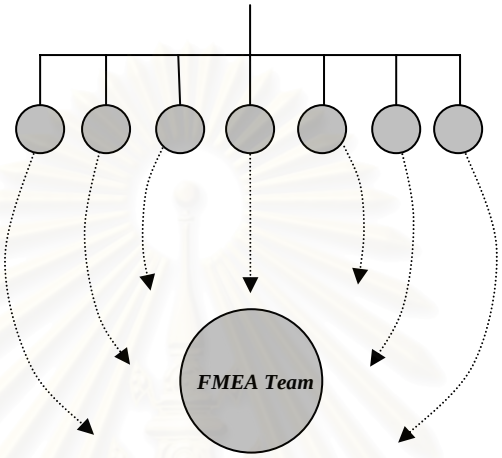


Figure 4.2: FMEA Team Structure

According to the rating of each value, the member ignored to use the typical rating, and determined the new rating; five is the highest and one is the lowest score. Moreover, MFT determines additional criterion for risk analysis. Additional condition is if the result of severity (s) multiplied by detection (d) is equal or greater than eight, it means that the failure has to be seriously considered.

In order to establish the effective FMEA, members in the team must vigilantly determine and understand the score of entire criteria (S, O, D). The definition of each band is shown in table 4.1.

Table 4.1: Severity, Occurrence, and Detection Rating

Severity Rating:

S – Severity of Effect	***Rating***
Extremely serious failure, the production line is suddenly stopped without previous warning, and affects to product can not send to client absolutely.	**5**
Serious failure, the production line can be stopped with warning, and affects to product can not send to client.	**4**
Moderately serious failure, the delay of part effects to the production line a little, and product still can delivery to client.	**3**
The failure is insignificant, the delay of part does not affect to the production line and delivery to client.	**2**
Not severe, there is no delay of part occur.	**1**

Occurrence Rating:

O – Occurrence probability	***Possible failure rate***	***Rating***
Very high: It is almost certain that the type/cause of failure will be occurred very often.	1/20	**5**
High: The type/cause of failure occurs repeatedly. Problematic, not perfect system.	1/100	**4**
Moderate: The type/cause of failure occurs occasionally. Advanced system.	1/1,000	**3**
Low: The probability that the type/cause of failure occurs is low. Proven system design.	1/150,000	**2**
Unlikely: The occurrence of the type/cause of failure is unlikely.	<1/1,500,000	**1**

Detection Rating:

D- Detection Probability	***Rating***
Unlikely: It is impossible or unlikely that a type and/or cause of failure is detected through test and analysis measures.	**5**
Low: The probability of the type and/or cause of failure which are detected though test and analysis measures is low.	**4**
Moderate: The probability of the type and/or cause of failure which are detected through test and analysis measures is moderate.	**3**
High: The probability that the type and/or cause of failure are detected through test and analysis measures is high.	**2**
Very high: It is uncertain that the type and/or cause of failure is detected through test and analysis measures.	**1**

Rules:

- The failures must be taken action when RPN value is equal or over 27.
- If the score S x D is equal or greater than eight, that failures must be taken action.

2. Step 1 System Structuring: Initially, members have to understand the entire working supply chain workflow; since receiving the order and forecasting from customer until delivery the products to client. Furthermore, members also have to understand lead time in each process/task and responsible person for each process/task.

3. Step 2 Functional Analysis: In this step, the entire processes, table 4.2, are listed in the FMEA and elaborately describe function of each process into the FMEA table. The analysis facilitates members to define potential failure mode.

4. Step 3 Failure Analysis: In this step, failure modes, failure effects, and failure causes are analyzed by brainstorming among MFT in order to comprehend each failure. Then, failures are being analyzed in order to define failure effects and failure causes. Finally, information is listed in FMEA table 4.3.

Table 4.2: Work Flow Chart

Supply Chain Workflow Chart

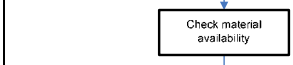
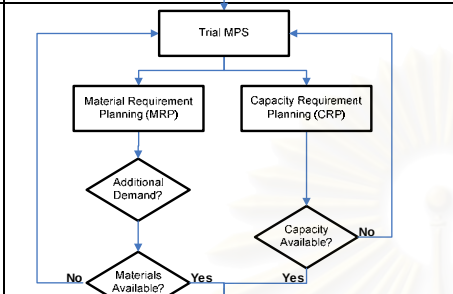
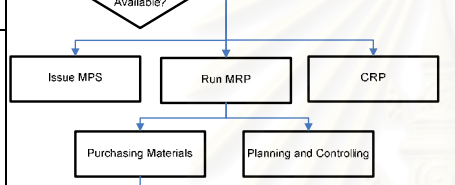
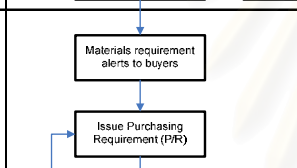
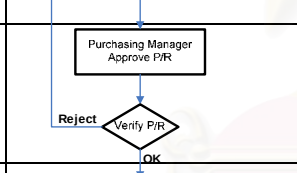
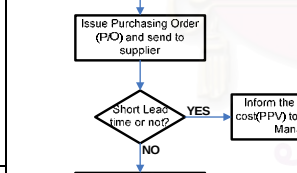
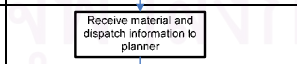
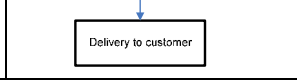
Step	Work Flow	Process	Lead time	Task	Responsibility
1		Receiving demand and forecasting from customer	2 Days	- Receive demand and order from customer.	Program Coordinator
2		Check Availability of material		- Verify the material availability status for using in generating MPS	Planner
3		Master Production Schedule Trial	2 Days (Running in every Friday)	- Trial MPS - Generating MPS, MRP and CRP. - Checking Capacity	Planner
4		Generating MPS, MRP, and CRP			
5		Creating purchasing requirement	1 Day	- Issue P/R and send to PUR MGR for approval.	Buyer
6		Approve Purchasing requirement	2-3 Days	- Approving P/R	Purchasing Manager
7		Send purchasing order to suppliers	1 Day	- Issue P/O and send to suppliers - Inform expediting cost if happened. - Inform delivery date to planner	Buyer
8		Inform delivery commitment to planner			
9		Follow up supplier to delivery material	Corresponding to supplier lead time.	- Follow up supplier to send the material on schedule.	Buyer
10		Receiving material and incoming inspection	2 Days	- Receive material and keep them in warehouse	Buyer Incoming Quality Team
11		Manufacturing and Inspection	Corresponding to manufacturing lead time of each product.	- Manufacture product - Final inspection.	Production Engineering, Quality Assurance engineering
12		Delivery product to customer	3-5 Days (By Air)	- Packing as standard pack - Contact frieght forwarder to send product to customer	Traffic Team

Table 4.3: List of Failure Modes, Failure Effects, and Failure Causes in FMEA

No.	*Process*	*Function*	*Failure Modes*	*Failure Effects*	*Failure Causes*
1	Receive demand and forecasting from customer	Apply information for generating MPS, MRP, and CRP	Inaccuracy of Forecasting	Order is dynamic and hard to control part available on production schedule.	Customer can not generate accuracy forecasting.
			Uncertainty Demand	Creating inaccuracy MPS	Customer no have certainty demand
			Demand does not upload into the system.	Company does not produce part according to customer order.	Forget to upload demand.
2	Check Availability of material	Checking information	Using wrong information	Creating wrong MPS	Using no update information
3	Master Production Schedule Trial	Trial MPS	Using wrong aggregate plan	Trial mistake	Using no update information
			Using in accuracy capacity	Trial mistake	The current information is worng.
4	Generating MPS, MRP, and CRP	Generating MPS, MRP, and CRP	Inaccuracy of MRP parameters	Creating wrong MRP	Using wrong MRP parameter
			Demand is changed even fixed order period	Product can not be delivered to customer on schedule.	Customer changes demand
			No have knowledge of performing MRP effectively	Can not create MPS, MRP and CRP smoothly.	No training provide for related person
5	Creating purchasing requirement	Issue PR	Issue incomplete PR	Can not issue PO	Buyer does not circumspect for issuing PR
6	Approve Purchasing requirement	Approve PR for issuing PO	Long lead time to open PO.	Part is sent to company delay.	Manager uses more time to approve PO
7	Send purchasing order to suppliers	Send PO	PO is sent to supplier quite late.	Part is sent to company delay.	Buyer issues PO too late.
8	Inform delivery commitment to planner	Notify delivery schedule	Commit the wrong date to customer	Commit wrong product delivery date to customer	Inform wrong committed date to planner

No.	*Process*	*Function*	*Failure Modes*	*Failure Effects*	*Failure Causes*
9	Follow up supplier to delivery material	Expedite material to send as committed.	Quality problem	Need time to rework or re production	Supplier can not control quality of part.
			Make to order	Supplier can not support quick turn lot.	Supplier does not want to keep inventory since the forecasting is inaccuracy.
			Supplier cannot support fluctuated demand.	Part can not be sent before production lead time.	Wrong forecasting data
			Highly diversity of location of suppliers	Supplier is located far away from company.	Buy follow approved vendor list of customer.
10	Receive the parts from suppliers	Receive part and incoming inspection	The quanitity is less than PO.	Production Line is stopped.	Supplier does not check properly before dispatching
11	Manufacturing and Inspection	Production and Inspection	Quality problem	Need time to rework or re production	Product can not be dipatched to customer on schedule
12	Delivery product to customer	Delivery product	Send the wrong product to customer	Customer complain and affect to the company performance	Do not verify product before sending
			Do not send product on delivery plan		Forget to arrange the transportation car.

5. Step 4 Risk Assessments: The objective of this step is to evaluate all failures and identify failure prevention and failure protection. It is important to make sure that double-evaluations should be avoided. Double evaluation will only happen once preventive or detective actions are presupposed in an evaluation. After listed all failure modes, failure affects, and failure causes com, each failure must be rated to three significant numbers according to severity, occurrence, and detection. These three numbers must be listed into the FMEA table, then calculate the RPN in order to understand the risk priority of each failure.

Table 4.4: The FMEA Table After Risks Assessing

No.	*Process*	*Function*	*Failure Modes*	*Failure Effects*	*Failure Causes*	*Failure Prevention*	*Failure Detection*	*S*	*O*	*D*	*RPN*
1	Receive demand and forecasting from customer	Apply information for generating MPS, MRP, and CRP	Inaccuracy of Forecasting	Order is dynamic and hard to control part available on production schedule.	Customer can not generate accuracy forecasting.	-	-	3	4	5	***60***
			Uncertainty Demand	Creating inaccuracy MPS	Customer no have certainty demand	-	-	3	4	5	***60***
			Demand does not upload into the system.	Company does not produce part according to customer order.	Forget to upload demand.	Upload demand daily rather than weekly	Daily check with demand uploaded report	5	1	1	5
2	Check Availability of material	Checking information	Using wrong information	Creating wrong MPS	Using no update information	Using updated informaiton	Checking the date of creation	2	2	1	4
3	Master Production Schedule Trial	Trial MPS	Using wrong aggregate plan	Trial mistake	Using no update information	Using updated informaiton	Checking the date of creation	2	2	1	4
			Using in accuracy capacity	Trial mistake	The current information is worng.	Using updated informaiton	Quarterly review by planning MGR	4	3	2	***24***
4	Generating MPS, MRP, and CRP	Generating MPS, MRP, and CRP	Inaccuracy of MRP parameters	Creating wrong MRP	Using wrong MRP parameter	-	-	4	5	3	***60***
			Demand is changed even fixed order period	Product can not be delivered to customer on schedule.	Customer changes demand	-	-	4	3	3	***36***
			No have knowledge of performing MRP effectively	Can not create MPS, MRP and CRP smoothly.	No training provide for related person	Provide training	Training Matrix	1	4	1	4
5	Creating purchasing requirement	Issue PR	Issue incomplete PR	Can not issue PO	Buyer does not circumspect for issuing PR	Purchasing Manager daily check.	PR report	3	5	1	15
6	Approve Purchasing requirement	Approve PR for issuing PO	Long lead time to open PO.	Part is sent to company delay.	Manager uses more time to approve PO	-	-	4	3	2	***24***

No.	*Process*	*Function*	*Failure Modes*	*Failure Effects*	*Failure Causes*	*Failure Prevention*	*Failure Detection*	*S*	*O*	*D*	*RPN*
7	Send purchasing order to suppliers	Send PO	PO is sent to supplier quite late.	Part is sent to company delay.	Buyer issues PO too late.	Purchasing Manager daily check.	PO report	4	2	1	8
8	Inform delivery commitment to planner	Notify delivery schedule	Commit the wrong date to customer	Commit wrong product delivery date to customer	Inform wrong committed date to planner	Verify the information before sending to customer.	Commitment date report	1	2	1	2
9	Follow up supplier to delivery material	Expedite material to send as committed.	Quality problem	Need time to rework or re production	Supplier can not control quality of part.	Send supplier quality engineering team to solve the problem	100% check before sending to company.	5	2	1	10
			Make to order	Supplier can not support quick turn lot.	Supplier does not want to keep inventory since the forecasting is inaccuracy.	-	-	1	5	1	5
			Supplier cannot support fluctuated demand.	Part can not be sent before production lead time.	Wrong forecasting data	-	-	4	4	2	***32***
			Highly diversity of location of suppliers	Supplier is located far away from company.	Buy follow approved vendor list of customer.	-	-	4	4	2	***32***
10	Receive the parts from suppliers	Receive part and incoming inspection	The quanitity is less than PO.	Production Line is stopped.	Supplier does not check properly before dispatching	Check the quantity 100% before dispatching	Determined in work instruction.	5	3	1	15
11	Manufacturing and Inspection	Production and Inspection	Quality problem	Need time to rework or re production	Product can not be dipatched to customer on schedule	Applying pokayoke concept	100% check and detemine in procedure.	4	2	1	8
12	Delivery product to customer	Delivery product	Send the wrong product to customer	Customer complain and affect to the company performance	Do not verify product before sending	Control by adopting bar code system rather than manual checking	Barcode	1	1	2	2
			Do not send product on delivery plan		Forget to arrange the transportation car.	Hire the courier people to do transportation arrangement	Delivery report	2	1	1	2

6. Step 5 Optimizing / Quality improvement: Once RPN is generated; members can easily understand which failure must be taken action. Typically, in this step is not only giving team to understand which risks have to take action, but also encourages team to brain storm and initiate ideas into action scheme.

According to the table 4.4, there are eight failures which RPN value equal or greater than 27 and S x D equal or more than 8. Those failures need to be analyzed and define appropriate solutions. FMEA table with RPN value and action solution are demonstrated in following table:

Table 4.5: The FMEA Table with RPN and Action

No.	*Process*	*Function*	*Failure Modes*	*Failure Effects*	*Failure Causes*	*Failure Prevention*	*Failure Detection*	*S*	*O*	*D*	*RPN*	*Action R:\I:*
1	Receive demand and forecasting from customer	Apply information for generating MPS, MRP, and CRP	Inaccuracy of Forecasting	Order is dynamic and hard to control part available on production schedule.	Customer can not generate accuracy forecasting.	-	-	3	4	5	***60***	Establishing Demand Management policy
			Uncertainty Demand	Creating inaccuracy MPS	Customer no have certainty demand	-	-	3	4	5	***60***	Establishing Demand Management policy
			Demand does not upload into the system.	Company does not produce part according to customer order.	Forget to upload demand.	Upload demand daily rather than weekly	Daily check with demand uploaded report	5	1	1	5	N/A
2	Check Availability of material	Checking information	Using wrong information	Creating wrong MPS	Using no update information	Using updated informaiton	Checking the date of creation	2	2	1	4	N/A
3	Master Production Schedule Trial	Trial MPS	Using wrong aggregate plan	Trial mistake	Using no update information	Using updated informaiton	Checking the date of creation	2	2	1	4	N/A
			Using in accuracy capacity	Trial mistake	The current information is worng.	Using updated informaiton	Quarterly review by planning MGR	4	3	2	***24***	Using the real capacity information
4	Generating MPS, MRP, and CRP	Generating MPS, MRP, and CRP	Inaccuracy of MRP parameters	Creating wrong MRP	Using wrong MRP parameter	-	-	4	5	3	***60***	N/A
			Demand is changed even fixed order period	Product can not be delivered to customer on schedule.	Customer changes demand	-	-	4	3	3	***36***	Establishing Demand Management policy
			No have knowledge of performing MRP effectively	Can not create MPS, MRP and CRP smoothly.	No training provide for related person	Provide training	Training Matrix	1	4	1	4	N/A
5	Creating purchasing requirement	Issue PR	Issue incomplete PR	Can not issue PO	Buyer does not circumspect for issuing PR	Purchasing Manager daily check.	PR report	3	5	1	15	N/A
6	Approve Purchasing requirement	Approve PR for issuing PO	Long lead time to open PO.	Part is sent to company delay.	Manager uses more time to approve PO	-	-	4	3	2	***24***	Implement new EDI system

No.	*Process*	*Function*	*Failure Modes*	*Failure Effects*	*Failure Causes*	*Failure Prevention*	*Failure Detection*	*S*	*O*	*D*	*RPN*	*Action R:\I:*
7	Send purchasing order to suppliers	Send PO	PO is sent to supplier quite late.	Part is sent to company delay.	Buyer issues PO too late.	Purchasing Manager daily check.	PO report	4	2	1	8	N/A
8	Inform delivery commitment to planner	Notify delivery schedule	Commit the wrong date to customer	Commit wrong product delivery date to customer	Inform wrong committed date to planner	Verify the information before sending to customer.	Commitment date report	1	2	1	2	N/A
9	Follow up supplier to delivery material	Expedite material to send as committed.	Quality problem	Need time to rework or re production	Supplier can not control quality of part.	Send supplier quality engineering team to solve the problem	100% check before sending to company.	5	2	1	10	N/A
			Make to order	Supplier can not support quick turn lot.	Supplier does not want to keep inventory since the forecasting is inaccuracy.	-	-	1	5	1	5	N/A
			Supplier cannot support fluctuated demand.	Part can not be sent before production lead time.	Wrong forecasting data	-	-	4	4	2	***32***	Establishing Demand Management policy
			Highly diversity of location of suppliers	Supplier is located far away from company.	Buy follow approved vendor list of customer.	-	-	4	4	2	***32***	Promoting Localization Project
10	Receive the parts from suppliers	Receive part and incoming inspection	The quanitity is less than PO.	Production Line is stopped.	Supplier does not check properly before dispatching	Check the quantity 100% before dispatching	Determined in work instruction.	5	3	1	15	N/A
11	Manufacturing and Inspection	Production and Inspection	Quality problem	Need time to rework or re production	Product can not be dipatched to customer on schedule	Applying pokayoke concept	100% check and detemine in procedure.	4	2	1	8	N/A
12	Delivery product to customer	Delivery product	Send the wrong product to customer	Customer complain and affect to the company performance	Do not verify product before sending	Control by adopting bar code system rather than manual checking	Barcode	1	1	2	2	N/A
			Do not send product on delivery plan		Forget to arrange the transportation car.	Hire the courier people to do transportation arrangement	Delivery report	2	1	1	2	N/A

4.1.2 Proposed Solution

Regarding to table 4.5, there are eight significant failures that RPN value shows more than 27 points and another failure that has S x D value equal eight. Consequently, there are total seven failures that required actions. In order to, insure that those failures will not be happened again in the future, those failures have to be elaborately analyzed and define appropriate solutions. The solution can be divided into two significant areas namely external and internal area.

1. External Area: This area concentrates on the method to reduce delivery lead time by managing with suppliers and customer.

- Establish Localization Project.

2. Internal Area: This area focuses on improving MRP and purchasing system by adopting below concepts.

- Demand Management Policy for Establishing MRP
- Improving Efficiency of MRP System
- Shortening Purchase Lead Time

4.2 External Area

4.2.1 Formulating Localization Project

Localization project is a method to reduce cost of product by moving out from oversea suppliers to local suppliers as well as reduce purchasing lead time. Currently, case studied company is facing with global competition, company intensively searching for the best way to achieve customer requirements; reducing cost saving and on time delivery while maintain or increase their margins and benefits. Moreover, localization activity facilitates company to minimize material lot size. For example, part A currently purchases from the company A in US with the price $ 108.3, Minimum order quantity (MOQ): 1,000, and lead time around 45 days. Once

company finishes localizing this item, company then is able to purchase part A only $83 with MOQ 300 and lead time only 14 days. Currently, case studied company is promoting this activity as a key supply chain management strategy.

4.2.2 Localization Project Workflow

The working flow of sourcing localization project can be divided into seven significant steps as show in the localization project flowchart below:

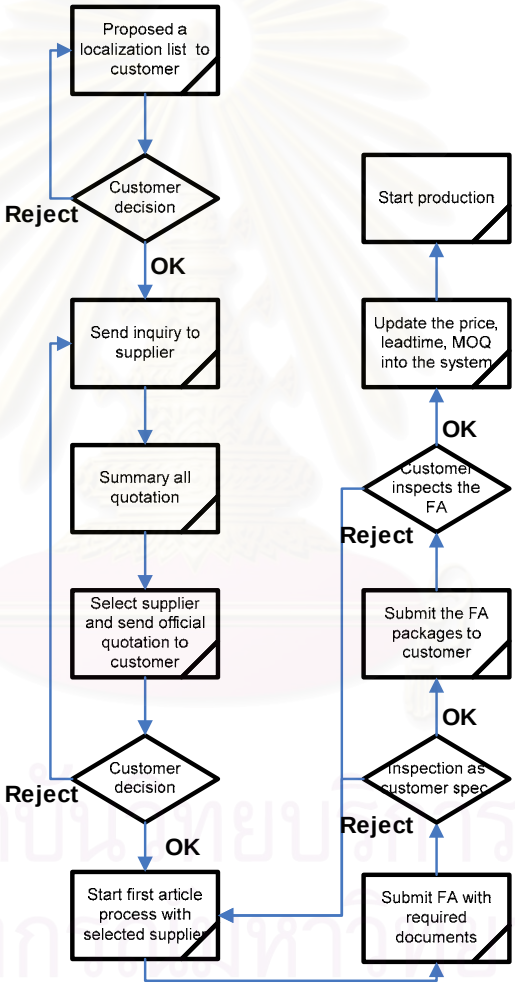


Figure 4.3: Sourcing Localization Project Workflow Chart

1. Step 1 Propose localization list to customer: According to complication of products, localization list must be approved by customer before initiate sourcing locally. Products are quite sensitive and complicate. If one of components does not conform to specification, product can be failed to perform. Once client receives the

proposed localization list, customer typically analyzes in details in order to understand localization feasibility and risk management. Moreover, customer also considers that the local suppliers are capable enough to control and maintain quality level according to specification.

2. Step 2 Send inquiry to supplier: This is the stage of sending request for quotations to all suppliers. Supply chain engineers, SCE, are fully responsible to send, follow up, and select the suppliers. Basically, there are two kinds of suppliers namely suppliers in approved vendor list and new suppliers. In case of new supplier, they are mandatory required approval from supplier quality engineering department.

Total Cost of Ownership concept, TCO, is applied into this step, which facilitates company to understand entire cost elements including intangible costs. Supplier must use case studied company's quotation format or equivalent quotation format. Typically, inquiry will be sent at least to two suppliers in order to acquire the most competitive price. The example of quotation template is shown as follow:

X Request for quotation

Change enquiry

Contact persons =>

Tel:

Fax:

Design:

Telephone:

Title:

Drawing No./ Index:

Annual production:

EMPB deadline:

Caution! Cost details must be filled in!

Process and delivery terms must be documented according to the guidelines of QS 9000 and DA 6.1.

(A) raw material costs												
Raw material (type)												
Price/unit												
Deviation												
Gross weight (g)												
Gross material costs												
Scrap weight												
Scrap costs/ Unit												
Scrap costs/ Part												
Net material price												

(B) purchased parts/external procurement			
Parts title	Vendor	Costs	
1			
2			
3			
4			
5			
6			
7			
Total		$	-

(C) process/installation costs

Process title	Machine type External/internal for external: name the vendor.	Setting time per part (sec)	Cycle time (sec)	Available capacity (units/AT)	Underlying layered Model	Hourly rate of machine (min.)		Hourly rate operator (min.)	Tool costs (USD)	Lot size (pcs)	Process costs (USD)
						depreciation	Miscellaneous				
1											
2											
3											
4											
5											
6											
7											
8											
9											
Total											

(A) raw material costs	
(B) purchased parts/external procurements	
(C) process/installation costs	
(D) Overhead	
(E) profit	
(F) packaging	
(G) transport costs	
Aggregate costs (USD)	

Remarks:

Issued Date:

Vendor signature

Figure 4.4: Quotation Format

3. Step 3 Select appropriate suppliers and send official quotations to customer: Basically, lead time for collecting all quotations is approximately two weeks after sending inquiries. Once gather all quotations, SCE has to compare the

quotations then select the most competitive supplier. Subsequently, company will send official quotations to customer for approval. Also, SCE has to request customer to issue purchasing order for first article parts and tooling, if any. First article, FA, is a compulsory parts to demonstrate the ability of supplier whether they can produce part according to the customer standard or not.

4. Step 4 Start first article process with selected suppliers: When customer endorses proposed quotation, case studied company will inform to selected suppliers to start first article process (FA). Usually, case studied company requests supplier to send the FA sample around five pieces together with related documents. The documents that supplier has to submit comprise of inspection data, control process chart, packaging standard, and process capability (C_pk). Initially, supplier has to inform submission date to company so that company can plan internal processes timeline and commit completion date to customer.

5. Step 5 Submit FA with required documents: In order to insure that part conform to the specification, supplier quality engineering team, SQE, has to inspect FA sample. SQE not only inspect FA sample according to specification, but also perform functional test in production line in order to insure the quality of FA sample before submitting report to customer. Once FA is approved, FA package will be submitted to customer in order to obtain final approval. However, in case of rejection, the reasons of rejection will be informed not only to SCE but also to supplier in order to define solutions of the problem and request for FA sample replacement.

6. Step 6 Submit the FA packages to customer: Customer carries out final approval by verifying FA inspection result and re-validate critical specification/dimension. In case of the dimensional result does not conform to customer specification, customer will inform case studied company to either re verify or disapprove the FA.

7. Step 7 Updating all parameter in the system: Once FA report is fully approved by customer; customer will send FA report back to case studied company. Subsequently, case studied company will update all significant parameters such as prices, suppliers, lead times, and etc. into Oracle system. Finally, new parameters will

be uploaded into Oracle system. Once MRP is executed by planner, purchasing order will be sent to new approved suppliers according to newly uploaded parameters.

4.2.3 Sourcing Localization Project Implementation

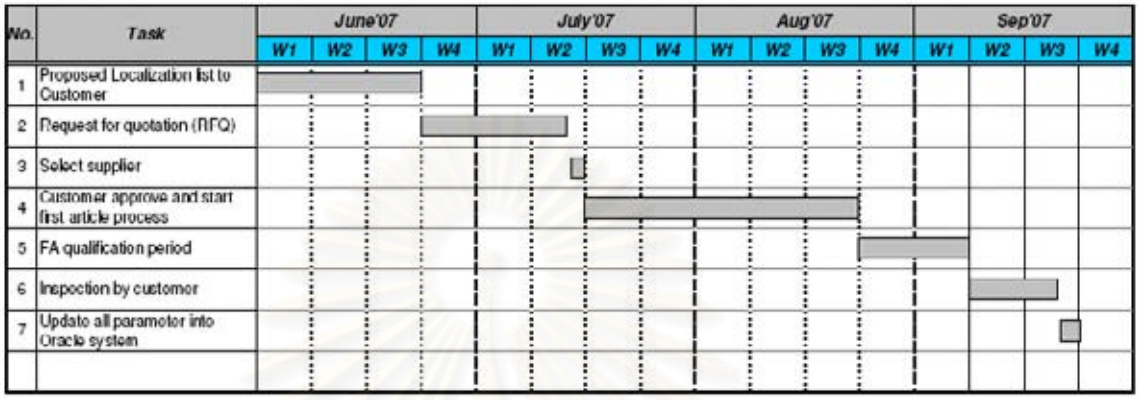


Figure 4.5: Localization Project Schedule

1. Step1 Propose a localization list to customer: As mentioned earlier on complication and sensitivity of product, localizing items must be submitted to customer in order to obtain official authorization to perform localization process with local suppliers. Standard criterion to select localization item are purchasing lead time greater than 30 days and items that produce in high cost countries such as U.S.A, Europe, Japan, etc. The proposed of localization list is shown in table 4.6. Items in table 4.6 were palpable that approval items are not in optical commodity due to they are considering as critical item. Moreover, customer does not believe in capability of local optical suppliers. Anyway, optical items can be considered as potential localization item in the future.

Table 4.6: Localization Proposed List

Localization Proposed List
Customer: AAA
Date: XXXXX

No	Part No	Description	Supplier	Location	Commodity	Consolidated Demand	MOQ	Std Cost	Lead time (Days)	Delivery Term	Customer Approval	Remark
1	0+40001525	EMA, PG5500, P-Board, 758(IIa), 4 Pump	JDS UNIPHASE CORPORATION	America	PCBA	10769	1500	433.92	84	FOB	Yes	Need fully testing in production line
2	0+4112	Connector, Scupc, Amp Receptacle, Duplex	KONCENT COMMUNICATION, INC.	America	OPTICAL	5703	5000	0.7	28	FOB	No	Critical Item; do not approve.
3	0+4364	Filter, Telemetry, 1510 S-C	BROWAVE CORPORATION	America	OPTICAL	8682	1	37.8	21	FOB	No	Critical Item; do not approve.
4	0+4367	Coupler, 98/2 1X2 S-C	AOFR PTY LIMITED	Australia	OPTICAL	79988	250	9.3	14	FOB	No	Critical Item; do not approve.
5	0+4368	Coupler, 98/2 1X2 P-C	AOFR PTY LIMITED	Australia	OPTICAL	19769	100	11.8	14	FOB	No	Critical Item; do not approve.
6	0+4369	Coupler, 98/2 1X2 S-L	AOFR PTY LIMITED	Australia	OPTICAL	1045	50	12.7	14	FOB	No	Critical Item; do not approve.
7	0+4370	COUPLER	AOFR PTY LIMITED	Australia	OPTICAL	2090	10	15	14	FOB	No	Critical Item; do not approve.
8	0+4374	Coupler, 50/50 1X2 P-L	AOFR PTY LIMITED	Australia	OPTICAL	1045	10	15	14	FOB	No	Critical Item; do not approve.
9	0+4381	Wdm, 980/1550 S-C	AOFR PTY LIMITED	Australia	OPTICAL	5256	14	19.8	14	FOB	No	Critical Item; do not approve.
10	0+4382	Wdm, 980/1550 P-C	AOFR PTY LIMITED	Australia	OPTICAL	16974	14	21.2	14	FOB	No	Critical Item; do not approve.
11	0+4383	WDM, 980/1550 BS-C	AOFR PTY LIMITED	Australia	OPTICAL	61712	14	19.3	14	FOB	No	Critical Item; do not approve.
12	0+4388	Isolator, Ss, S-C	BROWAVE CORPORATION	America	OPTICAL	63554	1	23.21	14	FOB	No	Critical Item; do not approve.
13	0+4389	Isolator, Ss, P-C	KONCENT COMMUNICATION, INC.	America	OPTICAL	50625	1	28.6	14	FOB	No	Critical Item; do not approve.
14	0+4390	Isolator, Ss, S-L	KONCENT COMMUNICATION, INC.	America	OPTICAL	2090	1	32.5	14	FOB	No	Critical Item; do not approve.
15	0+4391	ISOLATOR, DS, S- C	BROWAVE CORPORATION	America	OPTICAL	4360	1	32.93	14	FOB	No	Critical Item; do not approve.
16	0+4393	Isolator, 1480, S	KONCENT COMMUNICATION, INC.	America	OPTICAL	10769	1	36.3	14	FOB	No	Critical Item; do not approve.
17	0+4512	Coupler, 95/5 1X2 P-L	AOFR PTY LIMITED	Australia	OPTICAL	1045	50	13	14	FOB	No	Critical Item; do not approve.
18	0+4647	Photodiode, Sff-Ldc	FERMIONICS OPTO-TECHNOLOGY	America	OPTICAL	71923	1	54	30	FOB	No	Critical Item; do not approve.
19	0+4649	Coupler, Tap 980 1X2 60/40 Consold Spec	AOFR PTY LIMITED	Australia	OPTICAL	2180	10	27.8	21	FOB	No	Critical Item; do not approve.
20	0+4746	Shipping Case, 8Xx	ATLAS BOX& CRATING CO.,INC	America	SUBDIRECT	1045	300	3.6933	45	FOB	Yes	
21	0+4767	Voa, Mems, Epoxy Free	JDS UNIPHASE CORPORATION	America	OPTICAL	23290	10	232	42	FOB	No	Critical Item; do not approve.
22	0+4784	Coupler, 90/10 1X2 S-C	AOFR PTY LIMITED	Australia	OPTICAL	12949	50	11.6	14	FOB	No	Critical Item; do not approve.
23	0+4785	COUPLER, 99/ 01 1X2 S- C	AOFR PTY LIMITED	Australia	OPTICAL	10769	50	11.2	14	FOB	No	Critical Item; do not approve.
24	0+4867	Standoff, M/F #2-56 Thread .875 3/16Hex	HARDWARE SPECILATY CO.,INC	America	HARDWARE	51796	1000	0.65	56	FOB	Yes	
25	0+4868	Coupler, 95/5 1X2 P-C	AOFR PTY LIMITED	Australia	OPTICAL	25472	100	10.1	14	FOB	No	Critical Item; do not approve.
26	0+4873	Coupler, 50/50 1X2 P-C	AOFR PTY LIMITED	Australia	OPTICAL	23273	100	9.7	14	FOB	No	Critical Item; do not approve.
27	0+4874	Case, Shipping, 550	ATLAS BOX& CRATING CO.,INC	America	SUBDIRECT	2180	200	6.78	45	FOB	Yes	
28	0+4883	Isolator, Ds, P-C	KONCENT COMMUNICATION, INC.	America	OPTICAL	4180	1	36.3	14	FOB	No	Critical Item; do not approve.
29	0+4966	Retainer-Wide	GERMAN MACHINE INC.	America	MECHANICAL	8682	500	9.54	60	FOB	Yes	
30	0+4972	Foam, Splice Holder	RIMCO PLASTICS CORP.	America	MECHANICAL	4341	500	0.1	56	FOB	Yes	
31	0+4995	PCBA, PG2600 E-Board No IIC, P/N 0+4995	CTS CORPORATION	America	PCBA	11814	3000	76.35	112	FOB	Yes	Need fully testing in production line
32	0+5000145019	Pigtail, MZ, LC, 1071, Blu	BROWAVE CORPORATION	America	OPTICAL	15428	10000	21.99	21	FOB	No	Critical Item; do not approve.
33	0+5000810	Cover, Coil Pocket, IIa	GERMAN MACHINE INC.	America	MECHANICAL	12949	300	3.807	60	FOB	Yes	
34	0+5000872	Screw, #2-56 X .75 Lg., Shcs	HARDWARE SPECILATY CO.,INC	America	HARDWARE	21538	5000	0.75	56	FOB	Yes	
35	0+5001405	Base, Assembly, Mts	HIGH TECH MACHINISTS INC.	America	MECHANICAL	2180	5000	80	42	FOB	Yes	
36	0+5001408	Holder, Pigtail	GERMAN MACHINE INC.	America	MECHANICAL	2180	800	6.24	52	FOB	Yes	
37	0+5009798	Photodiode InGaAs PIN Hgh-Speed Dia 5.5	JDS UNIPHASE CORPORATION	America	OPTICAL	8540	90	23	70	FOB	No	Critical Item; do not approve.
38	0+5077	Amp Label, No Die Cut, Laser Class 3B	GM NAMEPLATE	America	SUBDIRECT	15132	1000	1.7	45	FOB	Yes	
39	0+5145	Gff, Single Standard C-Band Ii, G20	BROWAVE CORPORATION	America	OPTICAL	4341	1	118.11	21	FOB	No	Critical Item; do not approve.
40	0+5147	Gff, Single Standard C-Band Ii, G29	BROWAVE CORPORATION	America	OPTICAL	21538	1	116.5824	21	FOB	No	Critical Item; do not approve.

No	Part No	Description	Supplier	Location	Commodity	Consolidated Demand	MOQ	Std Cost	Lead time (Days)	Delivery Term	Customer Approval	Remark
41	0+5165	Gff, IIa Rev 2 (Old 5092)	BROWAVE CORPORATION	America	OPTICAL	2180	1	150.6	21	FOB	No	Critical Item; do not approve.
42	0+5246	SCREW, 2- 56 X 3/ 8 SHCS, SS	HARDWARE SPECILATY CO.,INC	America	HARDWARE	43076	5000	0.97	56	FOB	Yes	
43	0+5254	Splicing Compound (2 Oz Bottle)	HORIZON SOLUTIONS CORP.	America	SUBDIRECT	1539.81	6	30.6	30	FOB	Yes	
44	0+5294	Wdm, 980/1550 L-Band	AOFR PTY LIMITED	Australia	OPTICAL	8360	50	29	14	FOB	No	Critical Item; do not approve.
45	0+5312	GFF	BROWAVE CORPORATION	America	OPTICAL	1045	1	167.44	21	FOB	No	Critical Item; do not approve.
46	0+5363	Filter, Telemetry 1510 S-C < .6 II	BROWAVE CORPORATION	America	OPTICAL	3504	1	33.5616	21	FOB	No	Critical Item; do not approve.
47	0+5365	Coupler, 80/20 1X2 P-C	AOFR PTY LIMITED	Australia	OPTICAL	1752	100	13	14	FOB	No	Critical Item; do not approve.
48	0+907	Label, Dcm 4 X 1.75 Zebra (3000/Roll)	GM NAMEPLATE	America	SUBDIRECT	11406	10000	0.24	28	FOB	Yes	
49	1015303	Coupler 1x2 1% C-Band	BROWAVE CORPORATION	America	OPTICAL	4496	1	8.2	42	FOB	No	Critical Item; do not approve.
50	40002455	Label, Outer carton Barolo Product	GM NAMEPLATE	America	SUBDIRECT	2248	1500	1.12	21	FOB	Yes	
51	40002456	Label, Blank 5x3" Matte White Perm Paper	GM NAMEPLATE	America	SUBDIRECT	2248	1000	0.11	21	FOB	Yes	
52	4438321	Fusion Sleeve 40mm Mini	PRO-STAINLESS ,INC.	America	MECHANICAL	13488	1000	0.464	56	FOB	Yes	
53	5006281-300	WDM Dvc 3PCX1F 1547.465 3.19nm PB C	KONCENT COMMUNICATION, INC.	America	OPTICAL	2248	50	120	3	FOB	No	Critical Item; do not approve.
54	5006730	Foam Silicone 1/16" Thk w/Adhesive Back	MCMASTER-CARR SUPPLY COMPA	America	SUBDIRECT	2248	500	21	56	Ex work	Yes	
55	5007662	Rubber Boot (1F) 1Fiber Silicone UL94	KENT H LANDSBERG	America	SUBDIRECT	2248	10000	0.4	56	FOB	Yes	
56	5008892	Coupler 1x2 2% C-Band Low PDL	BROWAVE CORPORATION	America	OPTICAL	4496	1	6.9	42	FOB	No	Critical Item; do not approve.
57	5009070-300	WDM Dvc 3PCX1F 1547.465 3.19nm PB C	BROWAVE CORPORATION	America	OPTICAL	2248	1	102	21	FOB	No	Cannot change supplier.
58	5009160	Crystal 25.0 MHz 18pF SMT	DIGI-KEY CORPORATION	America	ELECTRICAL	13488	10000	0.64	84	Ex work	Yes	
59	5009165	Label, Pizza Box Barolo	GM NAMEPLATE	America	SUBDIRECT	2248	5000	0.13	50	FOB	Yes	
60	5009170	IC MC74HC1G08 Single 2-Input AND Gate S	NUCLEUS ELECTRONICS LTD.	America	ELECTRICAL	2248	3000	0.0597	98	FOB	Yes	
61	5009215	DWDM Dummy	GERMAN MACHINE INC.	America	MECHANICAL	2248	1000	1.0391	45	FOB	Yes	
62	5009220	Kit B&P, Barolo SOADM 1 Band Mdl Ass'y	AVANEX CORPORATION	America	PCBA	15736	10000	89.3	45	CIF	No	Cannot change supplier.
63	5009371	Kit OPT, PEFX001XCEV05P6 Mdl Ass'y	AVANEX CORPORATION	America	PCBA	2248	10000	85.9	45	CIF	No	Cannot change supplier.
64	5009543	IC PS29FS001 128Kx8 Ultra High-Speed Fla	AVANEX CORPORATION-AFM	America	ELECTRICAL	2248	2000	5	84	CIF	Yes	
65	5009784	IC MC74HC1G04 Single InverterSOT23-5	NUCLEUS ELECTRONICS LTD.	America	ELECTRICAL	2248	2500	0.0597	84	FOB	Yes	
66	5010314	Dummy Coupler	GERMAN MACHINE INC.	America	MECHANICAL	8992	1000	8.34	45	FOB	Yes	
67	5010493	VOA Broad Band Vertical	LIGHTCONNECT, INC	America	OPTICAL	2248	1	279	42	FOB	No	Critical Item; do not approve.
68	5010499-300	VOA Medium Band Vertical 1541.70~1553.27	LIGHTCONNECT, INC	America	OPTICAL	2248	1	175	45	FOB	No	Critical Item; do not approve.
69	5011042	Photodiode InGaAs PIN 80ยดm Dia w/Pigtail	KYOSEMI OPTO AMERICA CORPOR	America	OPTICAL	2248	1000	20	42	FOB	No	Critical Item; do not approve.
70	5012423	Box Pizza Barolo (Korrvu)	ATLAS BOX& CRATING CO.,INC	America	SUBDIRECT	2248	1000	25.89	45	FOB	Yes	
71	5012424	Box Barolo Insert (Korrvu)	ATLAS BOX& CRATING CO.,INC	America	SUBDIRECT	2248	1000	12.1	45	FOB	Yes	
72	5012425	Box Barolo Overwrap (Korrvu)	ATLAS BOX& CRATING CO.,INC	America	SUBDIRECT	2248	1500	5.32	45	FOB	Yes	
73	5012426	Box Barolo Shipping Overpack(Korrvu)	ATLAS BOX& CRATING CO.,INC	America	SUBDIRECT	2248	500	2.67	45	FOB	Yes	
74	5012502	Broadband VOA	SANTEC USA CORP	America	OPTICAL	2248	1	267	42	FOB	No	Critical Item; do not approve.
75	5012505-300	Medium-Band VOA 1539.17-1553.27	BROWAVE CORPORATION	America	OPTICAL	2248	1000	163	28	FOB	No	Critical Item; do not approve.
76	7590010042027	Pump, 974.5+/-0.5nm, 250mW, JDSU, 2700	JDS UNIPHASE CORPORATION	America	OPTICAL	2180	10	425	42	FOB	No	Critical Item; do not approve.
77	7875000090001	Cover, Pg1500, Skirted	GERMAN MACHINE INC.	America	MECHANICAL	15428	300	40.488	42	FOB	Yes	
78	8069031	Tubing Silicone 1.98x3.18mm	MCMASTER-CARR SUPPLY COMPA	America	SUBDIRECT	44.96	3000	0.89	56	Ex work	Yes	
79	9506331	Tubing Silicone 5/32"ID 7/32"OD 1/32"Wal	MCMASTER-CARR SUPPLY COMPA	America	SUBDIRECT	44960	3000	0.88	56	Ex work	Yes	
80	C01200030	Dust Caps, Sc Connector Nortel	CMP PLASTICS INTERNATIONAL IN	America	OPTICAL	20868	10000	0.02	14	FOB	No	Critical Item; do not approve.
81	C04050009	Label, Caution Sensitive	GM NAMEPLATE	America	SUBDIRECT	33019	3000	0.57	45	FOB	Yes	
82	C04050012	Label, Attention Static Senitive	GM NAMEPLATE	America	SUBDIRECT	7138	3000	0.42	45	FOB	Yes	
83	C04050016	Label, This End Up	GM NAMEPLATE	America	SUBDIRECT	24746	5000	0.41	45	FOB	Yes	
84	C07030005	BAG - STATIC SHIELD	HORIZON SOLUTIONS CORP.	America	SUBDIRECT	16473	2000	0.08	45	FOB	Yes	
85	0+40000788	ASSEMBLY, SPOOL, 202X95X30	UNITED PRECISION	America	MECHANICAL	4507	500	85.8	45	FOB	Yes	
86	400007470001	BASEPLATE, SMALL, BLACK, 19in DCM RA	UNITED PRECISION	America	MECHANICAL	4507	500	39.2	45	FOB	Yes	
87	400007460001	FACEPLATE, SMALL, BLACK, NO LOGO	UNITED PRECISION	America	MECHANICAL	4507	100	35.92	45	FOB	Yes	
88	400006280001	WINDOW, BULKHEAD, SC DUPLEX, BLAC	UNITED PRECISION	America	MECHANICAL	4507	500	69.23	45	FOB	Yes	
89	400007480001	COVER, SMALL, BLACK, 19in DCM RACK	UNITED PRECISION	America	MECHANICAL	4507	500	18.3	45	FOB	Yes	

2. Step 2 and Step 3: Inquiries so called request for quotation, RFQ, of each item will be sent to suppliers. Suppliers must perform the RFQ process by breakdown all costs in details by using company's format. Typically, inquiries are sent to at least two suppliers of each item in order to attain the most advantage prices. Usually, these two steps consume approximately four weeks to complete the tasks. Example of the quotation from supplier is demonstrated in the figure follow:

Once company gathered all quotations from all suppliers, case studied company then start supplier selection in order to select appropriate suppliers for FA process. Subsequently, case studied company summarized all results and prepared official quotation for customer. The list of selected supplier is shown in table 4.7.

3. Step 4: Once obtaining the approval list from customer, case studied company sent official email to suppliers to start producing FA sample. Typically, suppliers must submit fabricating lead time to case studied company at early stage, due to case studied company has to inform FA completion date to customer. The fabricating lead time is usually the same lead time shown in quotation. In this phase, supply chain engineers are responsible to monitor and manage the project in term of quality, technical issues, and delivery schedule from supplier.

4. Step 5: FA samples were submitted to supplier quality engineering team, SQE, along with complete required documents which are shown in table below 4.8.

X Request for quotation

Change enquiry

Contact persons => Mr. Bala Raj
Tel: 663-564-342
Fax: 663-564-343
Design:
Telephone:
Title: Managing Director
Drawing No./ Index: 0+4966 Retainer-Wide
Annual production:
EMPB deadline:

Caution! Cost details must be filled in!

Process and delivery terms must be documented according to the guidelines of QS 9000 and DA 6.1.

(A) raw material costs			(B) purchased parts/external procurement		
Raw material (type)	AL6061-T6		Parts title	Vendor	Costs
Price/unit	$10.15/Kg		1		
Deviation	-		2		
Gross weight (g)	232.000		3		
Gross material costs	$ 2.320		4		
Scrap weight	-		5		
Scrap costs/ Unit	-		6		
Scrap costs/ Part	$ 0.30		7		
Net material price	$ 2.620		Total		$ -

(C) process/installation costs

Process title	Machine type External/internal for external: name the vendor.	Setting time per part (sec)	Cycle time (sec)	Available capacity (units/AT)	Underlying layered Model	Hourly rate of machine (min.)		Hourly rate operator (min.)	Tool costs (USD)	Lot size (pcs)	Process costs (USD)
						depreciation	Miscellaneous				
1	Cutting	10	2	350000.0					-	100	$ 0.020
2	Machining	30	344	150000.0					-	100	$ 2.130
3	Deburring	30	23	600000.0					-	100	$ 0.120
4	Cleaning	30	10	600000.0					-	100	$ 0.040
5	Black Anodise	60	31	375000.0					-	100	$ 0.210
6	Packaging	10	8	534000.0					-	100	$ 0.010
7											
8											
9											
Total											$ 2.530

(A) raw material costs	$ 2.620
(B) purchased parts/external procurements	$ -
(C) process/installation costs	$ 2.530
(D) Overhead	$ 0.500
(E) profit	$ 0.339
(F) packaging	$ 0.200
(G) transport costs	$ 0.650
Aggregate costs (USD)	$ 6.84

Remarks: Delivery Term: Door to Door
Credit Term: 60 days after billing
Minimum Order Quantity: 100 Pcs
Lead time: 14 days
Issued Date: 3 May 2007
Vendor signature BALA RAJ

Figure 4.6: Quotation of 0+4966

Table 4.7: Comparison List

Localization Project: Comparison List
Customer: AAA
Date:

No.	Part No	Description	Commodity	Supplier	Quoted Price	MOQ	Lead time	Inco Term	Selection
				ANS INDUSTRIAL CO., LTD	362.1	1500	28	FOB	
1	0+40001525	EMA, PG5500, P-Board, 758(IIa), 4 Pump	PCBA	SCE ELECTRONICS(S) PTE LTD	353.2	800	28	CIF Bangkok	Yes
				INTER CENTER PACK (THAILAND) CO.,LTD.	2.89	100	28	Door to Door	Yes
2	0+4746	Shipping Case, 8Xx	SUBDIRECT	IDEAL JACOBS (XIAMEN) CORPORATION	2.94	100	28	Door to Door	
				COFFER INDUSTRIES LTD.	0.63	1000	28	Ex work	
3	0+4867	Standoff, M/F #2-56 Thread .875 3/16Hex	HARDWARE	BOSSARD (THAILAND) CO.,LTD	0.6	1000	28	Door to Door	Yes
				ADAMPAK (THAILAND) LTD.	5.89	200	14	Door to Door	
4	0+4874	Case, Shipping, 550	SUBDIRECT	INTER CENTER PACK (THAILAND) CO.,LTD.	5.52	200	14	Door to Door	Yes
				MECHILL ENGINEERING CO., LTD.	6.84	100	14	Door to Door	Yes
5	0+4966	Retainer-Wide	MECHANICAL	GLOBAL-THAIXON PRECISION INDUSTRY CO.,LTD.	7.32	300	21	Door to Door	
				SWIFTRONIC (THAILAND) CO.,LTD.	0.052	150	21	Door to Door	
6	0+4972	Foam, Splice Holder	MECHANICAL	FOAMEX (THAILAND) CO.,LTD	0.05	100	28	Door to Door	Yes
				SANMINA-SCI SYSTEMS SINGAPORE PTE LTD	58.33	1000	28	FOB	Yes
7	0+4995	PCBA, PG2600 E-Board No IIC, P/N 0+4995, Rev B	PCBA	KAGA ELECTRONICS (THAILAND) CO.,LTD.	64.81	1000	28	Door to Door	
				MECHILL ENGINEERING CO., LTD.	2.56	100	14	Door to Door	Yes
8	0+5000810	Cover, Coil Pocket, IIa	MECHANICAL	IPE COMERCIAL OFFSHORE DE MACAU LIMITEADA	2.59	250	14	FOB	
				GLOBAL-THAIXON PRECISION INDUSTRY CO.,LTD.	3.21	100	14	Door to Door	
				BOSSARD (THAILAND) CO.,LTD	0.65	3000	28	Door to Door	Yes
9	0+5000872	Screw, #2-56 X .75 Lg., Shcs	HARDWARE	COFFER INDUSTRIES LTD.	0.72	5000	28	Ex work	
				GLOBAL THAIXON CO.,LTD	38.43	500	28	Door to Door	Yes
10	0+5001405	Base, Assembly, Mts	MECHANICAL	MECHILL ENGINEERING CO., LTD.	39.56	500	28	Door to Door	
				MECHILL ENGINEERING CO., LTD.	5.31	100	14	Door to Door	Yes
11	0+5001408	Holder, Pigtail	MECHANICAL	GLOBAL THAIXON CO.,LTD	5.49	100	21	Door to Door	
				IDEAL JACOBS (XIAMEN) CORPORATION	0.8	1000	14	CIF Bangkok	Yes
12	0+5077	Amp Label, No Die Cut, Laser Class 3B	SUBDIRECT	BRADY (THAILAND) CO.,LTD.	0.93	1500	14	Door to Door	
				BOSSARD (THAILAND) CO.,LTD	0.69	1000	28	Door to Door	Yes
13	0+5246	SCREW, 2- 56 X 3/ 8 SHCS, SS	HARDWARE	COFFER INDUSTRIES LTD.	0.053	1000	28	Ex work	
				GLOBALTRONIC INTERTRADE CO., LTD	24.5	1	14	Door to Door	Yes
14	0+5254	Splicing Compound (2 Oz Bottle)	SUBDIRECT	CR DISTRIBUTION CO.,LTD.	24.9	1	28	Door to Door	
				IDEAL JACOBS (XIAMEN) CORPORATION	0.15	1000	14	CIF Bangkok	Yes
15	0+907	Label, Dcm 4 X 1.75 Zebra (3000/Roll)	SUBDIRECT	BRADY (THAILAND) CO.,LTD.	0.34	1500	28	Door to Door	
				IDEAL JACOBS (XIAMEN) CORPORATION	0.73	1000	14	CIF Bangkok	Yes
16	40002455	Label, Outer carton Barolo Product	SUBDIRECT	BRADY (THAILAND) CO.,LTD.	0.92	1000	14	Door to Door	
				IDEAL JACOBS (XIAMEN) CORPORATION	0.08	1000	14	CIF Bangkok	Yes
17	40002456	Label, Blank 5x3" Matte White Perm Paper	SUBDIRECT	BRADY (THAILAND) CO.,LTD.	0.11	1500	21	Door to Door	
				IPE COMERCIAL OFFSHORE DE MACAU LIMITEADA	0.32	500	28	FOB	
18	4438321	Fusion Sleeve 40mm Mini	MECHANICAL	MECHILL ENGINEERING CO., LTD.	0.283	300	28	Door to Door	Yes
				SWIFTRONIC (THAILAND) CO.,LTD.	16.2	500	28	Door to Door	Yes
19	5006730	Foam Silicone 1/16" Thk w/Adhesive Back	SUBDIRECT	GLOCOM MARKETING PTE LTD	16.7	500	28	FOB	
20	5007662	Rubber Boot (1F) 1Fiber Silicone UL94	SUBDIRECT	FIRST SILICON CO.,LTD	0.3	5000	28	Door to Door	Yes

No.	Part No	Description	Commodity	Supplier	Quoted Price	MOQ	Lead time	Inco Term	Selection
				HI-REL LIDS LTD	0.63	5000	35	FOB	
21	5009160	Crystal 25.0 MHz 18pF SMT	ELECTRICAL	CASIX, INC.	0.59	5000	28	FOB	Yes
				BRADY (THAILAND) CO.,LTD.	0.84	3000	28	CIF Bangkok	
22	5009165	Label, Pizza Box Barolo	SUBDIRECT	IDEAL JACOBS (XIAMEN) CORPORATION	0.08	3000	14	CIF Bangkok	Yes
				WINTECH MICROELECTRONICS SINGAPORE PTE LTD	0.05	1500	28	FOB	Yes
23	5009170	IC MC74HC1G08 Single 2-Input AND Gate SO	ELECTRICAL	TTI ELECTRONICS ASIA PTE LTD.	0.052	1500	28	FOB	
				GLOBAL THAIXON CO.,LTD	0.08	300	28	Door to Door	Yes
24	5009215	DWDM Dummy	MECHANICAL	IPE COMERCIAL OFFSHORE DE MACAU LIMITEADA	0.95	500	28	FOB	
				ARROW ELECTRONICS ASIA (S) PTE LTD.	4.6	1000	28	FOB	
25	5009543	IC PS29FS001 128Kx8 Ultra High-Speed Fla	ELECTRICAL	FE GLOBAL ELECTRONICS PTE LTD	4.5	1000	28	FOB	Yes
				FE GLOBAL ELECTRONICS PTE LTD	0.05	1000	28	FOB	Yes
26	5009784	IC MC74HC1G04 Single InverterSOT23-5	ELECTRICAL	WINTECH MICROELECTRONICS SINGAPORE PTE LTD	0.05	3000	28	FOB	
				MECHILL ENGINEERING CO., LTD.	4.75	500	14	Door to Door	Yes
				GLOBAL THAIXON CO.,LTD	5.23	500	14	Door to Door	
27	5010314	Dummy Coupler	MECHANICAL	IPE COMERCIAL OFFSHORE DE MACAU LIMITEADA	4.86	800	21	FOB	
				INTER CENTER PACK (THAILAND) CO.,LTD.	12.2	200	28	Door to Door	Yes
28	5012423	Box Pizza Barolo (Korrvu)	SUBDIRECT	ADAMPAK (THAILAND) LTD.	12.7	500	28	CIF Bangkok	
				INTER CENTER PACK (THAILAND) CO.,LTD.	8.1	200	14	Door to Door	Yes
29	5012424	Box Barolo Insert (Korrvu)	SUBDIRECT	ADAMPAK (THAILAND) LTD.	8.5	200	21	Door to Door	
				INTER CENTER PACK (THAILAND) CO.,LTD.	4.1	500	28	Door to Door	Yes
30	5012425	Box Barolo Overwrap (Korrvu)	SUBDIRECT	ADAMPAK (THAILAND) LTD.	4.24	500	28	Door to Door	
				INTER CENTER PACK (THAILAND) CO.,LTD.	1.82	300	28	Door to Door	Yes
31	5012426	Box Barolo Shipping Overpack(Korrvu)	SUBDIRECT	ADAMPAK (THAILAND) LTD.	2.59	300	28	Door to Door	
				MECHILL ENGINEERING CO., LTD.	25.13	100	28	Door to Door	Yes
32	7875000090001	Cover, Pg1500, Skirted	MECHANICAL	IPE COMERCIAL OFFSHORE DE MACAU LIMITEADA	27.34	300	28	FOB	
				FIRST SILICON CO.,LTD	0.75	1000	28	Door to Door	Yes
33	8069031	Tubing Silicone 1.98x3.18mm	SUBDIRECT	HLN RUBBER PRODUCTS PTE LTD	0.75	3000	28	Ex work	
				FIRST SILICON CO.,LTD	0.75	1000	28	Door to Door	Yes
34	9506331	Tubing Silicone 5/32"ID 7/32"OD 1/32"Wal	SUBDIRECT	HLN RUBBER PRODUCTS PTE LTD	0.81	3000	28	Ex work	
				IDEAL JACOBS (XIAMEN) CORPORATION	0.13	1000	14	CIF Bangkok	Yes
35	C04050009	Label, Caution Sensitive	SUBDIRECT	BRADY (THAILAND) CO.,LTD.	0.26	1200	14	Door to Door	
				IDEAL JACOBS (XIAMEN) CORPORATION	0.26	1000	14	CIF Bangkok	Yes
36	C04050012	Label, Attention Static Senitive	SUBDIRECT	BRADY (THAILAND) CO.,LTD.	0.45	1200	14	Door to Door	
				IDEAL JACOBS (XIAMEN) CORPORATION	0.11	1000	14	CIF Bangkok	Yes
37	C04050016	Label, This End Up	SUBDIRECT	BRADY (THAILAND) CO.,LTD.	0.21	2000	14	Door to Door	
				BRADY (THAILAND) CO.,LTD.	1.0	1000	28	Door to Door	Yes
38	C07030005	BAG - STATIC SHIELD	SUBDIRECT	L.M. INDUSTRY LTD.,PART.	2.4	1000	28	Door to Door	
				JINPAO PRECISION INDUSTRY CO.,LTD.	49.2	100	21	Door to Door	Yes
39	0+40000788	ASSEMBLY, SPOOL, 202X95X30	MECHANICAL	THAIFIRST PRECISION CO.,LTD	51.2	150	21	Door to Door	
				JINPAO PRECISION INDUSTRY CO.,LTD.	13.4	100	21	Door to Door	Yes
41	400007470001	BASEPLATE, SMALL, BLACK, 19in DCM RACK	MECHANICAL	THAIFIRST PRECISION CO.,LTD	14.2	150	21	Door to Door	
				THAIFIRST PRECISION CO.,LTD	12.28	150	21	Door to Door	
41	400007460001	FACEPLATE, SMALL, BLACK, NO LOGO	MECHANICAL	JINPAO PRECISION INDUSTRY CO.,LTD.	#N/A	100	21	Door to Door	Yes
				JINPAO PRECISION INDUSTRY CO.,LTD.	24.1	100	21	Door to Door	Yes
42	400006280001	WINDOW, BULKHEAD, SC DUPLEX, BLACK	MECHANICAL	THAIFIRST PRECISION CO.,LTD	25.2	150	21	Door to Door	
				THAIFIRST PRECISION CO.,LTD	5.8	150	21	Door to Door	
43	400007480001	COVER, SMALL, BLACK, 19in DCM RACK	MECHANICAL	JINPAO PRECISION INDUSTRY CO.,LTD.	#N/A	100	21	Door to Door	Yes

Table 4.8: Documentary Requirement for FA Approving

Production Part Approval Process Requirement (from Supplier)

Item	Requirement	PCB	Mechanical	Elec/Optical		Hardware	Indirect
				Std	Custom		
1.	Samples ***with Identification Label****	S	S	S	S	S	S
2.	Drawing/Specification	S	S	S	S	S	S
3.	Certificate of Compliance	S	S	N/A	S	S	S
4.	Material Certificate	S	S	N/A	S	S	S
5.	UL Certification	S	N/A	N/A	S	N/A	S
6.	Visual Inspection Report (if applicable)	S	S	N/A	S	S	S
7.	Dimensional Measurement Report	S	S	N/A	S	S	S
8.	MSA Study & GR&R	R	R	N/A	R	R	R
9.	Cpk data of Critical Parameter*	***S***	***S***	N/A	***S***	R	R
10.	Tooling Design with Drawing/Photo	N/A	S	N/A	S	N/A	N/A
11.	Process Flow Chart	S	S	N/A	S	S	S
12.	Process Control Plan	S	S	N/A	S	S	S
13.	FMEA	R	R	N/A	R	R	R
14.	Packaging Proposal	S	S	S	S	S	S

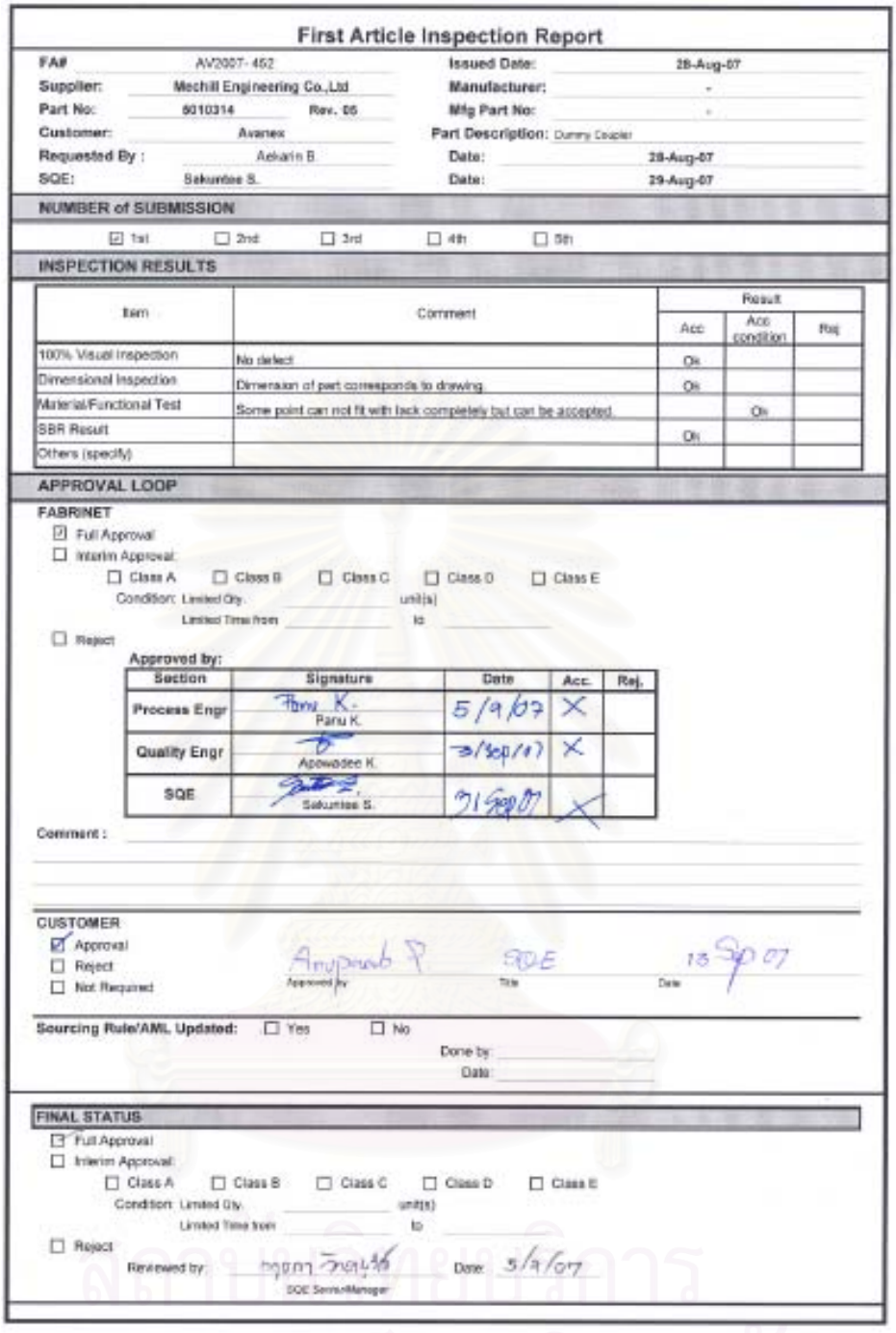
S = Supplier shall submit data or information to company as part of First Article Inspection/PPAP

R = Supplier shall provide data or information to company upon request as part of First Article Inspection/PPAP

C = If requested by company's customer, supplier shall submit data or information to company as part of First Article inspection/PPAP

* = The minimum required acceptance criteria for the PPAP initial study shall be a Cpk or Ppk of 1.67 or 1.33 during mass production from at least 30 samples.

Apparently, required documents for FA depend on requirement of each commodity. It depends on component category such as PCB, Mechanical part, Electrical part, Hardware, and etc. In this stage, there are 38 items which are able to continue with FA process. All FAs were submitted to customer along with First Article Inspection Report Cover Sheet as shown in figure 4.7.



First Article Inspection Report

FA# AV2007-452 Issued Date: 28-Aug-07
Supplier: Mechill Engineering Co.,Ltd Manufacturer: -
Part No: 6010314 Rev. 05 Mfg Part No: -
Customer: Avanex Part Description: Dummy Coupler
Requested By : Aekarin B. Date: 28-Aug-07
SQE: Sakuntee S. Date: 29-Aug-07

NUMBER of SUBMISSION

☑ 1st ☐ 2nd ☐ 3rd ☐ 4th ☐ 5th

INSPECTION RESULTS

Item	Comment	Result		
		Acc	Acc condition	Rej
100% Visual Inspection	No defect	Ok		
Dimensional Inspection	Dimension of part corresponds to drawing	Ok		
Material/Functional Test	Some point can not fit with lock completely but can be accepted.		Ok	
SBR Result		Ok		
Others (specify)				

APPROVAL LOOP

FABRINET

☑ Full Approval
☐ Interim Approval:
☐ Class A ☐ Class B ☐ Class C ☐ Class D ☐ Class E
Condition: Limited Qty. unit(s)
Limited Time from to
☐ Reject

Approved by:

Section	Signature	Date	Acc.	Rej.
Process Engr	Paru K.	5/9/07	X	
Quality Engr	Apawadee K.	31/Aug/07	X	
SQE	Sakuntee S.	31/Aug/07	X	

Comment :

CUSTOMER

☑ Approval
☐ Reject
☐ Not Required
Approved by: Anupamb P. Title: SQE Date: 18 Sep 07

Sourcing Rule/AML Updated: ☐ Yes ☐ No
Done by:
Date:

FINAL STATUS

☑ Full Approval
☐ Interim Approval:
☐ Class A ☐ Class B ☐ Class C ☐ Class D ☐ Class E
Condition: Limited Qty. unit(s)
Limited Time from to
☐ Reject
Reviewed by: Date: 5/9/07
SQE Senior/Manager

Form-SQE-001 Rev.05

Figure 4.7: First Article Inspection Report

5. Step 6 and Step 7: Case studied company submitted qualified FA packages to customer in order to request for final approval. After submitting FA package, customer inspected part specification along with FA results from case studied company. According to the study, all FA packages were approved. Thus all

parameters such as supplier name, lead time, MOQ, pricing were updated into Oracle system. Generally, parameters must be updated into the system before Friday afternoon in order to insure that purchased part will be ordered on next ordering period.

To sum up, it is obvious that localization is effective technique to encourage company to minimize not only lead time of purchasing material and lot size but also pricing. Nevertheless, localization cannot be reduced for every item. Thus, some items still have long purchasing lead time.

4.3 Internal Area

4.3.1 Establishing Demand Management Policy

As mentioned in chapter 3, there were several resources that were required for generating material requirement planning (MRP). They are three elements that are significant parts of MRP as Bill of Materials, inventory data and MPS. Typically, MPS is the most important resource to generate MRP. If there is some changes in MPS, it will affect to MRP result and ordering particularly any change after purchasing orders already sent to suppliers. From the study, planning horizon should be at least as long as the longest cumulative lead time of components and demand in this period of time should be fixed in MPS. If any change occurs to MPS, MPS will impact on MRP result and eventually affect to delivery schedule.

1. Current Demand Situation of Case Studied Company

Usually, MPS is generated and released in every Thursday and MRP is processed in Friday evening. Once the MRP is processed completely, MRP result might need to be adjusted manually and sent to manager for approval. After MRP process, Oracle system automatically send signal to buyer for PR and PO generating respectively. POs will be sent to suppliers within one working day, then suppliers must respond with delivery commitment to case studied company not later than the week of receiving PO or four days after receiving PO.

According to figure 4.8, MRP is generated on week x and production has to start on week x + 6. Therefore, materials must be available in warehouse prior production plan. In order to guarantee that the material will available in warehouse, buyers' team has to concentrate on expediting material to deliver within committed schedule particularly items with long lead time. In this product, the longest purchasing lead time is 35 days or 5 weeks which has to be ordered on day x-35. This item is the most critical part due to there is no time for error while the rest of items can be delayed around one to three weeks. In conclusion, buyer must concentrate on this part in order to have part available prior production.

According to historical data, it can be found that demand of each week is lumpy and fluctuated throughout planning horizon. By comparing MPS of each week, it can be found that even the demand of week x+1 fluctuated week by week. Apparently, the changing of demand after submitting the PO radically affect to material availability. Basically, cause of deviation can be divided into two significant causes namely change of customer's order and incorrect MRP parameters; manufacturing yield and etc.

Bom No. 306510005ALT01 Marconi P3C Edfa

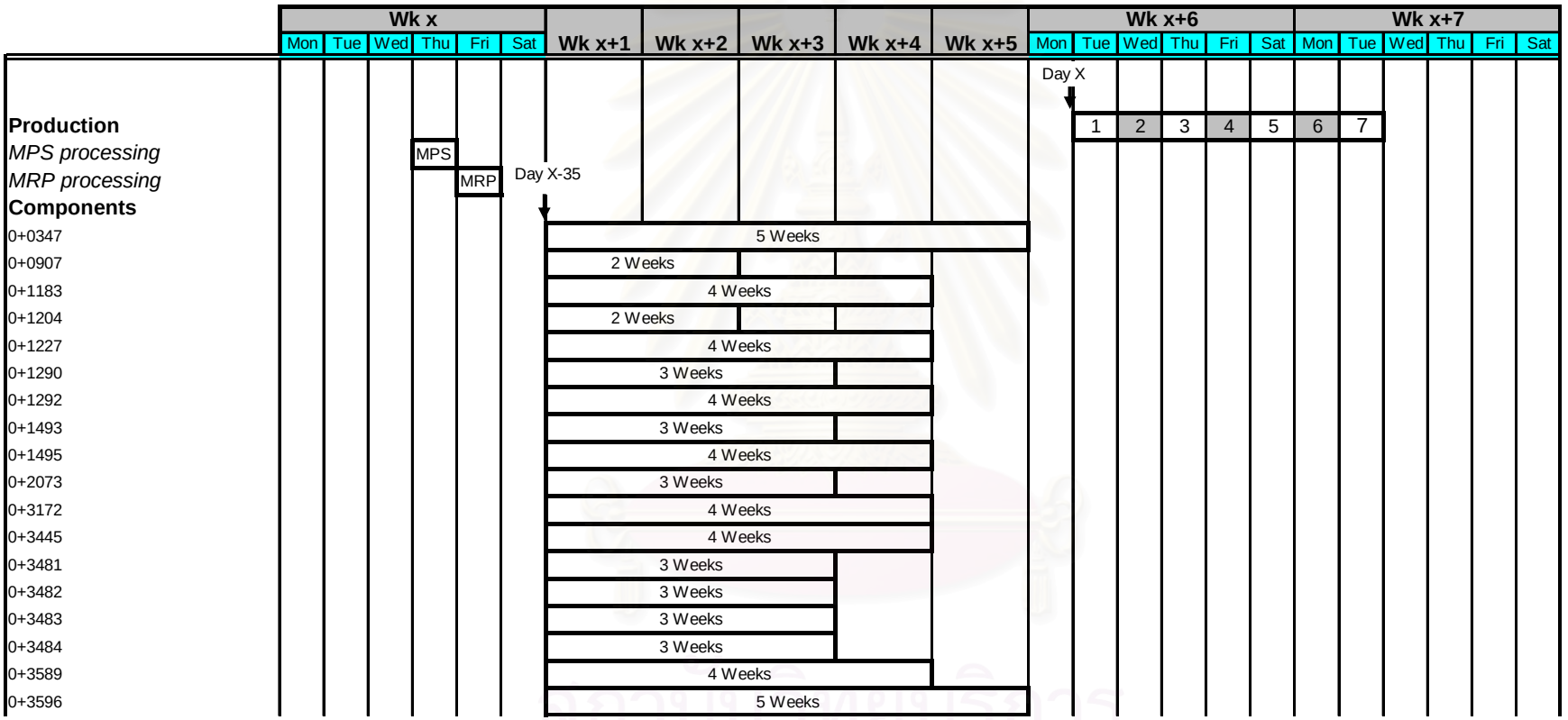


Figure 4.8: Example of Current MRP Schedule

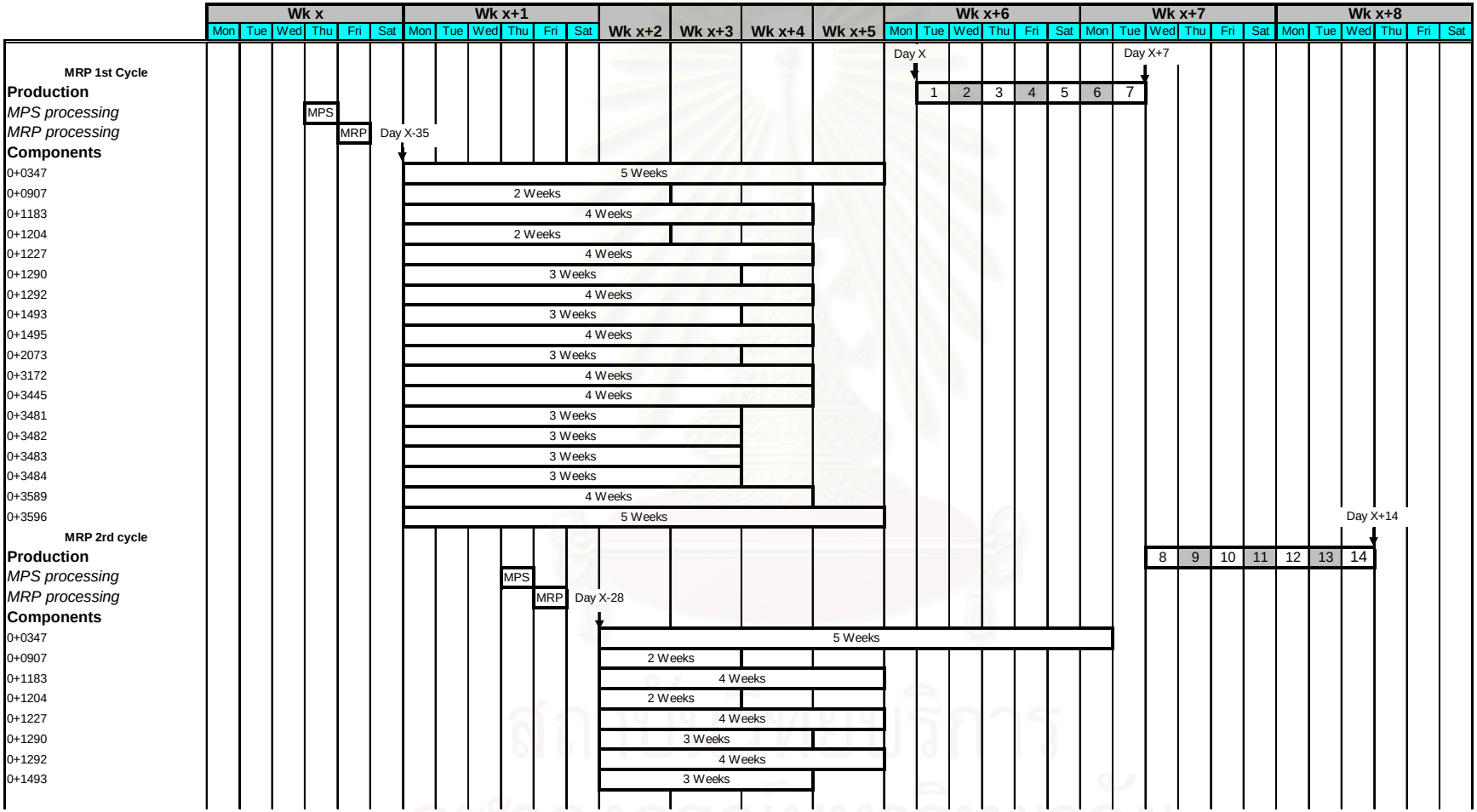


Figure 4.9: Example of MRP schedule for 2nd cycle

From figure 4.9, company committed to customer on the first of MRP that production must be completed on Day x+7 of week x+7. However, once demand of week x+6 has been changed, supply from suppliers are unable to cope with this change particularly in case of demand higher than previous demand. Consequently, case studied company cannot deliver the product to customer as committed.

2. Proposed Solution for Solving Problem

Nowadays, company attempts to solve this problem by expediting suppliers to deliver material in short period of time. However, it follows this practice since case studied company does not only have to pay expediting cost, but also have a high chance of bad quality parts. The appropriate solution to solve this problem is to define demand frozen zone. Frozen zone is a proposed solution for solving the conflict and instability. Within the determined frozen zone, it does not allow any change or adjustment. Thus, MPS will be more stable and material will be available to support production schedule.

According to case studied company, frozen zone is determined as the longest lead time of purchasing item plus cumulative manufacturing lead time of product which are shown in following figure. Objective of frozen zone is if there is any changing happened after PO was issued to supplier, the 2nd MRP generating will directly affect to the manufacturing lead time of suppliers and will be impact on manufacturing lead time of week x+6. Due to the suppliers cannot react to demand change in such a short period of time, shortage might happens. Once the frozen zone is setup, as the figure 4.1, any change will not allow in the period of issuing PO until production. Thus, case studied company and suppliers will not have to purchase material in short period of time. Finally, case studied company can ensure that materials will be available on schedule while low cost of expediting.

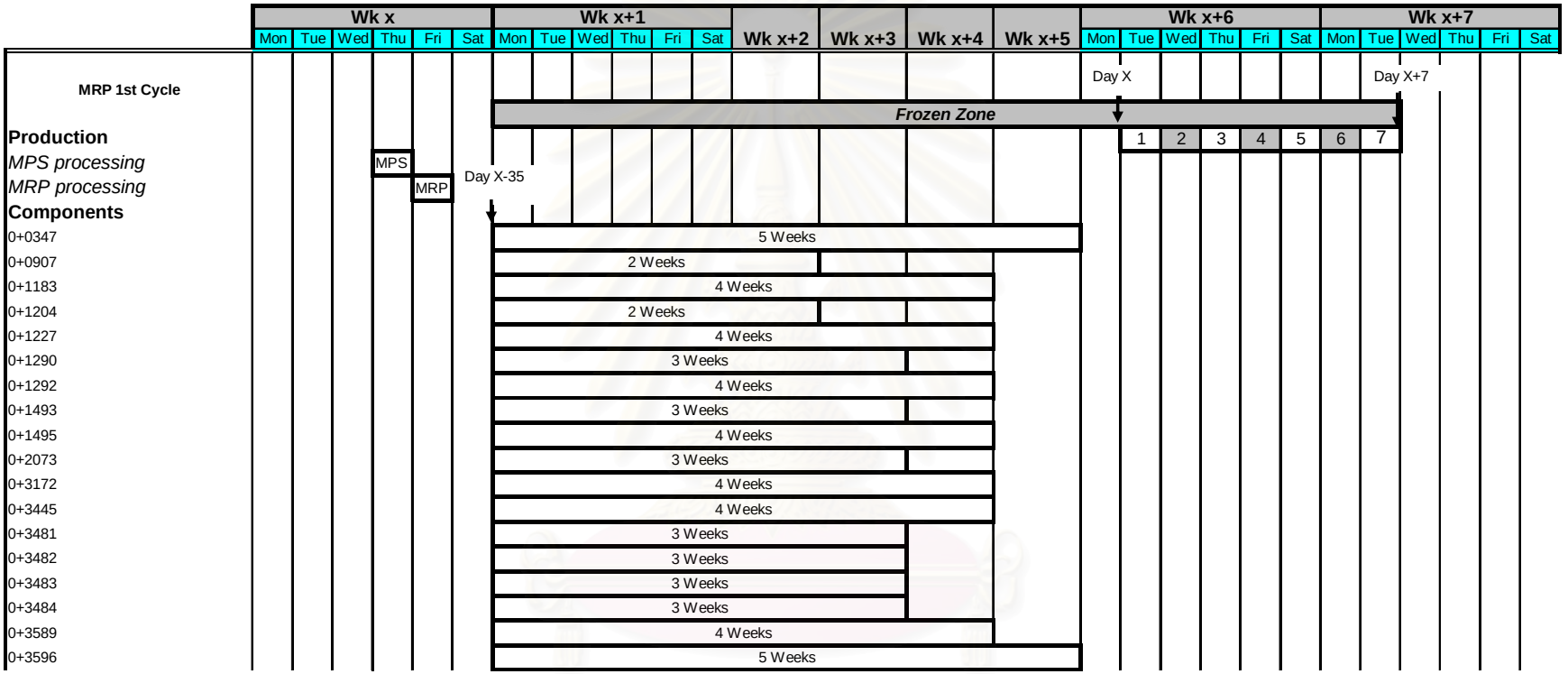


Figure 4.10: Example of MRP Schedule with Frozen Zone

4.3.2 Improving Efficiency of MRP System

In MRP system, there are numerous parameters that are meaningful for generating MRP effectiveness such as part number, description, item status, commodity, buyer name, supplier, % allocation, and etc. As discuss in chapter 2, the parameters that are influence to product delivery are Manufacturing Yield, Material Lead time, Production Lead time, and Capacity. Current status of each parameter is shown in table 4.9.

Table 4.9: MRP Parameters

Parameter Name	Set in system
Manufacturing Yield	95% of all products
Material Lead time	30 days
Production lead time	7 days
Capacity	According to product

1. Manufacturing Yield

Manufacturing Yield is an absolute number which came from number of units passed final inspection over number of input units. As mentioned, manufacturing yield is one significant factor which affects to delivery schedule. Since, MRP is calculated by using incorrect manufacturing yield, the result from MRP which is part requirement quantity is unrealistic as well. For example, planner plans production plan for product A 100 pieces with assumption that production yield is 100%. However, result of production shown that there is five pieces defect which mean actual manufacturing yield is only 95% not 100% like assumption. In this case, it means that company can deliver product A only 95 pieces to customer. Moreover, company has to order more components from suppliers and manufacture the new lot in order to fulfill the backlog order.

According to current status of company, manufacturing yield of products is determined as 95% in Oracle system. Perceptibly, production will be affected if actual yield is less than 95%. In contrast, company will probably have excess stock if actual

yield is higher than 95%. The deviation of manufacturing yield is very important since it affect to order quantity, production plan, and so on.

The first value using for calculating manufacturing yield is actual defect rate. Basically, defect means any kind of product with non conformance of specification. Currently, case studied company produces 10 products to customer AAA by utilizing seven production lines. Each production line manufactures the product independently due to they are separated by the characteristics and functions. The seven production lines are listed in the table 4.10.

Table 4.10: Production lines of customer AAA

Production line	*Manufacturing (Bom #)*	*Capacity/month*	*Capacity/Day*
Line AV-1	303660001	3,500	175
Line AV-2	PTB OSM5500-02	1,000	50
Line AV-3	306510005ALT01	1,500	75
Line AV-4	615709004Rev03	1,000	50
Line AV-5	605500001 and PEFX001XCEV05P6	700	35
Line AV-6	610991001 and 608750002	650	32.5
Line AV-7	308120002ALT03 and 792000090	500	25

Table 4.11: Actual Production Yield of Line AV-1

Production line	***Manufacturing(Bom #)***
Line AV-1	*303660001*

Mont.	*2006 Demand*	*Production*	*Defect*	*Yield(%)*
Jan	893	940	62	93.40%
Feb	962	1013	82	91.90%
Mar	478	503	35	93.04%
Apr	596	627	38	93.94%
May	686	722	51	92.94%
Jun	1653	1740	122	92.99%
Jul	1012	1065	83	92.21%
Aug	1087	1144	85	92.57%
Sep	1532	1613	103	93.61%
Oct	2589	2725	243	91.08%
Nov	2100	2211	139	93.71%
Dec	1840	1937	149	92.31%
				92.81%

The table 4.11 demonstrated the manufacturing of product 303660001 which was assembled in production line AV-1. Originally, MPS and purchasing order were generated by utilizing fixed yield, 95%; while actual yield for this product was approximately 93%. Obviously, this deviation directly affects to efficiency of case studied company due to MRP is generated by using registered yield in Oracle system. Thus, material requirement will not correspond to actual material requirement. Consequently, production will has inadequate available material for complete order from customer. Currently, case studied company try to solve this problem by expediting material which has to pay special fee in order to have sufficient material on time to support production.

In this study, actual yield will be analyzed and calculated by utilizing historical data of year 2006 then calculate average yield for each product. Average yield will be uploaded into Oracle system. As a result, next cycle of MPS and MRP will be generated by using updated information. Actual yield by products are demonstrated in following table;

Table 4.12: Production Yield Summary

Production line	***Manufacturing (Bom #)***	***Yield (%)***
Line AV-1	303660001	*92.81*
Line AV-2	PTB OSM5500-02	*93.11*
Line AV-3	306510005ALT01	*95.13*
Line AV-4	615709004Rev03	*93.16*
Line AV-5	605500001 and	*93.23*
	PEFX001XCEV05P6	*94.11*
Line AV-6	61099100	*95.83*
	608750002	*94.91*
Line AV-7	308120002ALT03	*92.52*
	792000090	*93.76*

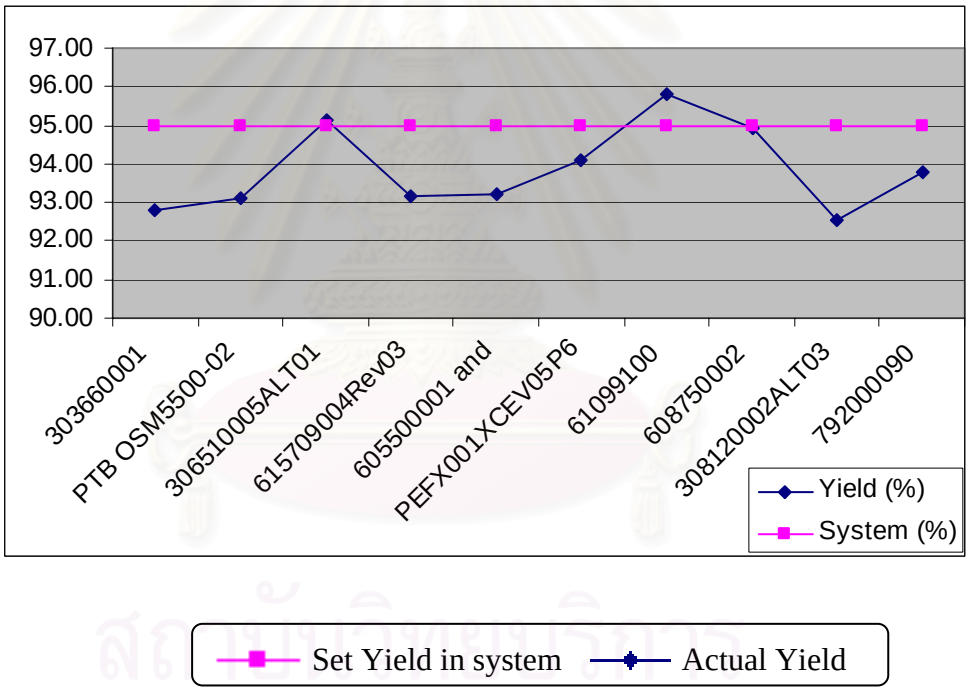


Figure 4.11: The Comparison of Actual yield and Set yield in system

According to production yield in table 4.12 and figure 4.11, it appears that almost every actual yield have some deviations with registered yield in Oracle system. Theoretically, this problem causes inadequate part supply to support production line. After case studied company applies average yield to Oracle system, it facilitates case studied company to diminish such problems; a shortage of parts, excess orders, and

expediting cost. Moreover, it helps case studied company to deliver product as committed.

2. Material Lead time and Production Lead time

As mentioned, material lead time in Oracle system is set as 30 days lead time, however, actual lead time for some products are greater than the set lead time in Oracle system. Furthermore, another significant parameter that link with material lead time is production lead time. Production lead time, currently, is set in the system as seven days for every product. These are the facts that influence delivery date of product since both factors will be used as a parameter to calculate dispatch timing of each product to customer. Consequently, by updating correct information is definitely improved competency of case studied company particularly delivery performance and service level. Correct manufacturing lead time and material lead time in Oracle system are shown in table 4.13.

Table 4.13: Manufacturing L/T and Longest Material L/T of each BOM

No	Bom No.	Description	Manufacturing L/T (Days)	Longest Material L/T (Days)
1	303660001	PG1500 D18	7	30
2	306510005ALT01	Marconi P3C Edfa	7	60
3	PTB OSM5500-02	EDFA Model PTB OSM5500-02	10	42
4	610991001	POSR18.3-300-1545-SI-SCU-0-01	5	45
5	608750002	PG2600L Band+17 dBgainfix	5	42
6	308120002ALT03	EDFA Model 812-02 Alt 03	7	45
7	605500001	Siemens Mts 2-Light	7	42
8	792000090	MOD. F10 -0 PMNC SMNC With TiFi	3	30
9	615709004Rev03	100SMFCR25-410-1545-SI-SCU-0-04	7	60
10	PEFX001XCEV05P6	Barolo, SOADM 100G 4Skip1 (1 Band) Mdl 5	10	30

4.3.3 Shortening Purchase Lead Time

As mentioned in chapter 2, every purchasing requirement (PR) must be approved by purchasing manager before generating PO; otherwise buyer will not be able to generate PO. Currently this process, step 6 in table 4.2, consumes approximately 2-3 days for PR approval. The reason that case studied company spent remarkably long time can be separated into two cases; firstly, case studied company

does not have traceability system to track PR approval and secondly, human errors. In order to shorten purchasing lead time, in this chapter will apply Electronic Data Interchange, EDI, to manage this problem.

Basically, EDI concept allows two participants to electronically interact on business transaction and provide instantaneous information (Gaither et al., 2002). For case studied company, EDI concept encourages manager to immediately acknowledge PR information. Presently, case studied company has EDI program in place which is called Generic On Line Flow, GOLF. This program is created by IT for internal use. Practically, any requisition which was made by requestor will automatically send notification message from GOLF to approver's e-mail. Then, GOLF will automatically send reminding message once approver does not take action in appropriate period time. Moreover, system has ability to summarize approval reports by daily and weekly. According to the study of GOLF capability, PR requisition function will be using EDI platform of GOLF program in order to shorten approval lead time.

1. Program and Required system

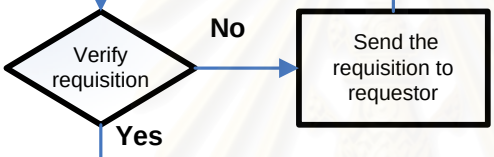
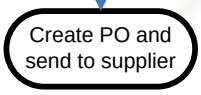
Typically, EDI is required system and software for interchanging information among parties. Therefore, computers should have appropriate specification such as speed of CPU, required program, and etc. The requirements are shown as follow.

Computer Requirement:
CPU: Pentium 3 or above
Ram: 512 MB or above
OS: Microsoft Window 2000 Professional or above

2. Operating Procedure

The operating procedure can be expressed by "Generic On Line Flow" workflow chart which is divided into four significant steps as shown in table below:

Table 4.14: Generic On Line Flow Workflow Chart

Step	Work Flow	Process	Responsibility
1		Generate requisition via Golf	Buyer
2		Send requisition to authorization person	Buyer
3		Verify requisition and make a decision	Purchasing Manager
4		Generate PO and send to supplier	Buyer

- Generate requisition via GOLF: To access into the program, buyer must log in to http://golf/login/mainlogin.asp, then input user name and password which is normally created by IT department. Prior using this program, user has to request user name and password from IT department.

Figure 4.12: Log in Page

Once login to the GOLF program, select “Make A Request” in main menu to access into the main page in order to create any requirement.

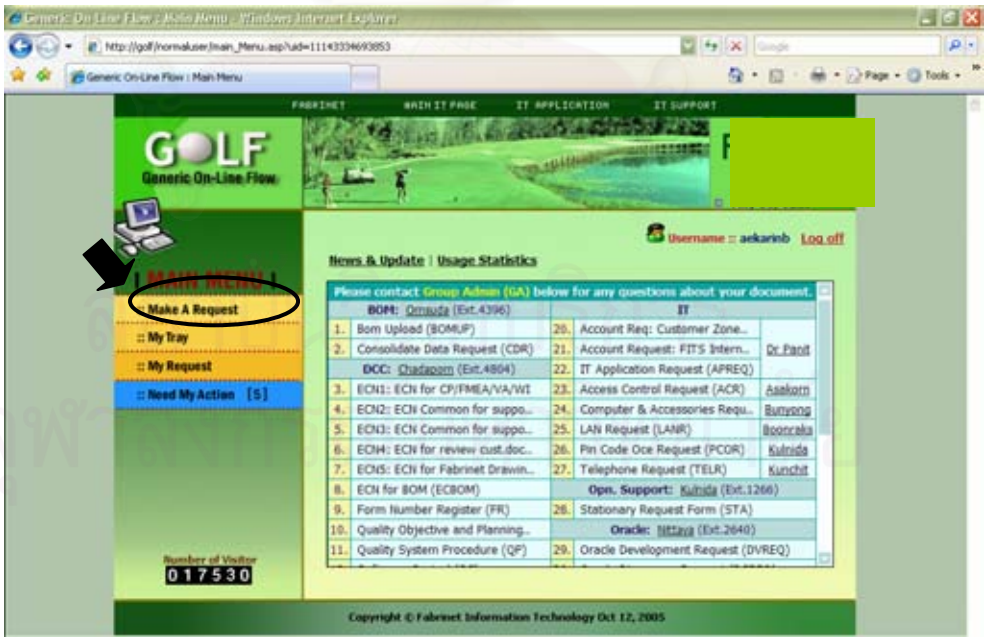


Figure 4.13: Make a Request

Subsequently, requestor has to select the Purchasing group for generating PR requisition as shown in figure 4.14. Once access into this page, requestor should either fill in the information such as business unit (customer name), Level, PR soft file, and some remark if any or use the default information as well as attached PR into “Request File” section as shown in figure 4.15.

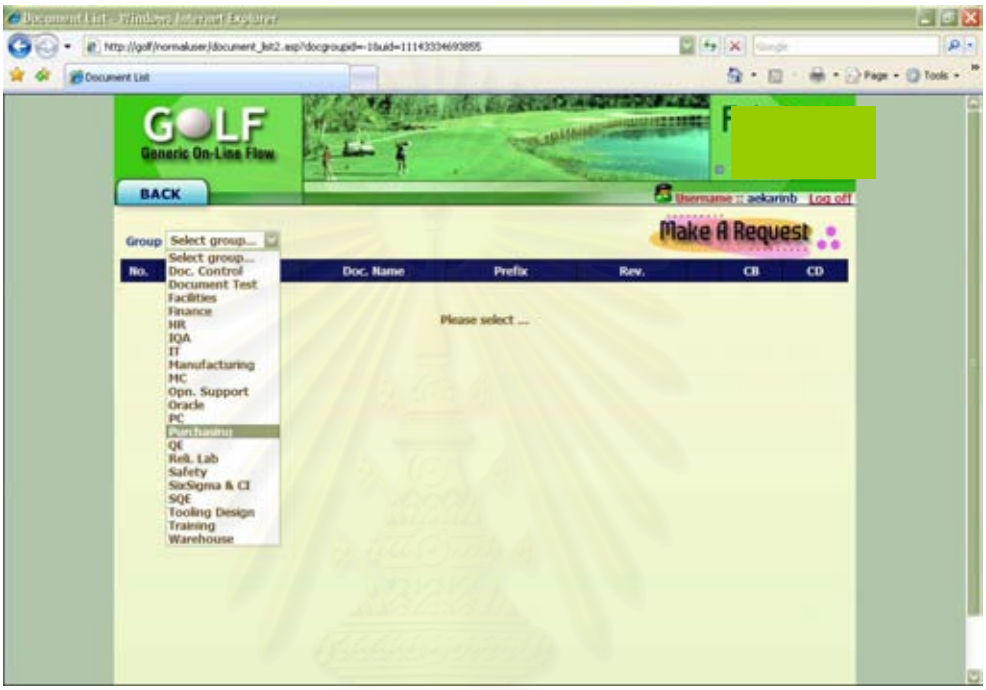


Figure 4.14: Requesting Group Selection

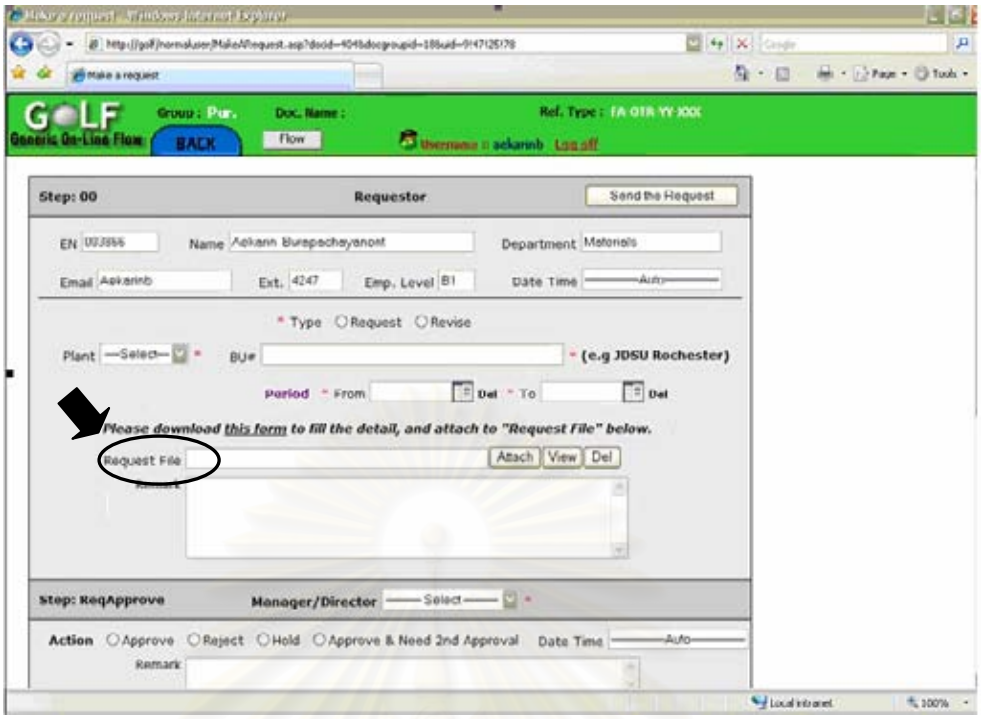


Figure 4.15: Fill in the PR Requisition Information

- Send requisition to authorize person: Once requestor finish creating PR requisition, requestor has to click “Send the request” then requisition will automatically sent to approver, in this case purchasing manager will be an authorize person. Typically, GOLF will send notification email to inform approver that there is a request waiting for your approval in GOLF system. Then, GOLF will automatically send reminding message if approver does not take action in appropriate period time. Reminding message will help case studied company to insure that GOLF will keep reminding approver until approval process is done. Example of email is shown in figure 4.16.

From: GOLF [GOLF@IT.Department]
Sent: Friday, Sep 28, 2007 8:48 AM
To: methee mahasoontorn
Cc: nadsuda dansiri
Subject: GOLF: Need K. Metheem 's action on "PR#1006985" (Ref. ID: 050670-DCC)

Hello K. Methee,

The request Ref. ID: 050670-DCC (**Group:** Purchasing, **Doc. Name:** PR# 1006985 has just been **sent by K. NadsudaD**. Please go to GOLF to get more details for this request, and perform your action in **STEP: MANAGER/DIRECTOR APPROVE**.
(You can access GOLF via this link: http://golf)

Key Details

Customer [00]	AAAA
Product/Model [00]	PTB OSM5500-02
Document No. [00]	PR#1006985

Approval History

No.	Step	Username	Date Time	Action
1.	00	NadsudaD	28-Sep-07 @8:44	Requested
2.	Pur. MGR	MetheeM		
3.	Buyer	NadsudaD		

Flow of Document

Step	Group	Current Username	Chosen in Step	Action	Next Step
00	Requestor	NadsudaD	-	Request	Pur MGR
Pur MGR.	Purchasing Manager	MetheeM	00	Approve	Buyer
				Hold	Pur Mgr
				Reject	Cancel
Buyer	Buyer	NadsudaD	00	Approve	DCC
				Hold	Buyer
				Reject	Cancel
DCC	Document Control Staff	WasanaN	00	Approve	Complete
				Hold	DCC
				Reject	Cancel

This e-mail has been generated from the system, please do not respond.

Best Regards,
GOLF

Figure 4.16: GOLF's email

- Verify requisition and make a decision: In this step, it encourages manager to access into GOLF to verify PR information. There are three actions that can be selected which are Approve, Hold, and Reject.

Approve: PR requisition will be approved by manager, and will automatically send notification message to requestor so that requestor can start issuing PO and send to supplier.

Hold: If there are some concerns or unclear information, in this case, manager ought to discuss with the requestor.

Reject: If the requisition is incorrect, PR will be rejected.

- Generate PO and send to supplier: Once PR requisition is approved by purchasing manager, approval information will be automatically sent to document controller for information storing. Meanwhile, approval email will automatically sent to buyer for PO creation.

To summarize, GOLF method facilitates company to shorten PR approval lead time while decrease human error. The consequent after implementing this system is decreasing of PR approval lead time from 2-3 days to 1 day. Furthermore, purchasing team can print out PR approval report in order to comprehend the numbers of PR that have been approved as well remaining PR in the system.

CHAPTER 5

EVALUATION OF SOLUTION IMPLEMENTATION

This chapter presents the evaluation of proposed solutions after implementing in cased studied company, details in chapter 4. The evaluation results are presented by using data comparison between before and after implementing in order to reveal the consequent of the new solutions.

5.1 EVALUATION PROCEDURE

5.1.1 Source of Data

In this chapter, there are two significant sources of data, which are used for performance evaluation between existing system and proposed solution as follow:

1. Historical data and parameters of company in the year 2006.
2. Output after implementing of the new developed system.

5.1.2 Evaluation Method

The evaluation methodology is to compare between two systems, existing and developed system, and compare with actual result.

5.1.3 Evaluation Assumptions

1. Only product of customer AAA is being evaluated.
2. Human error, any machine down, maintenance, and calibration would also be reflected into the evaluation of developed supply management system by using approximated value from the observation.

5.1.4 Evaluation Criteria

In order to explore the validity and the performance of the proposed system, in this chapter would reflect the performance via the expression of the criteria below:

1. On time delivery performance: On time delivery performance is to measure the delivery delay frequency of the product in specific period of time. Basically, on time delivery performance is calculated by using the equation below:

$$\text{On time delivery performance} = \frac{\textit{No of order completion}}{\textit{No of order committed}} \times 100\%$$

2. Material shortage and expediting cost: Material shortage is one of the significant factors which directly affect to on time delivery performance of product. Presently, company copes up with materials shortage by paying additional expediting cost in order to get materials than normal purchasing lead time. Though, the expediting cost has directly relative with material shortage problem. Thus, reducing materials shortage is reducing expediting cost at the same time.

3. Lead time to customer: Lead time is the period of time started from case studied company in receiving purchasing orders until delivery to customer. As mentioned in early chapter, this parameter is very important to measure service level.

5.2 EVALUATION RESULTS

5.2.1 On Time Delivery Performance

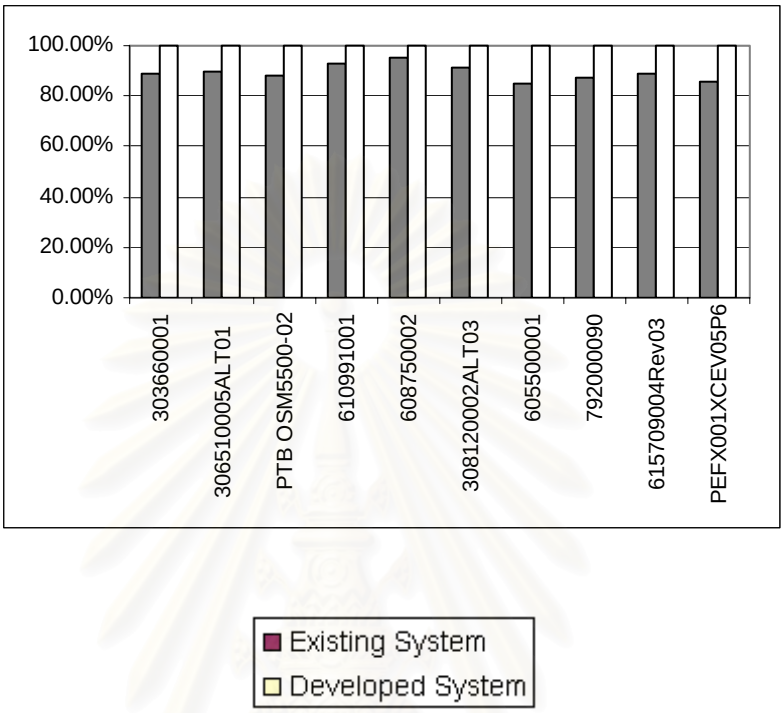


Figure 5.1: Delivery Performance Comparison between Existing and Developed System

According to table 5.1 and figure 5.1, they represent delivery performance after implementing the developed system. The developed system has evidently improved comparing with the existing system. In practically, there is human error which impacts to on time delivery. The error can be categorized into three major areas as follow:

1. Uploading demand is missing
2. Delayed of issuing Purchasing Requirement and approving Purchasing Order
3. Miss-arrangement in transportation

Table 5.1: On Time Delivery Performance of Year 2006

No	Bom No.	Month	2006												Average
			Jan	*Feb*	*Mar*	*Apr*	*May*	*June*	*July*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	
1	303660001	Existing System	90%	85%	95%	85%	90%	87%	92%	91%	88%	89%	88%	91%	***89.01%***
		Developed System	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	***100%***
2	306510005ALT01	Existing System	85%	88%	91%	92%	85%	83%	92%	92%	91%	89%	91%	88%	***89.33%***
		Developed System	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	***100%***
3	PTB OSM5500-02	Existing System	84%	93%	86%	86%	91%	88%	87%	82%	91%	93%	95%	96%	***87.91%***
		Developed System	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	***100%***
4	610991001	Existing System	95%	93%	91%	93%	93%	93%	93%	93%	93%	93%	100%	100%	***92.92%***
		Developed System	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	***100%***
5	608750002	Existing System	93%	100%	100%	93%	100%	82%	98%	100%	94%	94%	100%	100%	***95.61%***
		Developed System	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	***100%***
6	308120002ALT03	Existing System	89%	91%	89%	94%	85%	100%	91%	85%	82%	100%	100%	100%	***91.03%***
		Developed System	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	***100%***
7	605500001	Existing System	89%	100%	73%	81%	87%	90%	64%	74%	91%	100%	100%	85%	***83.84%***
		Developed System	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	***100%***
8	792000090	Existing System	100%	85%	93%	85%	85%	100%	100%	100%	100%	63%	100%	100%	***87.11%***
		Developed System	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	***100%***
9	615709004Rev03	Existing System	93%	85%	93%	93%	100%	76%	88%	78%	93%	91%	91%	91%	***88.73%***
		Developed System	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	***100%***
10	PEFX001XCEV05P6	Existing System	94%	62%	100%	90%	100%	100%	85%	88%	84%	75%	93%	95%	***86.02%***
		Developed System	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	***100%***

Actually, these cases have been considered into the developed system as defined in FMEA. However, from the analytical result, it shown that these factors have already been prevented by the specific method. Therefore, the developed system can be assumed that they are not a significant cause that affects delivery performance. In the meantime, machine down and maintenance are other factors that have been considered. According to last year data, it shown that there was no machine down, meanwhile machines maintenance was done in the period that there was no production. Consequently, it could be summarized that these factors are not significantly affect to the on time delivery performance.

5.2.2 Material Shortages and Expediting Costs

The material shortages of existing system against developed system are shown in the figure 5.2 and table 5.2. Meanwhile, expediting costs in the existing system compared to developed system is also expressed in the table 5.3 respectively.

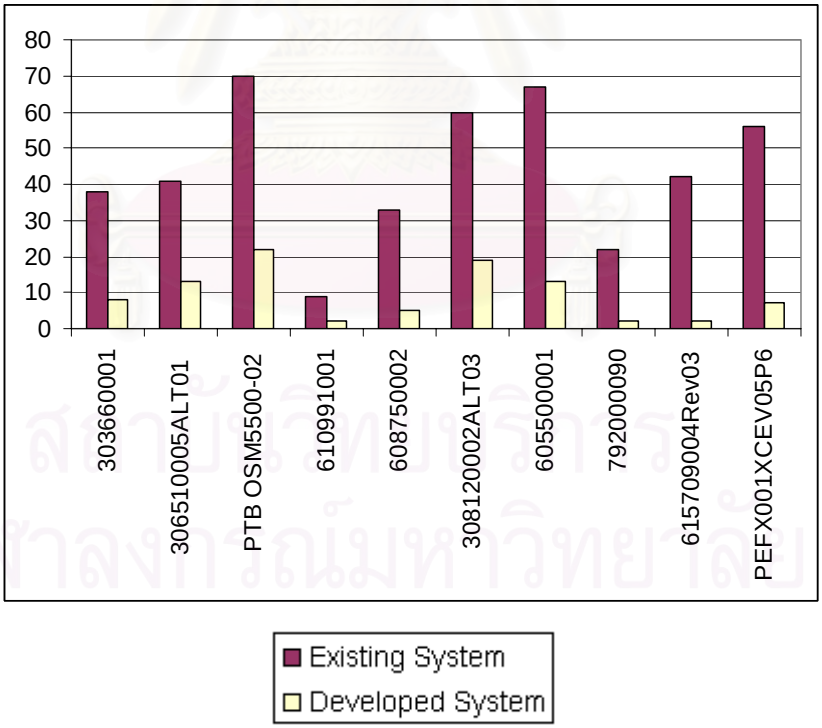


Figure 5.2 Material Shortage Comparison between Existing and Developed system

Table 5.2 Material Shortage Comparison between Existing and Developed system

No	Bom No.	Description	Month	Material shortage in year 2006 (Times)												Sum
				Jan	*Feb*	*Mar*	*Apr*	*May*	*June*	*July*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	
1	303660001	PG1500 D18	Existing System	3	6	1	0	1	6	7	2	1	5	3	3	38
			Developed System	1	0	0	0	0	0	2	0	1	1	0	3	8
2	306510005ALT01	Marconi P3C Edfa	Existing System	9	2	2	0	0	2	6	3	6	5	5	1	41
			Developed System	3	0	0	0	0	0	4	0	3	2	0	1	13
3	PTB OSM5500-02	EDFA Model PTB OSM5500-02	Existing System	12	11	7	1	1	5	12	5	5	3	5	3	70
			Developed System	7	0	0	0	0	0	7	0	4	2	0	2	22
4	610991001	POSR18.3-300-1545-SI-SCU-0-01	Existing System	1	1	0	0	0	1	0	1	1	1	2	1	9
			Developed System	0	0	0	0	0	0	0	0	1	0	0	1	2
5	608750002	PG2600L Band+17 dBgainfix	Existing System	5	6	3	1	1	1	2	3	4	4	2	1	33
			Developed System	0	0	0	0	0	0	0	0	3	1	0	1	5
6	308120002ALT03	EDFA Model 812-02 Alt 03	Existing System	13	8	6	0	3	3	3	4	6	7	5	2	60
			Developed System	9	0	0	0	0	0	2	0	5	2	0	1	19
7	605500001	Siemens Mts 2-Light	Existing System	11	6	4	3	6	3	6	5	6	8	7	2	67
			Developed System	2	0	0	0	0	0	2	0	5	3	0	1	13
8	792000090	MOD. F10 -0 PMNC SMNC With TiFi	Existing System	8	1	0	0	0	0	3	3	0	4	1	2	22
			Developed System	1	0	0	0	0	0	0	0	0	0	0	1	2
9	615709004Rev03	100SMFCR25-410-1545-SI-SCU-0-04	Existing System	4	5	1	2	1	0	7	5	3	3	7	4	42
			Developed System	0	0	0	0	0	0	0	0	1	0	0	1	2
10	PEFX001XCEV05P6	Barolo, SOADM 100G 4Skip1 (1 Band) Mdl 5	Existing System	13	5	0	1	1	1	6	6	6	6	7	4	56
			Developed System	2	0	0	0	0	0	0	0	2	2	0	1	7

Table 5.3 Expediting Costs Comparison between Existing and Developed system

Month	Expediting Cost of Year 2006 (USD)												Summary (USD)
	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	
Existing System	142,362.27	62,745.68	50,996.77	249.24	10,876.10	158,631.05	132,052.73	74,103.56	68,536.40	11,654.96	28,554.09	20,663.27	***761,426.13***
Developed System	30,579.61	0	0	0	0	0	17,841.88	0	34,992.90	4,304.10	0	2,482	***90,200.47***

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According to the table 5.2, material shortages reduced significantly from 438 times to 93 times. Material expediting costs dramatically decreased approximately USD 670,000.

5.2.3 Lead Time to Customer

The comparison of lead time to customer between existing system and developed system are demonstrated in figure 5.3 and table 5.3 respectively. Lead time in the table 5.3 is the lead time for supply chain workflow consisting of 12 steps started from receiving demand and forecasting from customer, check Availability of material, master production schedule trial, generating MPS, MRP, and CRP, creating purchasing requirement, purchasing requirement approval, sending purchasing order to suppliers, informing delivery commitment to planner, follow up supplier to delivery material, receiving material and incoming inspection, manufacturing and inspection to delivery product to customer.

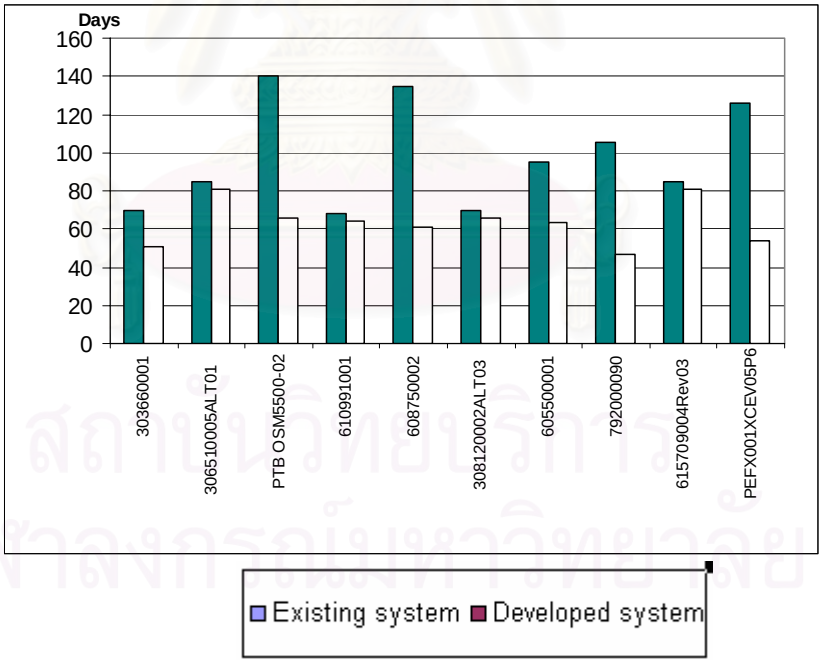


Figure 5.3 Summary of Lead Time to Customer between Existing and Developed system

Table 5.4 Summary of Lead Time to Customer between
Existing and Developed system

No.	Bom no	Description	Comparison	Lead time of supply chain work flow (Days)												Summary (Max-Days)
				1	2	3	4	5	6	7	8	9	10	11	12	
1	303660001	PG1500 D18	Existing system	2		2		1	3	3		45	2	7	5	70
			Developed system	2		2		1	1	1		30	2	7	5	51
2	306510005ALT01	Marconi P3C Edfa	Existing system	2		2		1	3	3		60	2	7	5	85
			Developed system	2		2		1	1	1		60	2	7	5	81
3	PTB OSM5500-02	EDFA Model PTB OSM5500-02	Existing system	2		2		1	3	3		112	2	10	5	140
			Developed system	2		2		1	1	1		42	2	10	5	66
4	610991001	POSR18.3-300-1545-SI-SCU-0-01	Existing system	2		2		1	3	3		45	2	5	5	68
			Developed system	2		2		1	1	1		45	2	5	5	64
5	608750002	PG2600L Band+17 dBgainfix	Existing system	2		2		1	3	3		112	2	5	5	135
			Developed system	2		2		1	1	1		42	2	5	5	61
6	308120002ALT03	EDFA Model 812-02 Alt 03	Existing system	2		2		1	3	3		45	2	7	5	70
			Developed system	2		2		1	1	1		45	2	7	5	66
7	605500001	Siemens Mts 2-Light	Existing system	2		2		1	3	3		70	2	7	5	95
			Developed system	2		2		1	1	1		42	2	7	5	63
8	792000090	MOD. F10 -0 PMNC SMNC With TiFi	Existing system	2		2		1	3	3		84	2	3	5	105
			Developed system	2		2		1	1	1		30	2	3	5	47
9	615709004Rev03	100SMFCR25-410-1545-SI-SCU-0-04	Existing system	2		2		1	3	3		60	2	7	5	85
			Developed system	2		2		1	1	1		60	2	7	5	81
10	PEFX001XCEV05P6	Barolo, SOADM 100G 4Skip1 (1 Band) Mdl 5	Existing system	2		2		1	3	3		98	2	10	5	126
			Developed system	2		2		1	1	1		30	2	10	5	54

According to the table 5.4, it shown that lead time of all products have been improved. Nevertheless, there were some products that could not be improved significantly such as 306510005ALT01, 610991001, 308120002ALT03, and 615709004Rev03.

5.3 EVALUATION PROCEDURE OF ACTUAL IMPLEMENTATION

5.3.1 Evaluation Method

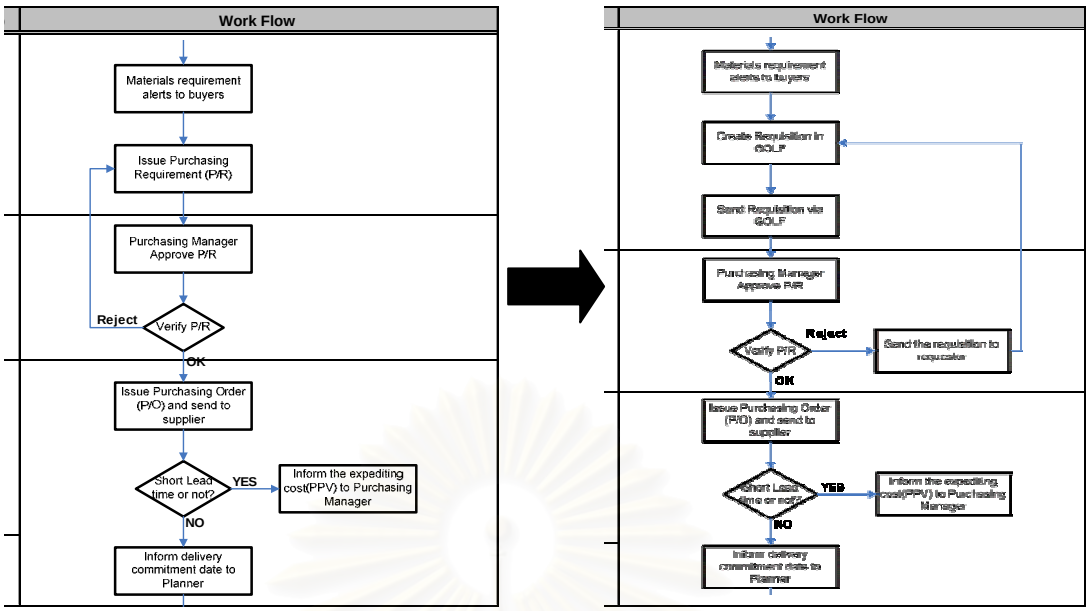
The evaluation method is to compare between two systems as existing and developed system by comparing the results from the fourth quarter of year 2007 until fourth quarter of year 2006.

5.3.2 Evaluation Criteria

Evaluation criteria are On Time Delivery, Material Shortages and Expediting Costs, and Lead Time to Customer.

5.3.3 Evaluation Results of Actual Implementation

In order to reveal the effectiveness of new developed system, case studied company applied the developed system into the real supply chain workflow. New supply chain workflow after implementing changes can be shown in figure 5.4. Supply chain workflow was modified in step 5 and 6, which concerning to lead time of issue PR until sending PO to suppliers. These two steps adopted EDI concept which is called GOLF, Generic Online Flow. GOLF facilitates case studied company to diminish lead time of issuing purchasing requisition (PR). Actually, they were not only the step 5 and 6 that have been improved but also step 9. Step 9 is influenced to the entire supply chain workflow due to it has the longest lead time step within the whole chain.



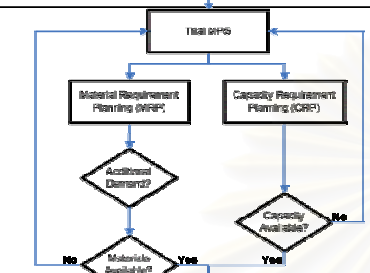
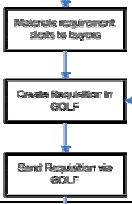
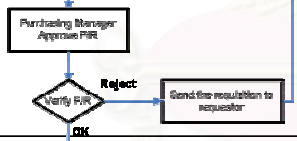
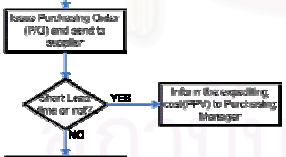
Before **After**

Figure 5.4 Changed Step of Supply Chain Workflow

After implementing, the new supply chain workflow has been changed as displayed in table 5.5. The new workflow is a consequence of lead time compression and developed supply management system.

Table 5.5 Supply Chain Workflow after Implementing New Supply Management

Supply Chain Workflow Chart

Step	Work Flow	Process	Lead time	Task	Responsibility
1		Receiving demand and forecasting from customer	2 Days	- Receive demand and order from customer.	Program Coordinator
2		Check Availability of material		- Verify the material availability status for using in generating MPS	Planner
3		Master Production Schedule Trial	2 Days (Running in every Friday)	- Trial MPS - Generating MPS, MRP and CRP. - Checking Capacity	Planner
4		Generating MPS, MRP, and CRP			
5		Creating purchasing requirement	1 Day	- Issue P/R and send to PUR MGR for approval.	Buyer
6		Approve Purchasing requirement	1 Days	- Approving P/R	Purchasing Manager
7		Send purchasing order to suppliers	1 Day	- Issue P/O and send to suppliers - Inform expediting cost if happened. - Inform delivery date to planner	Buyer
8		Inform delivery commitment to planner			
9		Follow up supplier to delivery material	Corresponding to supplier lead time.	- Follow up supplier to send the material on schedule.	Buyer
10		Receiving material and incoming inspection	2 Days	- Receive materials and keep them in warehouse	Buyer Incoming Quality Team
11		Manufacturing and Inspection	Corresponding to manufacturing lead time of each product.	- Manufacture product - Final inspection.	Production Engineering, Quality Assurance engineering
12		Delivery product to customer	3-5 Days (By Air)	- Packing as standard pack - Contact frieght forwarder to send product to customer	Traffic Team

1. On Time Delivery Performance

Table 5.6 Delivery Performance Comparison between Quarter 4 of year 2006 and 2007

No	Bom No.	Description	Month	On time del (%)			Average
				Oct	*Nov*	*Dec*	
1	303660001	PG1500 D18	Q4 (2006)	89%	88%	91%	***89.33%***
			Q4 (2007)	100%	100%	100%	***100.00%***
2	306510005ALT01	Marconi P3C Edfa	Q4 (2006)	89%	91%	88%	***89.33%***
			Q4 (2007)	100%	100%	100%	***100.00%***
3	PTB OSM5500-02	EDFA Model PTB OSM5500-02	Q4 (2006)	93%	95%	96%	***94.67%***
			Q4 (2007)	100%	100%	100%	***100.00%***
4	610991001	POSR18.3-300-1545-SI-SCU-0-01	Q4 (2006)	93%	100%	100%	***97.67%***
			Q4 (2007)	100%	100%	100%	***100.00%***
5	608750002	PG2600L Band+17 dBgainfix	Q4 (2006)	94%	100%	100%	***97.92%***
			Q4 (2007)	100%	100%	100%	***100.00%***
6	308120002ALT03	EDFA Model 812-02 Alt 03	Q4 (2006)	100%	100%	100%	***100.00%***
			Q4 (2007)	100%	100%	100%	***100.00%***
7	605500001	Siemens Mts 2-Light	Q4 (2006)	100%	100%	85%	***94.93%***
			Q4 (2007)	100%	100%	100%	***100.00%***
8	792000090	MOD. F10 -0 PMNC SMNC With TiFi	Q4 (2006)	63%	100%	100%	***87.62%***
			Q4 (2007)	100%	100%	100%	***100.00%***
9	615709004Rev03	100SMFCR25-410-1545-SI-SCU-0-04	Q4 (2006)	91%	91%	91%	***90.80%***
			Q4 (2007)	100%	100%	100%	***100.00%***
10	PEFX001XCEV05P6	Barolo, SOADM 100G 4Skip1 (1 Band) Mdl 5	Q4 (2006)	75%	93%	95%	***87.59%***
			Q4 (2007)	100%	100%	100%	***100.00%***

According to the table 5.5, there was a significant improvement since entire products could be delivered to customer AAA on schedule 100%. Therefore, it could be concluded that the new developed system is able to improve on time delivery of products.

2. Material Shortages and Expediting Costs

Material shortages of fourth quarter of year 2007 against fourth quarter of year 2006 are shown in figure below:

Table 5.7 Material Shortage Comparison between
Quarter 4 of year 2006 and 2007

No	Bom No.	Description	Quarter	Shotages (Time)			Sum
				Oct	*Nov*	*Dec*	
1	303660001	PG1500 D18	Qtr 4-2006	5	3	3	11
			Qtr 4-2007	1	2	3	6
2	306510005ALT01	Marconi P3C Edfa	Qtr 4-2006	5	5	1	11
			Qtr 4-2007	0	1	1	2
3	PTB OSM5500-02	EDFA Model PTB OSM5500-02	Qtr 4-2006	3	5	3	11
			Qtr 4-2007	2	1	2	5
4	610991001	POSR18.3-300-1545-SI-SCU-0-01	Qtr 4-2006	1	2	1	4
			Qtr 4-2007	0	1	1	2
5	608750002	PG2600L Band+17 dBgainfix	Qtr 4-2006	4	2	1	7
			Qtr 4-2007	1	1	1	3
6	308120002ALT03	EDFA Model 812-02 Alt 03	Qtr 4-2006	7	5	2	14
			Qtr 4-2007	2	1	1	4
7	605500001	Siemens Mts 2-Light	Qtr 4-2006	8	7	2	17
			Qtr 4-2007	3	0	1	4
8	792000090	MOD. F10 -0 PMNC SMNC With TiFi	Qtr 4-2006	4	1	2	7
			Qtr 4-2007	0	0	1	1
9	615709004Rev03	100SMFCR25-410-1545-SI-SCU-0-04	Qtr 4-2006	3	7	4	14
			Qtr 4-2007	1	0	1	2
10	PEFX001XCEV05P6	Barolo, SOADM 100G 4Skip1 (1 Band) Mdl 5	Qtr 4-2006	6	7	4	17
			Qtr 4-2007	2	2	1	5

According to the figure 5.5, it was obvious that the numbers of shortages were decreased significantly. Furthermore, the comparison of expediting costs was also decreased which was displayed in table 5.6.

Table 5.8 Expediting Costs Comparison between
Quarter 4 of year 2006 and 2007

Month	Month			Summary (USD)
	Oct	*Nov*	*Dec*	
Q4-2006	11,654.96	28,554.09	20,663.27	*60,872.32*
Q4-2007	5,938.91	1,278.34	2,103.33	*9,320.58*

The expediting costs after implementing developed system in the last quarter, it is obvious that it significantly decreased by approximately $51K.

3. Lead Time to Customer

The actual lead time of fourth quarter of year 2007 against fourth quarter of year 2006 are shown in figure below:

Table 5.9 Lead Time to Customer Comparison between Quarter 4 of year 2006 and 2007

No.	Bom no	Description	Comparison	Summary (Days)
1	303660001	PG1500 D18	Qtr 4, 2006	70
			Qtr 4, 2007	55
2	306510005ALT01	Marconi P3C Edfa	Qtr 4, 2006	85
			Qtr 4, 2007	85
3	PTB OSM5500-02	EDFA Model PTB OSM5500-02	Qtr 4, 2006	140
			Qtr 4, 2007	70
4	610991001	POSR18.3-300-1545-SI-SCU-0-01	Qtr 4, 2006	68
			Qtr 4, 2007	64
5	608750002	PG2600L Band+17 dBgainfix	Qtr 4, 2006	135
			Qtr 4, 2007	70
6	308120002ALT03	EDFA Model 812-02 Alt 03	Qtr 4, 2006	70
			Qtr 4, 2007	72
7	605500001	Siemens Mts 2-Light	Qtr 4, 2006	95
			Qtr 4, 2007	70
8	792000090	MOD. F10 -0 PMNC SMNC With TiFi	Qtr 4, 2006	105
			Qtr 4, 2007	47
9	615709004Rev03	100SMFCR25-410-1545-SI-SCU-0-04	Qtr 4, 2006	85
			Qtr 4, 2007	81
10	PEFX001XCEV05P6	Barolo, SOADM 100G 4Skip1 (1 Band) Mdl 5	Qtr 4, 2006	126
			Qtr 4, 2007	54

Regarding to table 5.8, it apparently showed a better improvement in fourth quarter of year 2007 comparing to year 2006 within the same quarter.

5.4 DISCUSSION OF RESULTS

In this chapter, there are three aspects in adopting to measure performance of the developed system.

5.4.1 On Time Delivery Performance

According to the figure 5.1, it was obvious that the developed system improved delivery performance of case studied company significantly. The developed system has a better performance because there is a better ability in managing material workflow since receiving an order from customer, ordering, production, and delivery products to customer. Actually, the simulation considered human errors, maintenance, and machine down, but these factors were not influenced delivery performance. In the

same way, on time delivery performance of actual implementation in fourth quarter of 2007 was also able to achieve 100% on time.

Typically, the improvement of on time delivery is not only increasing the reliability to clients, but also facilitates MRP system to operate with less conflict as well as reduce material inventory. Furthermore, on time delivery is another significant factor to both company and customer in order to establish long term relationship, as a partner; this is an ultimate goal of company's CEO.

5.4.2 Material Shortages and Expediting Costs

The result of developed supply management system showed significant reduction of both material shortages and expediting costs. Initially, expediting costs and material shortages came from various causes such as changing of order from clients, using wrong manufacturing yield for MRP, and ordering material in shorter lead time than normal purchasing lead time.

The uncertainty of order directly affects to costs of material expediting and also reflects to material shortages. Moreover, another cause that affects to the material shortages and expediting costs is manufacturing yield. Manufacturing yield is normally dynamic and can be changed every month. Originally, company used average manufacturing yield, 95%, in Oracle system. Once using actual yield; material shortages and expediting costs could be improved significantly, however, still could not completely eliminate these two problems.

Regarding to actual result of fourth quarter in year 2007, it had the same trend as simulating. However, simulating result is better than actual result due to the errors or mistaking happens particularly from human error which is very difficult to control. By the way, the consequent of material shortages and expediting costs are still significant improvement.

5.4.3 Lead Time to Customer

At the first glance, lead times after implementing developed system have been decreased. The reasons of the decrement mainly came from workflow analysis and localization project. Nevertheless, there were some products that could not be improved significantly such as 306510005ALT01, 610991001, 308120002ALT03, and 615709004Rev03. These are the consequences of the longest lead time material that cannot be reduced because customer does not allow to do locally sourcing. Meanwhile, the actual implementation of quarter 4 in year 2007 provided the similarity of simulation results. Once consider to the actual implementations results, it is obviously shown that the lead time of some products were higher than simulation such as 303660001, 306510005ALT01, PTB OSM5500-02, 608750002, 308120002ALT03, 605500001. The key reason that actual implementation was slight longer is some errors from the operator such as forgot to contact forwarder to receive products. However, it was not a big effect to the lead time to customer.

Typically, items list of localization project must be proposed to customer for approval to start localization project. Once company proposed to customer, they disagreed to localize some critical items due to there are some doubts on second source supplier's quality control, production, and capabilities. In order to reduce lead time effectively, case studied company has to work synergically with customer in order to manage their suppliers to promote lead time reduction activity.

Moreover, another factor that should be considered is manufacturing lead time. Manufacturing of each product is diversity due to the complication of each product. A better way to reduce manufacturing lead time is to apply lean manufacturing concept. Typically, lean manufacturing concept encourages company to reduce seven significant wastes which sustain company to reduce lead time in production line efficiently.

5.5 ANALYTICAL RESULT OF THE DEVELOPED SUPPLY MANAGEMENT SYSTEM

The analytical result will be expressed the argument in term of advantages and disadvantages of applying the new developed supply management system.

5.5.1 Advantages

1. The developed system encourages case studied company to generate risk management. Risk management can assist case studied company to apprehend the risks as well as provide the strategic methodologies to prevent these risks occurring in the future by using Failure modes and effects analysis (FMEA).

2. Localization activity has become an important activity that company has to concentrate on. This activity assists case studied company not only to reduce lead time of delivery products to client but also encourage case studied company to reduce excess stock, reduce complicated transaction between company and current suppliers, and diminish the cost of expediting material. Another advantage of this activity is to gain more case studied company's revenue which some items explicitly can be discounted approximately 50% from previous price.

3. The developed supply management system assists MRP system to operate smoothly since the demand is more stable. Thus, purchasing order quantity is more accuracy than preceding time. This is the consequence of applying frozen zone concept.

4. The developed system helps case studied company to analyze the entire workflow of case studied company's supply chain in order to understand long lead time process as well as encourages case studied company to improve workflow. As a result, case studied company can reduce overall purchasing lead time and gain more efficiency and effectiveness.

5. The developed system supports company objectives. Some of objectives are on time delivery, gain more competitive advantages, reduce expediting cost, and enhance the company revenue growth rate.

6. The study facilitates case studied company to create framework for developed supply management system which can be reflected to others customers. Particularly the customers that currently have the same supply management problem as customer AAA.

5.5.2 Disadvantages

1. The most significant of disadvantages from the implementation of Supply management is the frozen zone. The frozen zone policy creates low responsiveness and flexibility for customer on adjusting the demand in near period.

2. Lead time reduction cannot be fully implemented due to there are some restrictions from customer to pursue the localization for all of items. The main reason is supplier lacks of knowledge to produce the part particularly on critical items.

3. The developed system must involve with many parties from various functions. In case any party in the team cannot perform their role appropriately, system cannot work effectively. Therefore, project leader is the most important person to tune up the level of understanding and collaboration in order to drive the project successfully.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

This thesis involves the development of a supply management system for a contract manufacturing company. Originally, the system was ineffective in managing supply system especially in on time delivery. Moreover, the company was facing with high material expediting cost. The development began with the investigation of existing system by analyzing several aspects in detail. The causes of problems were defined by using logical methodology. The solution framework was then defined to improve the supply management system. The thesis focuses on three objectives that are to reduce material shortages, to reduce expediting cost, and to improve on time delivery.

Ishigawa Diagram was adopted as analytical tool to analyze the causes and effects of the problem. Prior to developing solutions, the existing workflows were thoroughly analyzed in order to find ways to reduce working steps. Subsequently, all the causes of problems that have been derived from Ishigawa diagram were reflected into Failure Mode and Effective Analysis, FMEA, in order to define the critical failures by using Risk Priority Number (RPN). As a result, FMEA assisted to determine solutions to insure that any failures would not occur. After that the solutions were determined and divided into two significant areas: internal and external. The external area dealt with localization of purchasing items while the internal area were related to three activities namely establishing demand management policy, improvement of MRP system, and shortening purchase lead time.

The localization of purchasing activity had to deal with both customers and suppliers. It started from submitting the localization list to customer for approval. After receiving the approval, the company sent Requests for Quotation, RFQ, to suppliers. RFQ is sent to at least two suppliers in order to obtain the most competitive prices. The company received the quotations within two weeks, and then selected the

most competitive quotations and submitted official quotations to the relevant customers. First Article process, FA, is the next step which started after the customer had approved the quotations. The FA from all suppliers was submitted to the supplier quality engineering team, SQE, for insuring the specifications before submitting to the customer. The customer was responsible to perform final approval. After customer approval, the approved reports were returned to the company, and then company will update the new information in the company's data base. Consequently, the next purchase order will be sent to new suppliers along with new information according to the updated information in the system.

As for the internal area, the improvement started from the demand management policy. Originally, one cause of late product deliveries to customers was the changing of demand during the fixed order period and/or after sending PO to suppliers. Obviously, these causes affect the delivery performance and also expediting cost. In order to solve these problems, the company established a strategic demand management policy which called frozen zone. The frozen zone of a product was determined from the longest lead time among all purchased items plus cumulative manufacturing lead time of the product. This strategy facilitates material requirement planning, MRP, to operate smoothly which helps improving on time delivery and reducing the cost of material expediting. Besides establishing demand management policy, the company improved the efficiency of the MRP system by improving the accuracy of manufacturing yield and lead time of the purchased and the manufactured items. Originally, the company sets manufacturing yields, purchasing lead time, and manufacturing lead time for all products to be the same at 95%, 30 days, and 7 days, respectively. With accurate information, the company could operate the MRP system to plan for more accurate purchase orders and manufacturing orders.

The last area that company developed in this project was shortening purchasing lead time by reducing the time for issuing purchasing requirements (PR). An Electronic Data Interchange concept (EDI) was adopted. The company was using a computer system called Generic On Line Flow, GOLF. The EDI concept was applied to the GOLF system, which helped the company to reduce not only the lead time, but also human errors. After implementing this concept, company reduced the time to issue a PR from three days to one day.

The developed system shows significant improvements in on time delivery, reduced material shortages and expediting costs as well as decreased lead time to customer. A test with historical data showed that 100% on time delivery could be achieved. The actual operations with the improved system in the fourth quarter of 2007 also yield the same result. Material shortages and expediting costs were also reduced significantly in a simulated test and actual implementing. In simulated test, the material shortages were reduced by more than 60%, whilst the expediting costs were reduced by USD 670,000. In actual operation, the material shortages were reduced approximately 60% and the expediting costs were reduced by USD 51,000 in the fourth quarter of 2007. The lead time to customer was also shown to be improved for both simulated and actual operation. Nevertheless, not all the lead time of all products could be improved significantly because the lead time of some items could not be decreased.

In conclusion, the improvements have benefited the company greatly. Although the study was conducted mainly on the biggest client, the same treatments can be applied to the rest of the clients because they have the same problems.

6.2 RECOMMENDATIONS

The developed supply management system is a major step to improve the existing system. Nonetheless, there are still rooms for further improvements. The future improvements that company should consider are as follow:

1. Decrease frozen zone: Since the frozen zone policy creates low responsiveness and flexibility of customers to adjust their orders in very short period, in order to decrease frozen zone, the company should attempt to reduce the lead time of purchased materials. The company and/ or its suppliers may stock common and frequently used materials. However, the company has to be careful with the obsolescence of some items because it is a nature of this business to have short product life.

2. Establish vendor managed inventory: Vendor managed inventory, VMI, may be considered for the common items which have high volume and are used frequently. VMI may help the company to reduce lead time and price, as well as insure availability of materials.

3. Apply Lean Manufacturing Management to production line: In analyzing the supply chain, manufacturing and inspection steps have long lead times in workflow. Lean manufacturing is a concept that is useful for materials management by helping the company to reduce the seven wastes which are:

- Over production: Production produces product without customer's demand.
- Waiting: It is a loss time from resources having nothing to do in the process, for example the time that the employee waits when an automatic machine operates.
- Unnecessary transportation: It is loss from movements material or part in long distance and ineffectiveness transportation.
- Inappropriate process: A method that is not appropriate for production.
- Excess work-in-progress inventories.
- Unnecessary motion and effort: All movements of employees that are not useful in performing their tasks such as finding tooling, grasping parts, etc.
- Defective products: Defects or rework parts in production are loss and waste of time.

Lean manufacturing can reduce inventory turnover, space, lead time and, material handling. Due to small production lot, it encourages the company to improve product quality, process capability, and reduce manufacturing lead time effectively.

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Appendices

APPENDIX 1

Current Status Check Sheet

No.	Part no.	Description	Supplier	Commodity	Consolidated demand	Plt	Moq	Std Cost	Rohs	NCNR	Possible to do locally	Delivery Term
1	40003550	SD BB TBuffer F 1.5x1.5x3 SM BlP	FUJIKURA ASIA LTD.	OPTICAL	1451	28	100	1.18	No	NO	No	Ex Work
2	40003642	SD Plug Tube Flash Tifi	AVANEX FRANCE S.A	MECHANICAL	2902	28	150	1.29	No	NO	Yes	FOB
3	550000204	Epoxi-Stycast 2057 + catalist 9	CHEMTEC INDUSTRIAL PRODUCTS CO.,LTD	SUBDIRECT	0.07255	14	1	0.045	Yes	NO	No	Door to Door
4	550001017	Loctite thread lock 270 conf. da 10ml	CHEMTEC INDUSTRIAL PRODUCTS CO.,LTD	SUBDIRECT	2.902	14	3	0.021	Yes	NO	No	Door to Door
5	550306201	THERMOP. RESINE STAYSTIK MONO COMP._	ESCO-THAI CO.,LTD	SUBDIRECT	4.353	14	2	0.04	Yes	NO	No	Door to Door
6	551004601	Wire 52In48Sn	DCE HOLNE (R&D) LIMITED	SUBDIRECT	145.1	28	1	0.06	Yes	NO	Yes	Ex Work
7	551010101	Etichetta neutra 76 x 25 Bar Code	LASER PRINTING (THAILAND) CO.,LTD.	SUBDIRECT	2902	14	100	2.7	Yes	NO	Yes	Door to Door
8	551041001	Etichetta neutra 76 x 25 (caution)	LASER PRINTING (THAILAND) CO.,LTD.	SUBDIRECT	2902	14	500	2.7	Yes	NO	Yes	Door to Door
9	551041301	THT B423 101mm x 90 mt Y391593	LAIRD TECHNOLOGIES (SEA) PTE LTD	SUBDIRECT	43.53	14	300	0.003	Yes	NO	Yes	Ex Work
10	561002101	Insert Box for ""FLASH"" PE FOAM	AVANEX FRANCE S.A	SUBDIRECT	1451	28	500	0.03	Yes	NO	Yes	FOB
11	561002701	INSERT BOX TOP CONDUCTIVE PE FOAM	AVANEX FRANCE S.A	SUBDIRECT	1451	14	500	0.64	Yes	NO	Yes	FOB
12	611003701	GPO MALE FLANGE MOUNT A001-N33-05	CORNING GILBERT INC.	OPTICAL	1451	28	500	4.75	Yes	YES	No	FOB
13	631130701	COVER F10 GOLD LID	Hi-Rel Lids Ltd	MECHANICAL	1451	28	500	2.7	No	NO	Yes	Ex Work
14	791047301	12.5Gb/s_MODULATOR CHIP FLASH LD MET	CORNING INC.	OPTICAL	1451	14	300	0.032	No	NO	No	FOB
15	400006280001	WINDOW, BULKHEAD, SC DUPLEX, BLACK	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	4507	21	100	24.1	No	No	Yes	Door to Door
16	400007460001	FACEPLATE, SMALL, BLACK, NO LOGO	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	4507	21	100	12.28	No	No	Yes	Door to Door
17	400007470001	BASEPLATE, SMALL, BLACK, 19in DCM RACK	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	4507	21	100	13.4	No	No	Yes	Door to Door
18	400007480001	COVER, SMALL, BLACK, 19in DCM RACK	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	4507	21	100	5.8	Yes	No	Yes	Door to Door
19	7590010042027	Pump, 974.5+/-0.5nm, 250mW, JDSU, 2700	JDS UNIPHASE CORPORATION	OPTICAL	2180	28	1000	389	No	YES	Yes	FOB
20	7590010043045	Pump, 980Nm, 450Mw	JDS UNIPHASE CORPORATION	OPTICAL	2090	42	10	610	No	YES	Yes	FOB
21	7590010090001	Photodiode, JDSU, C-Band	JDS UNIPHASE CORPORATION	OPTICAL	4360	42	100	35	No	YES	Yes	Ex Work
22	7590200010001	Standoff, M-F .156 Round #2-56 .236 Lg	BOSSARD (THAILAND) LTD.	HARDWARE	2090	21	1500	0.13	Yes	YES	Yes	Door to Door
23	7590210090001	LABEL, REMOVABLE, ESD WARNING	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1045	14	3000	0.11	Yes	NO	Yes	Door to Door
24	7872710150001	Ring, Fiber Management, Molded	LANNA LAMPHUN PRECISION LTD.	MECHANICAL	1045	21	3000	1.21	Yes	NO	Yes	FOB
25	75825521450001	Screw, Buthdcap #2-56X.156L Blkoxide Fin	COFFER INDUSTRIAL SUPPLIES	HARDWARE	6270	21	2000	0.31	No	YES	Yes	Door to Door
26	0+0347	Pump, Thermal Shim	HENKEL (THAILAND) LTD.	MECHANICAL	75388	30	1500	0.3468	No	NO	Yes	Ex Work
27	0+0364	Screw, 4-40 BSC x 1/4 SST	BOSSARD (THAILAND) LTD.	HARDWARE	21538	28	1	0.0112	Yes	YES	Yes	Door to Door
28	0+0784	Screw, 2-56 X 1/8 Bsc, Ss	HARDWARE SPECILATY CO.,INC	HARDWARE	248938	30	1000	0.02	Yes	NO	Yes	FOB
29	0+0907	Label, Dcm 4 X 1.75 Zebra (3000/Roll)	ADAMPAK (THAILAND) LTD.	SUBDIRECT	8682	14	1000	0.0284	Yes	NO	Yes	FOB
30	0+0962	Lc Dust Caps - H-132 - Wadm	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	56796	28	1	0.06	No	NO	Yes	Ex Work
31	0+1061	Jumper, Fc/Upc Measurement, 900 Micron	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	5804	21	1	17.36	No	No	Yes	Ex Work
32	0+1097	Lc Bulkhead Cleaner	AVANEX CORPORATION-AEP	SUBDIRECT	2902	21	50	152	No	NO	Yes	Ex Work
33	0+1178	Pump, 1487nm, 150mW	FURUKAWA AMERICA, INC.	OPTICAL	10769	42	20	14.85	No	No	Yes	FOB
34	0+1204	FOAM, COMPONENT, MOSAIC	FOAMEX ASIA CO.,LTD	SUBDIRECT	427406	14	10000	0.1	Yes	NO	Yes	Door to Door
35	0+1218	1465/1487 Pump Combiner	AVANEX CORPORATION-AEP	OPTICAL	10769	42	20	27.5	No	NO	Yes	Ex Work
36	0+1227	Cover, Eeprom Connector	UNITED PRECISION	MECHANICAL	8682	28	3000	1.88	Yes	YES	Yes	FOB
37	0+1290	Bag, Static Shield Esd 6X8	SPECIALTY TECH CORPORATION LIMITED	SUBDIRECT	4341	21	4500	0.1739	Yes	NO	Yes	FOB
38	0+1292	SCREW, 2-56x3/16, FLAT SOCKETHEAD, ALLOY STEEL, BLACK	COFFER INDUSTRIAL SUPPLIES	HARDWARE	30387	28	1000	0.0527	Yes	YES	Yes	Ex Work
39	0+1382	Wdm, 980/1550 P-C	AOFR PTY LIMITED	OPTICAL	21538	21	10	36	Yes	No	Yes	Ex Work
40	0+1493	Plate, Coil Top	EAGLE METALCRAFT., INC.	MECHANICAL	4341	21	100	3.25	No	NO	Yes	Ex Work
41	0+1495	Spacer, Coil	RIMCO PLASTICS CORP.	MECHANICAL	4341	28	100	0.07	Yes	NO	Yes	Ex Work
42	0+1720	SPLICE PROTECTOR,MINI HEAT SH	AVANEX CORPORATION-AFM	MECHANICAL	9014	28	1	0.4	No	No	Yes	Ex Work
43	0+1959	Label, Void (Tamper Resistant)	ADAMPAK (THAILAND) LTD.	SUBDIRECT	34360	14	5000	0.1702	Yes	NO	Yes	FOB
44	0+1984	Screw, M2.5X8 Phh,Flthd Ss W/Lock Patch	BOSSARD (THAILAND) LTD.	MECHANICAL	4784	14	1000	0.08	Yes	No	Yes	Door to Door
45	0+1986	Screw, M 2X6, Shcs, Ss W/ Locking Patch	BOSSARD (THAILAND) LTD.	MECHANICAL	2392	14	1000	0.03	Yes	No	Yes	Door to Door
46	0+1989	Screw, M3X6 Phh-Flthd Ss W/Lock Patch	PENINSULA COMPONENTS, INC. (SINGAPORE BRACH)	HARDWARE	70828	14	1000	0.0085	No	NO	Yes	FOB
47	0+2073	15dB C-Band 1x1	AVANEX CORPORATION-AEP	OPTICAL	4341	21	1	274.91	No	NO	No	Ex Work
48	0+2078	Label, Dcm In Process	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	7176	21	1500	0.27	Yes	YES	Yes	CIF Bangkok
49	0+307490001	PCB, Customer Interface Module, PG5500	MPL INC.	PCB	10769	42	25	104.55	No	NO	Yes	FOB
50	0+3172	Saddle, Wire	BOSSARD (THAILAND) LTD.	HARDWARE	8682	28	1000	0.27	Yes	YES	Yes	Door to Door
51	0+3444	Coupler	OPLINK COMMUNICATION INC.	OPTICAL	10769	42	100	60	Yes	No	No	FOB
52	0+3445	Blank, Pigtail	LANNA LAMPHUN PRECISION LTD.	MECHANICAL	56738	28	1000	0.21	No	YES	Yes	FOB
53	0+3481	Pigtail, #3 White, Length 102.5 Cm	AVANEX CORPORATION-AEP	OPTICAL	8848	21	1	17.62	No	No	No	Ex Work
54	0+3482	Pigtail, #2, Red, Length 102.5 Cm	AVANEX CORPORATION-AEP	OPTICAL	4341	21	1	17.62	No	No	No	Ex Work
55	0+3483	Pigtail, #1, Blue, Length 102.5 Cm	AVANEX CORPORATION-AEP	OPTICAL	4341	21	1	17.62	No	No	No	Ex Work
56	0+3484	Pigtail, #4, Green , Length 102.5 Cm	AVANEX CORPORATION-AEP	OPTICAL	4341	21	1	20.66	No	No	No	Ex Work
57	0+3488	SADDLE, MICRO WIRE	BOSSARD (THAILAND) LTD.	HARDWARE	43076	28	1000	0.0298	No	YES	Yes	Door to Door
58	0+3589	Cover, Assembly	AVANEX CORPORATION-AEP	MECHANICAL	4341	28	100	25.88	Yes	NO	Yes	Ex Work
59	0+3596	Pcb, Assy	AVANEX CORPORATION-AEP	PCB	4341	28	1	776.06	No	NO	Yes	Ex Work
60	0+3650	Cover, Gff Heater Box	AVANEX CORPORATION-AEP	MECHANICAL	4341	28	200	2.4	Yes	YES	Yes	Ex Work
61	0+3651	Spacer, Gff Box	HIGH TECH MACHINISTS INC.	MECHANICAL	4341	28	200	11.66	Yes	YES	Yes	Ex Work

No.	Part no.	Description	Supplier	Commodity	Consolidated demand	Plt	Moq	Std Cost	Rohs	NCNR	Possible to do locally	Delivery Term
62	0+3724	Cap, Mu Dust	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	5225	14	1	0.1	No	NO	No	Ex Work
63	0+3851	Tray, Component	GLOBAL-THAIXON PRECISION INDUSTRY CO.,LTD.	MECHANICAL	25898	28	500	8.5445	No	YES	Yes	Door to Door
64	0+3854	Pocket Coil	CIVICA (THAILAND) CO.,LTD	MECHANICAL	12949	21	200	0.4769	Yes	YES	Yes	FOB
65	0+3857	Heater, Coil	MINCO PRODUCTS INC.	MECHANICAL	12949	42	1000	55.225	No	NO	Yes	FOB
66	0+3903	INSULATOR, PCB	SWIFTRONIC (THAILAND) CO.,LTD.	MECHANICAL	10769	28	100	0.2071	No	YES	Yes	Door to Door
67	0+3904	Standoff, M-F 3/16 Hex 11/16 Long Ss	QUALITY AND EXPRESS SUPPLY CO.,LTD.	HARDWARE	47436	28	2000	0.6954	No	NO	Yes	FOB
68	0+3918	Label, Clei Code	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	8682	14	5000	0.0312	Yes	NO	Yes	CIF Bangkok
69	0+40000003	Pump, 974.5+/-0.5nm, 270mW, JDSU, 2900	JDS UNIPHASE CORPORATION	OPTICAL	2180	42	10	0.64	Yes	YES	No	FOB
70	0+40000048	Coil Heater Assy, CR, PG2600	MINCO PRODUCTS INC.	MECHANICAL	6259	42	500	44.75	No	NO	Yes	FOB
71	0+40000069	812_COIL_1	COFFER INDUSTRIAL SUPPLIES	MECHANICAL	1752	21	1500	1.6	Yes	No	Yes	Ex Work
72	0+40000080	Shipping Case, Tellabs 802,812,842 Rev2	PRIMAX GENERAL CO.,LTD.	SUBDIRECT	1752	14	25	6.1556	Yes	NO	Yes	FOB
73	0+40000130	Standoff M3 x 0.5, 4.5mm Hex, M-F, 28mm LG	HARDWARE SPECILATY CO.,INC	HARDWARE	43076	42	500	0.6375	Yes	NO	Yes	FOB
74	0+40000253	PCBA, PG2600, T-BOARD-II, SINGLE SLOT	BRECONRIDGE MANUFACTURING SOLUTIONS	PCB	1752	28	500	326.13	Yes	YES	Yes	FOB
75	0+40000495	FOAM, FIBER RETENTION	RIMCO PLASTICS CORP.	SUBDIRECT	5594	14	1000	0.04	Yes	NO	Yes	Ex Work
76	0+40000638	HEAT SINK, W/ HEAT PIPES (MACHINED)	AAVID THERMALLOY (S) PTE LTD	MECHANICAL	1752	30	100	105	No	NO	Yes	Ex Work
77	0+40000665	SCREW, #2-56, 100 DEG, 3/16 LG, PH FH,SS	BOSSARD (THAILAND) LTD.	HARDWARE	4180	28	1000	0.0694	Yes	YES	Yes	Door to Door
78	0+40000788	ASSEMBLY, SPOOL, 202X95X30	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	4507	21	100	49.2	Yes	No	Yes	FOB
79	0+40000797	Insulator 4.25 x 2 x .010 Lexan	SWIFTRONIC (THAILAND) CO.,LTD.	MECHANICAL	3504	21	500	0.44	Yes	YES	Yes	Door to Door
80	0+40000808	GFF, Single, Standard, C-Band II, G23	AUXORA INC.	OPTICAL	1752	21	1	95.9737	Yes	YES	Yes	FOB
81	0+40000813	GFF, Single, Standard, C-Band II, G42	BROWAVE CORPORATION	OPTICAL	2180	21	1	157.2	Yes	YES	Yes	Ex Work
82	0+40000945	Shipping Case,Marconi 6XX	INTER CENTER PACK (THAILAND) CO.,LTD.	SUBDIRECT	4341	14	50	4.7688	Yes	NO	Yes	Door to Door
83	0+40000951	OSM Coil 1 Ver 1	COFFER INDUSTRIAL SUPPLIES	MECHANICAL	10769	21	1500	0.07	Yes	No	Yes	Ex Work
84	0+40000952	OSM Coil 2 Ver 1	COFFER INDUSTRIAL SUPPLIES	MECHANICAL	10769	21	1500	0.07	Yes	No	Yes	Ex Work
85	0+40001295	550_COIL_1 ver2	COFFER INDUSTRIAL SUPPLIES	MECHANICAL	2180	21	1000	1.4	Yes	No	Yes	Ex Work
86	0+40001297	550_COIL_2 ver2	COFFER INDUSTRIAL SUPPLIES	MECHANICAL	2180	21	1000	1.62	Yes	No	Yes	Ex Work
87	0+40001325	BASE, PG2600, ADVA L-BAND	CHINASOL TECHNOLOGY (HONGKONG) CO., LTD.	MECHANICAL	1045	21	100	51.6	Yes	YES	Yes	CIF Bangkok
88	0+40001326	COVER, PG2600, ADVA L-BAND	CIVICA (THAILAND) CO.,LTD	MECHANICAL	1045	21	300	6.9075	Yes	NO	Yes	FOB
89	0+40001342	PCBA, PG2600, P-BOARD, PLAT 8, 875	BRECONRIDGE MANUFACTURING SOLUTIONS	PCB	1045	28	1	343.18	No	NO	Yes	FOB
90	0+40001347	COIL POCKET, PG2600, 6.6 MM DEEP	MECHILL ENGINEERING CO., LTD.	MECHANICAL	1045	28	200	55.4	No	YES	Yes	Door to Door
91	0+40001352	COIL HEATER, PG2600	MINCO PRODUCTS INC.	MECHANICAL	1045	42	100	90.25	No	NO	Yes	FOB
92	0+40001397	PCBA, PG2600, P-BOARD, PLAT 8, 802-2	AVANEX CORPORATION-AEP	PCB	1752	28	1	157.54	No	NO	Yes	Ex Work
93	0+40001525	EMA, PG5500, P-Board, 758(lla), 4 Pump	SCE ELECTRONICS(S) PTE LTD	PCB	10769	28	800	353.2	No	NO	Yes	FOB
94	0+40001851	FIBER MGMT RING - 2, MOLDED	LANNA LAMPHUN PRECISION LTD.	MECHANICAL	1752	28	500	1.3439	Yes	YES	Yes	FOB
95	0+40002003	875 Coil 1 Ver 2	COFFER INDUSTRIAL SUPPLIES	MECHANICAL	1045	14	1000	0.21	Yes	No	Yes	Ex Work
96	0+40002140	PCBA, PG1500, 366 Variant, P/N 40002140	SANMINA-SCI SYSTEMS SINGAPORE PTE LTD	PCB	15428	30	1000	156.24	Yes	YES	Yes	FOB
97	0+40002143	366_Coil 1 ver1	COFFER INDUSTRIAL SUPPLIES	MECHANICAL	15428	28	500	0.05	Yes	No	Yes	Ex Work
98	0+40002446	TRAT, PG1500, COMPONENT, TAPPED	MMI PRECISION (THAILAND) LTD.	MECHANICAL	15428	21	200	18.9	No	YES	Yes	Door to Door
99	0+40002863001	Assy, Pigtail Bifurcated 900Um Blk& Wht	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	2180	14	1	38.81	Yes	NO	No	Ex Work
100	0+40002863002	Assy, Pigtail Bifurcated 900Um Blk&Wht	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	2180	14	1	38.81	Yes	NO	No	Ex Work
101	0+40002863003	Assy, Pigtail Bifurcated 900Um Blk&Wht	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	2180	14	1	38.81	Yes	NO	No	Ex Work
102	0+40002863004	Assy, Pigtail Bifurcated 900Um Blk&Wht	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	2180	14	1	38.81	Yes	NO	No	Ex Work
103	0+40002863005	Assy, Pigtail Bifurcated 900Um Blk&Wht	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	2180	14	1	38.81	Yes	NO	No	Ex Work
104	0+40002866005	Pigtail Bifur,827&830 Mu/Upc,Blu/Red	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	2090	14	1	51.16	Yes	NO	No	Ex Work
105	0+40002873002	Pigtail,Adva 827&830Mu/Upcblk900Umzhblck	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	1045	14	1	25.11	Yes	NO	No	Ex Work
106	0+40002880	Jumper, SC/UPC 900um Buffer - 10M	SEIKOH GIKEN HONG KONG CO., LIMITED	OPTICAL	7154	21	50	32.76	Yes	No	No	Ex Work
107	0+4014	Foam, Blanket	SWIFTRONIC (THAILAND) CO.,LTD.	SUBDIRECT	4341	21	500	0.95	Yes	NO	Yes	Door to Door
108	0+4112	Connector, Scupc, Amp Receptacle, Duplex	CORNING CABLE SYSTEMS PTY LTD	MECHANICAL	1196	14	3000	1.3	Yes	No	Yes	FOB
109	0+4181	Splice Protector, 15Mm,No Rod	CORNING CABLE SYSTEMS PTY LTD	MECHANICAL	718896	14	1000	0.56	Yes	YES	Yes	Ex Work
110	0+4182	20dB C-Band 1x1	AVANEX CORPORATION-AEP	OPTICAL	10769	21	1	274.12	No	NO	No	Ex Work
111	0+4356	THERMAL MATERIAL, SARCON 200G- M, 300 X 200 SHEET	FUJIPOLY (THAILAND) CO.,LTD	MECHANICAL	2153.8	28	9	38.2795	Yes	YES	Yes	Door to Door
112	0+4364	Filter, Telemetry, 1510 S-C	BROWAVE CORPORATION	OPTICAL	8682	21	1	31.88	Yes	YES	No	FOB
113	0+4367	Coupler, 98/2 1X2 S-C	AOFR PTY LIMITED	OPTICAL	79988	14	250	9.3	Yes	NO	No	FOB
114	0+4368	Coupler, 98/2 1X2 P-C	AVANEX CORPORATION-AEP	OPTICAL	19769	14	100	10.8	Yes	NO	No	FOB
115	0+4369	Coupler, 98/2 1X2 S-L	AOFR PTY LIMITED	OPTICAL	1045	14	50	12.7	Yes	NO	No	FOB
116	0+4370	Coupler	AOFR PTY LIMITED	OPTICAL	2090	14	10	15	Yes	NO	No	FOB
117	0+4374	Coupler, 50/50 1X2 P-L	AOFR PTY LIMITED	OPTICAL	1045	14	10	15	Yes	NO	No	FOB
118	0+4381	Wdm, 980/1550 S-C	AOFR PTY LIMITED	OPTICAL	5256	14	14	19.4	Yes	NO	No	FOB
119	0+4382	Wdm, 980/1550 P-C	AOFR PTY LIMITED	OPTICAL	16974	14	14	20.8	Yes	NO	No	FOB
120	0+4383	WDM, 980/1550 BS-C	AOFR PTY LIMITED	OPTICAL	61712	14	14	19.5	Yes	NO	Yes	FOB
121	0+4388	Isolator, Ss, S-C	KONCENT COMMUNICATION, INC.	OPTICAL	63554	21	1	22.93	Yes	NO	Yes	FOB
122	0+4389	Isolator, Ss, P-C	BROWAVE CORPORATION	OPTICAL	52076	21	1	26.5	Yes	NO	Yes	FOB
123	0+4390	Isolator, Ss, S-L	ALCATEL JAPAN LTD.	OPTICAL	2090	30	100	32.5	Yes	NO	Yes	FOB
124	0+4391	ISOLATOR, DS, S- C	BROWAVE CORPORATION	OPTICAL	4360	3	1	31.711	Yes	NO	Yes	FOB

No.	Part no.	Description	Supplier	Commodity	Consolidated demand	Plt	Moq	Std Cost	Rohs	NCNR	Possible to do locally	Delivery Term
125	0+4393	Isolator, 1480, S	KONCENT COMMUNICATION, INC.	OPTICAL	10769	3	10	35	Yes	NO	Yes	FOB
126	0+4512	Coupler, 95/5 1X2 P-L	AOFR PTY LIMITED	OPTICAL	1045	14	50	13	Yes	NO	Yes	FOB
127	0+4579	HOLDER, SPLICE PROTECTOR	CORNING CABLE SYSTEMS PTY LTD	MECHANICAL	86152	14	1	0.29	No	YES	Yes	Ex Work
128	0+4647	Photodiode, Sff-Ldc	BROWAVE CORPORATION	OPTICAL	71923	21	100	54	Yes	NO	No	FOB
129	0+4649	Coupler, Tap 980 1X2 60/40 Consold Spec	AOFR PTY LIMITED	OPTICAL	2180	14	10	27	Yes	NO	No	FOB
130	0+4686	Pigtail Assy, Bifurcated, Lc/Upc, 8Xx	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	53845	21	1	34.52	No	No	Yes	Ex Work
131	0+4735	Label, Pigtails, S1I	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1045	14	1000	0.1209	Yes	NO	Yes	CIF Bangkok
132	0+4736	Label, Pigtails, S1O	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1045	14	1000	0.1209	Yes	NO	Yes	CIF Bangkok
133	0+4737	Label, Pigtails, S2I	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1045	14	1000	0.1209	Yes	NO	Yes	CIF Bangkok
134	0+4738	Label, Pigtails, S2O	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1045	14	1000	0.159	Yes	NO	Yes	CIF Bangkok
135	0+4742	Splice Protector,Heat Shrink,15Mm,No Rod	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	398035	28	1000	0.34	Yes	NO	No	Ex Work
136	0+4746	Shipping Case, 8Xx	INTER CENTER PACK (THAILAND) CO.,LTD.	SUBDIRECT	5552	28	100	2.89	Yes	NO	Yes	FOB
137	0+4765	PCB, V- BOARD, ILA	SCE ELECTRONICS(S) PTE LTD	PCB	10769	21	100	591.01	Yes	YES	Yes	Ex Work
138	0+4767	Voa, Mems, Epoxy Free	JDS UNIPHASE CORPORATION	OPTICAL	23290	42	10	232	Yes	YES	Yes	FOB
139	0+4784	Coupler, 90/10 1X2 S-C	AOFR PTY LIMITED	OPTICAL	12949	14	50	11.5	Yes	NO	Yes	FOB
140	0+4785	COUPLER, 99/ 01 1X2 S- C	AOFR PTY LIMITED	OPTICAL	10769	14	50	10.8	Yes	NO	No	FOB
141	0+4804	Label, Pigtails, M1	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1045	14	1000	0.1209	Yes	NO	Yes	CIF Bangkok
142	0+4816	Label, Contr Covr Esd Warn Attnt	AVANEX CORPORATION-AEP	SUBDIRECT	24110	14	1000	0.0851	Yes	NO	Yes	Ex Work
143	0+4867	Standoff, M/F #2-56 Thread .875 3/16Hex	BOSSARD (THAILAND) CO.,LTD	HARDWARE	51796	28	1000	0.6	Yes	NO	Yes	FOB
144	0+4868	Coupler, 95/5 1X2 P-C	AOFR PTY LIMITED	OPTICAL	25472	14	100	9.9	Yes	NO	No	FOB
145	0+4873	Coupler, 50/50 1X2 P-C	AVANEX CORPORATION-AEP	OPTICAL	23273	14	100	9.5	Yes	NO	No	FOB
146	0+4874	Case, Shipping, 550	INTER CENTER PACK (THAILAND) CO.,LTD.	SUBDIRECT	2180	14	200	5.52	Yes	NO	Yes	FOB
147	0+4879	Tape, Kapton Esd 1/4"" Wescorp	SPECIALTY TECH CORPORATION LIMITED	SUBDIRECT	3660.6	21	2333	0.7607	Yes	NO	No	FOB
148	0+4880	Tape, Kapton Esd 1/2"" Wescorp	SPECIALTY TECH CORPORATION LIMITED	SUBDIRECT	3789	21	2333	1.3758	Yes	NO	No	FOB
149	0+4883	Isolator, Ds, P-C	KONCENT COMMUNICATION, INC.	OPTICAL	4180	14	1	35	Yes	NO	Yes	FOB
150	0+4953	Foam, Component Holder (2X1.75X..125)	RIMCO PLASTICS CORP.	SUBDIRECT	1752	14	1000	0.47	Yes	NO	Yes	Ex Work
151	0+4966	Retainer-Wide	MECHILL ENGINEERING CO., LTD.	MECHANICAL	8682	14	100	6.84	Yes	YES	Yes	FOB
152	0+4972	Foam, Splice Holder	FOAMEX (THAILAND) CO.,LTD	MECHANICAL	15535	28	100	0.05	Yes	NO	Yes	FOB
153	0+4994	Pcba, Pg2600, E-Board, Baseline, Iic	AVANEX CORPORATION-AEP	PCB	1752	21	300	155.21	Yes	YES	Yes	Ex Work
154	0+4995	PCBA, PG2600 E-Board No IIC, P/N 0+4995, Rev B	CTS CORPORATION	PCB	13994	112	1000	58.33	No	YES	Yes	FOB
155	0+5000116	Shipping Case, Single Channel	INTER CENTER PACK (THAILAND) CO.,LTD.	SUBDIRECT	15428	14	350	2.56	Yes	NO	Yes	Door to Door
156	0+5000145019	Pigtail, MZ, LC, 1071, Blu	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	15428	21	1	21.99	No	No	No	FOB
157	0+5000145020	Pigtail, MZ, LC, 731, Red	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	15428	21	1	21.94	No	No	Yes	Ex Work
158	0+5000145021	Pigtail, MZ, LC, 731 Blk	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	15428	21	1	21.94	No	No	Yes	Ex Work
159	0+5000184	SPACER, PIGTAIL	ITS PRECISION & INDUSTRIAL PTE LTD	MECHANICAL	15428	21	1000	0.1	No	NO	Yes	Ex Work
160	0+5000187	PCBA, PG1500 P-BOARD, P/N 5000187	SANMINA-SCI SYSTEMS SINGAPORE PTE LTD	PCB	15428	30	1500	215.6	Yes	YES	Yes	FOB
161	0+50001940001	Label, Pigtails, PT	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1752	14	1000	0.1209	No	No	Yes	CIF Bangkok
162	0+50001940002	Label, Pigtails, LT	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1752	14	1000	0.1539	No	No	Yes	CIF Bangkok
163	0+50001940005	Label, Pigtails, OA	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1752	14	1000	0.1209	No	No	Yes	CIF Bangkok
164	0+50001940006	Label, Pigtails, OD	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1752	14	1000	0.1209	No	No	Yes	CIF Bangkok
165	0+50001940007	Label, Pigtails, PI	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1752	14	1000	0.1539	No	No	Yes	CIF Bangkok
166	0+50001940008	Label, Pigtails, PO	GANNON BUSINESS FORMS	SUBDIRECT	1752	21	1000	0.2013	No	No	Yes	FOB
167	0+50001940009	Label, Pigtails, LI	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1752	14	1000	0.1539	No	No	Yes	CIF Bangkok
168	0+50001940010	Label, Pigtails, LO	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	1752	14	1000	0.1209	No	No	Yes	CIF Bangkok
169	0+5000342	Standoff, M-F, 3-16 Hex, #2-56, .25 Lg.	COFFER INDUSTRIAL SUPPLIES	HARDWARE	7008	28	1000	0.36	Yes	YES	Yes	Ex Work
170	0+5000357	Insulator, E Board, Pg1500	IDEAL JACOBS (XIAMEN) CORPORATION	MECHANICAL	30856	14	1000	0.8552	No	NO	Yes	CIF Bangkok
171	0+5000794	STANDOFF, M- F, 3- 16 HEX, #2- 56, 0.406LG	FERMIONICS OPTO-TECHNOLOGY	HARDWARE	21538	28	2000	0.5525	No	NO	Yes	FOB
172	0+5000810	Cover, Coil Pocket, Ila	MECHILL ENGINEERING CO., LTD.	MECHANICAL	17456	14	100	2.56	No	YES	Yes	FOB
173	0+5000813	STACKER, ILA	ADDCOM SOLUTION PTE LTD	MECHANICAL	10769	30	1	1.97	No	YES	Yes	Ex Work
174	0+5000872	Screw, #2-56 X .75 Lg., Shcs	BOSSARD (THAILAND) CO.,LTD	HARDWARE	30552	28	3000	0.65	Yes	NO	Yes	FOB
175	0+5001119	Standoff, M-F 5/32Rnd #2-56 .25 Lg 300Ss	BOSSARD PTE LTD.	HARDWARE	7346	28	1000	0.59	Yes	YES	Yes	FOB
176	0+5001285	Tape, Vhb Component Holding	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	126221	14	5000	0.18	Yes	NO	No	CIF Bangkok
177	0+5001287	Tape, Vhb Foam	IDEAL JACOBS (XIAMEN) CORPORATION	MECHANICAL	60690	14	2000	0.062	Yes	NO	Yes	CIF Bangkok
178	0+5001288	Tape, Vhb Foam	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	92683	14	1500	0.03	Yes	NO	No	CIF Bangkok
179	0+5001405	Base, Assembly, Mts	GLOBAL THAIXON CO.,LTD	MECHANICAL	2180	28	500	38.43	No	NO	Yes	FOB
180	0+5001408	HOLDER, PIGTAIL	MECHILL ENGINEERING CO., LTD.	MECHANICAL	4360	14	100	5.31	No	YES	Yes	FOB
181	0+5001423	Cover	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	2180	14	50	12.1387	Yes	NO	Yes	Door to Door
182	0+50015220006	PIGTAIL, BIFUR, SC/UPC, RED/BLUE *	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	1752	21	1	38.65	No	YES	Yes	Ex Work
183	0+50015220007	PIGTAIL, BIFUR, LC/UPC, RED/BLUE *	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	1752	21	42	41.48	No	YES	Yes	Ex Work
184	0+50015220009	PIGTAIL, BIFUR, LC/UPC, RED/BLUE *	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	1752	21	1	38.44	No	YES	Yes	Ex Work
185	0+50015220010	PIGTAIL, BIFUR, LC/UPC, RED/BLUE *	CORNING CABLE SYSTEMS PTY LTD	OPTICAL	1752	21	1	38.47	No	YES	Yes	Ex Work
186	0+5001636	Putty, Thermal, Pg1500	FUJIPOLY (THAILAND) CO.,LTD	MECHANICAL	92.568	28	7	117.5	Yes	YES	Yes	Door to Door
187	0+5009798	Photodiode InGaAs PIN Hgh-Speed Dia 5.5	FERMIONICS OPTO-TECHNOLOGY	OPTICAL	8540	42	90	23	Yes	YES	Yes	FOB
188	0+5077	Amp Label, No Die Cut, Laser Class 3B	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	15132	14	1000	0.8	Yes	NO	Yes	FOB
189	0+5080	Amp Label, Left Die Cut, Laser Class 1M	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	30856	14	300	0.23	Yes	NO	Yes	CIF Bangkok
190	0+5145	Gff, Single Standard C-Band Ii, G20	AVANEX CORPORATION-AEP	OPTICAL	4341	21	1	0.64	Yes	No	Yes	FOB

No.	Part no.	Description	Supplier	Commodity	Consolidated demand	Plt	Moq	Std Cost	Rohs	NCNR	Possible to do locally	Delivery Term
191	0+5147	Gff, Single Standard C-Band Ii, G29	BROWAVE CORPORATION	OPTICAL	21538	21	1	93.6375	Yes	YES	Yes	FOB
192	0+5165	Gff, Ila Rev 2 (Old 5092)	BROWAVE CORPORATION	OPTICAL	2180	21	1	150.6	Yes	No	Yes	FOB
193	0+5246	SCREW, 2- 56 X 3/ 8 SHCS, SS	BOSSARD (THAILAND) CO.,LTD	HARDWARE	54992	28	1000	0.69	Yes	NO	Yes	FOB
194	0+5254	Splicing Compound (2 Oz Bottle)	GLOBALTRONIC INTERTRADE CO., LTD	SUBDIRECT	45174.53	14	1	24.5	Yes	YES	Yes	FOB
195	0+5294	Wdm, 980/1550 L-Band	AOFR PTY LIMITED	OPTICAL	8360	14	50	28	Yes	NO	Yes	FOB
196	0+5312	GFF	BROWAVE CORPORATION	OPTICAL	1045	21	1	127.625	Yes	YES	Yes	FOB
197	0+5363	Filter, Telemetry 1510 S-C < .6 Il	BROWAVE CORPORATION	OPTICAL	3504	21	1	31.8835	Yes	YES	Yes	FOB
198	0+5365	Coupler, 80/20 1X2 P-C	AOFR PTY LIMITED	OPTICAL	1752	14	100	12.5	Yes	NO	Yes	FOB
199	0+5389	651 Coil 1	COFFER INDUSTRIAL SUPPLIES	MECHANICAL	4341	21	1000	0.6	No	No	Yes	Ex Work
200	0+5390	651 Coil 2	COFFER INDUSTRIAL SUPPLIES	MECHANICAL	4341	21	1000	0.6	No	No	Yes	Ex Work
201	0+907	Label, Dcm 4 X 1.75 Zebra (3000/Roll)	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	20420	14	1000	0.15	No	YES	Yes	FOB
202	0+908	Splice Protector, Flexible	FUJIKURA ASIA LTD.	SUBDIRECT	2392	45	1000	0.58	No	YES	Yes	Ex Work
203	0313131-002	Jumper LC SMF 900¤øm 5m 0.2dB IL (Cisco)	SUMITOMO ELECTRIC (THAILAND) LIMITED	OPTICAL	6744	21	2001	9.25	Yes	NO	No	Door to Door
204	1015303	Coupler 1x2 1% C-Band	BROWAVE CORPORATION	OPTICAL	4496	42	1	8.2	Yes	YES	Yes	FOB
205	2002138	Clamp Cable Aluminum w/Adh 1/4 Dia	BOSSARD (THAILAND) LTD.	HARDWARE	8992	28	1000	0.1855	Yes	YES	Yes	Door to Door
206	40000397	Fiber, DCM SMF-28-e .40.30 (1528-2 50km)	DRAKA COMTEQ FRANCE	OPTICAL	35880	28	150	5.05	No	YES	No	FOB
207	400005760001	WINDOW, BULKHEAD, BLANK, BLACK	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	1196	21	1500	1.04	No	No	Yes	Door to Door
208	400006280001	WINDOW, BULKHEAD, SC DUPLEX, BLACK	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	1196	21	150	1.12	No	No	Yes	Door to Door
209	400007490001	FACEPLATE, LARGE, BLACK, NO LOGO	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	1196	21	100	1.73	No	No	Yes	Door to Door
210	400007520001	BASEPLATE, LARGE, BLACK, 19in DCM RACK	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	1196	21	100	1.41	No	No	Yes	Door to Door
211	400007530001	COVER, LARGE, BLACK, 19in DCM RACK	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	1196	21	100	1.14	No	No	Yes	Door to Door
212	40000790	FLANGE, SMART, 253X95	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	4784	21	100	0	No	No	Yes	Door to Door
213	40000791	ASSEMBLY, SPOOL, 253X95X30	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	1196	21	400	49.71	No	No	Yes	Door to Door
214	40002052	Container, Shipping, 19in Rack Mods Gen	INTER CENTER PACK (THAILAND) CO.,LTD.	SUBDIRECT	1196	21	200	1.76	No	YES	Yes	Door to Door
215	40002455	Label, Outer carton Barolo Product	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	6755	14	1000	0.73	No	YES	Yes	FOB
216	40002456	Label, Blank 5x3" Matte White Perm Paper	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	29290	14	1000	0.08	Yes	NO	Yes	FOB
217	40002601-100	PCBA Siemens V600-V650	CTS ELECTRONICS CORPORATION (THAILAND), LTD.	PCB	1451	30	170	35.1108	No	NO	Yes	Door to Door
218	40003916	Flange, Plain, 95 Hub With PEMs	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	2392	21	1500	0	No	YES	Yes	Door to Door
219	40004256	Label, printed mdl Barolo SOADM 1 Band	ADAMPAK (THAILAND) LTD.	SUBDIRECT	44.96	14	1500	0.16	No	YES	Yes	FOB
220	40004257	Label, printed port Barolo SOADM 1 Band	ADAMPAK (THAILAND) LTD.	SUBDIRECT	2248	14	1500	0.16	Yes	YES	Yes	FOB
221	4438321	Fusion Sleeve 40mm Mini	MECHILL ENGINEERING CO., LTD.	MECHANICAL	22502	28	300	0.283	Yes	NO	Yes	FOB
222	4495131	Label Tamper Proof 0.3x1.2 Silver Polyes	WORLDMARK CHINA	SUBDIRECT	15736	21	5000	0.0713	Yes	NO	Yes	CIF Bangkok
223	5001287	Tape, Vhb, Individual Component Holding	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	2392	21	300	0.04	Yes	YES	No	CIF Bangkok
224	5001288	Tape, Vhb Foam	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	2248	14	3000	0.06	Yes	YES	No	CIF Bangkok
225	5002104	Epoxy 353ND Thin Viscosity	THAI DAIZO NICHIMOLY CO.,LTD. (T.D.N.)	SUBDIRECT	44.96	28	80	5.0904	Yes	NO	No	Ex Work
226	5005325	IC DG641 Low On-Res Video SW S0IC-16	WPI INTERNATIONAL (S) PTE LTD.	ELECTRICAL	6744	28	900	0.89	No	NO	No	Ex Work
227	5005521	Label ESD Warning 4x4	ADAMPAK (THAILAND) LTD.	SUBDIRECT	2248	14	1000	0.0624	Yes	NO	Yes	FOB
228	5005842-482	Res 1/10W 100K 0.1% 0805	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	53952	28	5000	0.16	Yes	NO	No	FOB
229	5005847	Clamp Cable Aluminum w/Adhesive 3/8 Dia	RICHCO INTERNATIONAL (THAILAND) CO.,LTD	HARDWARE	44.96	28	1000	0.1933	Yes	YES	Yes	Ex Work
230	5005877-001	Screw Flt Hd 1-72x1/8 Phil SST	COFFER INDUSTRIAL SUPPLIES	HARDWARE	44.96	28	1000	0.0684	Yes	NO	Yes	Ex Work
231	5005877-002	Screw Flt Hd 1-72x3/16 Phil SST	COFFER INDUSTRIAL SUPPLIES	HARDWARE	24728	28	1000	0.0429	Yes	NO	Yes	Ex Work
232	5005878-002	Screw Flt Hd 0-80x3/16 Phillips SST	BOSSARD PTE LTD.	HARDWARE	8992	28	3000	0.0818	Yes	YES	Yes	FOB
233	5005888-002	Screw Pan Hd 2-56x3/16 Phil SST	COFFER INDUSTRIAL SUPPLIES	HARDWARE	8992	28	1000	0.0454	Yes	NO	Yes	Ex Work
234	5005898-002	Screw Pan Hd 1-72x3/16 Phil SST	COFFER INDUSTRIAL SUPPLIES	HARDWARE	13488	28	5000	0.075	Yes	YES	Yes	Ex Work
235	5006008	Solder No Clean Telecor Plus 1.16 Flux C	ALPHA METALS SINGAPORE	SUBDIRECT	35968	28	24	9.75	Yes	NO	No	Ex Work
236	5006281-300	WDM Dvc 3PCX1F 1547.465 3.19nm PB C Typ	KONCENT COMMUNICATION, INC.	OPTICAL	2248	21	50	115	Yes	No	No	FOB
237	5006730	Foam Silicone 1/16" Thk w/Adhesive Back	SWIFTRONIC (THAILAND) CO.,LTD.	MECHANICAL	2248	28	500	16.2	Yes	NO	Yes	Ex work
238	5006825	Adhesive Loctite 222 MS	CHEMTEC INDUSTRIAL PRODUCTS CO.,LTD	SUBDIRECT	44.96	28	5	20.0908	Yes	NO	No	Door to Door
239	5007489	Tape Polyimide (Kapton) Film 2.7mil x 1/	UNITED DISTRIBUTION CO.,LTD.	SUBDIRECT	4496	28	810	1.9	Yes	NO	Yes	FOB
240	5007662	Rubber Boot (1F) 1Fiber Silicone UL94	KENT H LANDSBERG	MECHANICAL	5150	56	5000	0.3	Yes	YES	Yes	FOB
241	5008190-001	IC LM4040-2.5 Voltage Ref 2.5V 0.2% SOT-	AVNET ASIA PTE LTD	ELECTRICAL	26976	28	1000	0.5767	Yes	NO	No	Ex Work
242	5008202	XSTR MMBT2222A NPN Gen Purpose AMP SOT-	AVNET ASIA PTE LTD	ELECTRICAL	2248	28	6000	0.011	Yes	NO	No	Ex Work
243	5008923	IC C8051F020 Mix-Sig 64KB ISPFlash MCU T	EDOM TECHNOLOGY CO LTD	ELECTRICAL	2248	28	250	12.31	No	NO	Yes	Ex Work
244	5009012	IC LT1931 DC/DC Converter Inverting SOT-	WESTECH ELECTRONICS LIMITED	ELECTRICAL	2248	28	2500	2	Yes	NO	Yes	Ex Work
245	5009020	IC CY62128DV30L 128K SRAM 3.3V TSOP-32	ARROW ELECTRONICS ASIA (S) PTE LTD.	ELECTRICAL	2248	28	780	1.7	No	NO	Yes	FOB
246	5009052-001	Cap Cer 0.1uF 16V +80%-20% Y5V 0603	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	2248	14	4000	0.007	Yes	NO	Yes	FOB
247	5009053-015	Cap Cer 18pF 50V 5% 0603	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	161856	14	4000	0.007	Yes	NO	Yes	FOB
248	5009069	Diode LL4148 Switch 75V 500mWMiniMELF	EXCELPOINT SYSTEMS (PTE) LTD	ELECTRICAL	2248	28	2500	0.0122	No	NO	Yes	Ex Work
249	5009070-300	WDM Dvc 3PCX1F 1547.465 3.19nm PB C Typ	BROWAVE CORPORATION	OPTICAL	2248	21	1	102	Yes	YES	No	FOB
250	5009108	IC LT1930 DC/DC Converter Step-up SOT-23	WESTECH ELECTRONICS LIMITED	ELECTRICAL	2248	14	2500	1.85	Yes	NO	Yes	Ex Work
251	5009110	IC ADS7870 12-Bit Data Acquisition Syste	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	2248	14	480	3.81	No	NO	Yes	Ex Work
252	5009112	IC REF200 Dual Current Source/Current Si	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	13488	14	1500	2.65	No	NO	Yes	Ex Work
253	5009132	IC TLV5630 12-Bit DAC 8 Channel S/O TSSO	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	2248	25	280	7.9	Yes	NO	No	Ex Work
254	5009135-002	IC REF3020 Volt Ref CMOS LP 2.048V SOT-2	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	4496	28	250	0.695	Yes	NO	No	Ex Work
255	5009135-003	IC REF3025 Volt Ref CMOS LP 2.5V SOT-23	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	4496	14	250	0.59	Yes	NO	No	Ex Work

No.	Part no.	Description	Supplier	Commodity	Consolidated demand	Plt	Moq	Std Cost	Rohs	NCNR	Possible to do locally	Delivery Term
256	5009135-005	IC REF3040 Volt Ref CMOS LP 4.096V SOT-2	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	2248	14	250	0.59	Yes	NO	No	Ex Work
257	5009144	IC SN7417 Hex Buffers/DriversOpen Collec	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	2248	28	2500	0.5	Yes	NO	No	Ex Work
258	5009145	IC SN74LVC04A Hex Inverter TSSOP-14	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	2248	28	2000	0.068	Yes	NO	No	Ex Work
259	5009146	IC SN74HC74 Dual D-Type Flip-Flops w/Cle	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	4496	28	2500	0.14	Yes	NO	No	Ex Work
260	5009147	IC SN74LV00A Quad 2-In Pos-NAND Gate SOI	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	2248	28	2500	0.08	Yes	NO	No	Ex Work
261	5009148	IC TL074 Quad LN JFET-IN OP AMP SOP-14	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	6744	14	2500	0.17	Yes	NO	No	Ex Work
262	5009149	IC OPA602 Hi-Speed Precision OP AMP SOIC	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	13488	28	500	4.3	No	NO	No	Ex Work
263	5009150	IC LOG102 Logarthmic/Log Ratio AMP SO-14	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	2248	14	290	7.5	Yes	NO	No	Ex Work
264	5009151	Diode MBR0520L Schottky 0.5A 20V SOD-123	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	4496	14	12000	0.091	No	NO	No	Ex Work
265	5009152-001	Cap Cer 4.7uF 16V 10% X5R 1210	TTI ELECTRONICS ASIA PTE LTD.	ELECTRICAL	2248	7	4000	0.21	Yes	NO	No	Ex Work
266	5009152-002	Cap Cer 10uF 16V 10% X5R 1210	TTI ELECTRONICS ASIA PTE LTD.	ELECTRICAL	2248	7	4000	0.35	Yes	NO	No	Ex Work
267	5009160	Crystal 25.0 MHz 18pF SMT	CASIX, INC.	ELECTRICAL	14939	28	5000	0.59	No	NO	No	Ex work
268	5009165	Label, Pizza Box Barolo	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	2248	14	3000	0.08	Yes	NO	Yes	FOB
269	5009166-001	Ferrite Bead 600 Ohm 25% 100MHz 200mA 12	TTI ELECTRONICS ASIA PTE LTD.	ELECTRICAL	4496	28	3000	0.13	No	NO	No	Ex Work
270	5009168	LED 2x3mm Ultra Green w/ClearLens SMT	FUTURE ELECTRONICS INC. (DISTRIBUTION) PTE LTD.	ELECTRICAL	13488	14	2000	0.51	No	NO	Yes	Ex Work
271	5009170	IC MC74HC1G08 Single 2-Input AND Gate SO	NUCLEUS ELECTRONICS LTD.	ELECTRICAL	2248	98	1500	0.05	No	NO	Yes	FOB
272	5009181-005	Conn Hdr M 60P 2Row 2mm PC MtEnd Shroud	ADDCOM SOLUTION PTE LTD	ELECTRICAL	4496	14	100	2.17	Yes	NO	No	Ex Work
273	5009215	DWDM Dummy	GLOBAL THAIXON CO.,LTD	MECHANICAL	2248	28	300	0.08	Yes	YES	Yes	FOB
274	5009220	Kit B&P, Barolo SOADM 1 Band Mdl Ass'y	AVANEX CORPORATION	MECHANICAL	15736	45	100	15.3	Yes	YES	Yes	CIF
275	5009294	Kit MECH, Barolo SOADM 1 Band Mdl Ass'y	AVANEX CORPORATION-AEP	MECHANICAL	6744	30	300	17.9	Yes	YES	Yes	Ex Work
276	5009399-002	Cap Cer 2.2uF 6.3V 10% 0805	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	6744	28	4000	0.0138	Yes	NO	Yes	FOB
277	5009400-013	Cap Cer 1.0uF 16V 10% 1206	FERMIONICS OPTO-TECHNOLOGY	ELECTRICAL	2248	28	3000	0.0713	Yes	NO	No	FOB
278	5009401-001	Cap Cer 1000pF 50V 10% 0603	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	26976	14	4000	0.0051	Yes	NO	No	FOB
279	5009401-009	Cap Cer 4700pF 50V 10% 0603	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	4496	14	4000	0.006	Yes	NO	No	FOB
280	5009401-013	Cap Cer 0.010uF 50V 10% 0603	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	6744	7	4000	0.0047	Yes	NO	No	FOB
281	5009407-008	Cap Cer 1.0uF 6.3V 10% 0603	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	2248	14	4000	0.0113	Yes	NO	No	FOB
282	5009408-001	Cap Cer 4.7uF 6.3V 10% 1206	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	4496	14	2000	0.115	Yes	NO	No	FOB
283	5009410-001	Cap Cer 10uF 10V +80%-20% 1206	FUTURE ELECTRONICS INC. (DISTRIBUTION) PTE LTD.	ELECTRICAL	6744	14	5000	0.05	Yes	NO	No	Ex Work
284	5009411-005	Cap Tant 22uF 10V 10% 3528	WESTECH COMPONENT CO.,LTD.	ELECTRICAL	47208	28	2000	0.065	No	NO	No	Ex Work
285	5009528-001	Res 1/10W 0.0 Ohm 5% 0603	ASJ PTE LTD.	ELECTRICAL	2248	28	5000	0.0008	Yes	NO	No	Ex Work
286	5009528-035	Res 1/16W 27 Ohm 5% 0603	ASJ PTE LTD.	ELECTRICAL	2248	28	5000	0.0012	Yes	NO	No	Ex Work
287	5009528-065	Res 1/16W 470 Ohm 5% 0603	ASJ PTE LTD.	ELECTRICAL	177592	14	5000	0.0015	Yes	NO	No	Ex Work
288	5009528-073	Res 1/16W 1.0K 5% 0603	ASJ PTE LTD.	ELECTRICAL	4496	28	5000	0.0015	Yes	NO	No	Ex Work
289	5009528-080	Res 1/16W 2.0K 5% 0603	ASJ PTE LTD.	ELECTRICAL	4496	28	5000	0.0015	Yes	NO	No	Ex Work
290	5009528-084	Res 1/16W 3.0K 5% 0603	ASJ PTE LTD.	ELECTRICAL	2248	28	5000	0.0015	Yes	NO	No	Ex Work
291	5009528-089	Res 1/16W 4.7K 5% 0603	ASJ PTE LTD.	ELECTRICAL	4496	14	5000	0.0015	Yes	NO	No	Ex Work
292	5009528-106	Res 1/16W 24K 5% 0603	ASJ PTE LTD.	ELECTRICAL	29224	28	5000	0.0015	Yes	NO	No	Ex Work
293	5009528-113	Res 1/16W 47K 5% 0603	ASJ PTE LTD.	ELECTRICAL	13488	28	5000	0.0015	Yes	NO	No	Ex Work
294	5009528-121	Res 1/16W 100K 5% 0603	ASJ PTE LTD.	ELECTRICAL	15736	28	5000	0.0015	Yes	NO	No	Ex Work
295	5009533-146	Res 1/10W 120 Ohm 1% 0603	ASJ PTE LTD.	ELECTRICAL	26976	28	5000	0.0014	Yes	NO	No	Ex Work
296	5009533-245	Res 1/10W 845 Ohm 1% 0603	ASJ PTE LTD.	ELECTRICAL	6744	28	5000	0.0015	Yes	NO	No	Ex Work
297	5009533-268	Res 1/10W 1.40K 1% 0603	ASJ PTE LTD.	ELECTRICAL	2248	28	5000	0.0015	Yes	NO	No	Ex Work
298	5009533-296	Res 1/10W 2.49K 1% 0603	ASJ PTE LTD.	ELECTRICAL	4496	28	5000	0.0015	Yes	NO	No	Ex Work
299	5009533-367	Res 1/10W 10.0K 1% 0603	ASJ PTE LTD.	ELECTRICAL	2248	14	5000	0.0009	Yes	NO	No	Ex Work
300	5009533-379	Res 1/10W 13.3K 1% 0603	ASJ PTE LTD.	ELECTRICAL	2248	14	5000	0.0015	Yes	NO	No	Ex Work
301	5009533-399	Res 1/10W 20.0K 1% 0603	ASJ PTE LTD.	ELECTRICAL	2248	28	5000	0.0011	Yes	NO	No	Ex Work
302	5009533-458	Res 1/10W 62.0K 1% 0603	ASJ PTE LTD.	ELECTRICAL	103408	14	5000	0.0014	Yes	NO	No	Ex Work
303	5009533-474	Res 1/10W 86.6K 1% 0603	ASJ PTE LTD.	ELECTRICAL	2248	21	5000	0.0015	Yes	NO	No	Ex Work
304	5009533-486	Res 1/10W 113K 1% 0603	ASJ PTE LTD.	ELECTRICAL	2248	14	5000	0.0013	Yes	NO	No	Ex Work
305	5009533-516	Res 1/10W 210K 1% 0603	ASJ PTE LTD.	ELECTRICAL	2248	14	5000	0.0015	Yes	NO	No	Ex Work
306	5009533-520	Res 1/10W 226K 1% 0603	ASJ PTE LTD.	ELECTRICAL	2248	28	5000	0.0015	Yes	NO	No	Ex Work
307	5009533-600	Res 1/10W 1.20M 1% 0603	SOLOMON TECHNOLOGY THAILAND CO.,LTD	ELECTRICAL	2248	14	5000	0.0015	Yes	NO	No	Ex Work
308	5009533-604	Res 1/10W 2.21M 1% 0603	SOLOMON TECHNOLOGY THAILAND CO.,LTD	ELECTRICAL	2248	14	5000	0.0015	Yes	NO	No	Ex Work
309	5009540-004	Thermistor NTC 100K 5% 0603	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	13488	28	4000	0.12	Yes	NO	No	FOB
310	5009541-001	Inductor 10uH 20% Power OCTA-PAC SMT	PAC COMPONENTS PTE LTD	ELECTRICAL	2248	28	1100	1.33	No	NO	No	Ex Work
311	5009542-001	Res 1/4W 0.0 Ohm 5% 1206	ASJ PTE LTD.	ELECTRICAL	29224	28	5000	0.0035	Yes	NO	No	Ex Work
312	5009543	IC PS29FS001 128Kx8 Ultra High-Speed Fla	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	8052	28	1000	4.5	No	NO	No	CIF
313	5009784	IC MC74HC1G04 Single InverterSOT23-5	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	8052	28	1000	0.05	No	NO	No	FOB
314	5009789-004	IC ADP3335 500mA 3.3V Low Dropout Regula	EXCELPOINT SYSTEMS (PTE) LTD	ELECTRICAL	2248	28	1000	1.5975	No	NO	No	Ex Work
315	5009863-402	Kit PCBA, Top Ass'y Barolo 1 Band - Var2	BRECONRIDGE MANUFACTURING SOLUTIONS	MECHANICAL	44.96	28	500	22.1	Yes	YES	Yes	FOB
316	5009864	Label Blank Aluminum 3" x 4"	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	2248	14	500	3.27	Yes	NO	Yes	CIF Bangkok
317	5010266	Box 220x135x13.9 Unsealed	MMI PRECISION (THAILAND) LTD.	MECHANICAL	2248	28	200	13.4686	Yes	YES	Yes	Door to Door
318	5010267	Lid Bottom 159.3x87.3x0.76	THAI FIRST PRECISION IND. CO., LTD.	MECHANICAL	2248	28	150	3.3526	Yes	NO	Yes	Door to Door
319	5010276	Poly-Pad K-10 8.64x5.30 Custom	SWIFTRONIC (THAILAND) CO.,LTD.	MECHANICAL	2248	28	100	16.6259	Yes	YES	Yes	Door to Door
320	5010313	Lid Top 217.4x132.4x0.76	THAI FIRST PRECISION IND. CO., LTD.	MECHANICAL	2248	28	500	4.3839	Yes	NO	Yes	Door to Door
321	5010314	Dummy Coupler	MECHILL ENGINEERING CO., LTD.	MECHANICAL	10744	14	500	4.75	Yes	YES	Yes	FOB
322	5010315	Clamp 4-Couplers Extended Bottom	MMI PRECISION (THAILAND) LTD.	MECHANICAL	8992	28	100	3.1163	Yes	YES	Yes	Door to Door

No.	Part no.	Description	Supplier	Commodity	Consolidated demand	Plt	Moq	Std Cost	Rohs	NCNR	Possible to do locally	Delivery Term
323	5010382	IC SN74LV07A Hex Buffer/Driver w/Open Dr	WT MICROELECTRONICS SINGAPORE PTE LTD	ELECTRICAL	2248	14	2500	0.075	Yes	NO	No	Ex Work
324	5010491	IC LM337 3-Terminal Adjustable Negative	AVNET ASIA PTE LTD	ELECTRICAL	2248	28	2000	0.6	Yes	NO	Yes	Ex Work
325	5010493	VOA Broad Band Vertical	LIGHTCONNECT, INC	OPTICAL	2248	28	1	279	Yes	YES	No	FOB
326	5010499-300	VOA Medium Band Vertical 1541.70~1553.27	LIGHTCONNECT, INC	OPTICAL	2248	28	1	175	Yes	YES	No	FOB
327	5010504-001	Cap Tant 1.0uF 16V 20% 3216	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	26976	14	2000	0.065	No	NO	Yes	FOB
328	5010518	PCB Fab Barolo	SCE ELECTRONICS(S) PTE LTD	PCB	2248	28	500	11.7	No	YES	Yes	Ex Work
329	5010519-004	PCB Assy Barolo 1Band OADM	AVANEX CORPORATION-AEP	PCB	2248	28	300	12.3	Yes	YES	Yes	Ex Work
330	5010532	Clamp 6-DWDM Extended Bottom	MMI PRECISION (THAILAND) LTD.	MECHANICAL	2248	28	100	3.12	Yes	YES	Yes	Door to Door
331	5010564-002	Fuse Resettable 8.0V SMD 1812	FE GLOBAL ELECTRONICS PTE LTD	ELECTRICAL	13488	28	180	0.25	No	NO	Yes	FOB
332	5010825	Adhesive Loctite Activator 7649 (Primer	CHEMTEC INDUSTRIAL PRODUCTS CO.,LTD	SUBDIRECT	44.96	28	5	11.4517	Yes	NO	No	Door to Door
333	5011039	Label Blank Aluminum 0.745" x 3.543" Por	GM NAMEPLATE	SUBDIRECT	4496	21	1000	2.96	Yes	NO	Yes	FOB
334	5011042	Photodiode InGaAs PIN 80ยm Dia w/Pigtail	KYOSEMI OPTO AMERICA CORPORATION (KOAC)	OPTICAL	2248	28	3000	20	Yes	YES	No	FOB
335	5011553	Label, printed HW Version for Barolo Mdl	ADAMPAK (THAILAND) LTD.	SUBDIRECT	44.96	14	1000	0.0071	Yes	NO	Yes	FOB
336	5012423	Box Pizza Barolo (Korrvu)	INTER CENTER PACK (THAILAND) CO.,LTD.	SUBDIRECT	3699	28	200	12.2	Yes	NO	Yes	FOB
337	5012424	Box Barolo Insert (Korrvu)	INTER CENTER PACK (THAILAND) CO.,LTD.	SUBDIRECT	2248	14	200	8.1	Yes	NO	Yes	FOB
338	5012425	Box Barolo Overwrap (Korrvu)	INTER CENTER PACK (THAILAND) CO.,LTD.	SUBDIRECT	2248	28	500	4.1	Yes	NO	Yes	FOB
339	5012426	Box Barolo Shipping Overpack(Korrvu)	ATLAS BOX& CRATING CO.,INC	SUBDIRECT	6755	45	300	1.82	Yes	NO	Yes	FOB
340	5012502	Broadband VOA	SANTEC USA CORP	OPTICAL	2248	42	1	267	Yes	YES	Yes	FOB
341	5012505-300	Medium-Band VOA 1539.17-1553.27	BROWAVE CORPORATION	OPTICAL	2248	28	1	163	Yes	YES	Yes	FOB
342	5013120	Bracket Bottom 4-VOA	MMI PRECISION (THAILAND) LTD.	MECHANICAL	2248	28	10	3.1792	Yes	NO	Yes	Door to Door
343	5013122	Bracket Bottom 2-VOA	MMI PRECISION (THAILAND) LTD.	MECHANICAL	2248	28	100	2.8324	Yes	NO	Yes	Door to Door
344	5013729	Label Blank Paper 4.00" x 2.00"	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	2248	14	1000	0.0224	Yes	NO	Yes	CIF Bangkok
345	75825520350001	Washer, Nylon .090X.187X.016 (Black)	BOSSARD (THAILAND) LTD.	HARDWARE	5256	28	1000	0.145	Yes	YES	Yes	Door to Door
346	75825521450001	Screw, Buthdcap #2-56X.156L Blkoxide Fin	BOSSARD (THAILAND) LTD.	HARDWARE	24528	28	5000	0.0462	No	YES	Yes	Door to Door
347	75825522250001	Flex Circuit (.5mm Pit 40 Pos 51Mm Lg)	AVANEX CORPORATION-AEP	PCB	3504	28	200	4.75	No	No	Yes	Ex Work
348	7588310000001	Insulator, C-Shape	AVANEX CORPORATION-AEP	MECHANICAL	4341	28	450	7.17	No	NO	Yes	Ex Work
349	7588310010001	Insulator End Post Bottom	AVANEX CORPORATION-AEP	MECHANICAL	4341	28	450	7.17	No	NO	Yes	Ex Work
350	7588310020001	Insulator End Post Top	AVANEX CORPORATION-AEP	MECHANICAL	4341	28	450	7.17	No	NO	Yes	Ex Work
351	7590010042014	Pump, 974.5+/-0.5nm, 140mW, JDSU	JDS UNIPHASE CORPORATION	OPTICAL	4341	28	10	300	No	YES	No	FOB
352	7590010042020	Pump, 974.5+/-0.5nm, 200mW, JDSU	JDS UNIPHASE CORPORATION	OPTICAL	4341	28	10	383	No	YES	No	FOB
353	7590010042027	Pump, 974.5+/-0.5nm, 250mW, JDSU, 2700	JDS UNIPHASE CORPORATION	OPTICAL	15428	28	10	425	No	YES	No	FOB
354	7590010043039	Pump, 974.5+/-0.5nm, 390mW, JDSU	JDS UNIPHASE CORPORATION	OPTICAL	1752	28	10	530	No	YES	Yes	FOB
355	7590010043045	Pump, 980Nm, 450Mw	JDS UNIPHASE CORPORATION	OPTICAL	21538	42	10	610	No	YES	Yes	FOB
356	7590010090001	Photodiode, JDSU, C-Band	AVANEX CORPORATION-AEP	OPTICAL	65696	28	100	35	No	YES	Yes	Ex Work
357	7590200010001	Standoff, M-F .156 Round #2-56 .236 Lg	BOSSARD (THAILAND) LTD.	HARDWARE	1752	28	1000	1.3125	Yes	YES	Yes	Door to Door
358	7872710150001	Ring, Fiber Management, Molded	LANNA LAMPHUN PRECISION LTD.	MECHANICAL	1752	28	300	1.47	Yes	NO	Yes	FOB
359	7872710290001	RING, FIBER MANAGEMENT 2	LANNA LAMPHUN PRECISION LTD.	MECHANICAL	1752	14	200	33.35	No	YES	Yes	FOB
360	7875000050001	Holder, Flexible Splice	MINCO PRODUCTS INC.	MECHANICAL	46284	30	1000	1.95	No	NO	Yes	FOB
361	7875000090001	Cover, Pg1500, Skirted	MECHILL ENGINEERING CO., LTD.	MECHANICAL	15428	28	100	25.13	No	YES	Yes	FOB
362	7875200140001	Heatsink, Base PG5500 Extruded	AVANEX CORPORATION-AEP	MECHANICAL	10769	28	50	30.25	No	YES	Yes	Ex Work
363	7875200160001	Bracket, VOA	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	10769	14	100	2.6879	No	NO	Yes	Door to Door
364	7875200170001	HOLDER, PIGTAIL	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	10769	14	250	2.8035	No	NO	Yes	Door to Door
365	7875200190001	COVER, SHEET METAL	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	10769	14	250	4.9133	Yes	NO	Yes	Door to Door
366	7875200220001	Foam, Coil	MASTERCHIPS MARKETING PTE LTD	MECHANICAL	10769	28	250	1.0569	No	YES	Yes	CIF Bangkok
367	8069031	Tubing Silicone 1.98x3.18mm	FIRST SILICON CO.,LTD	MECHANICAL	44.96	28	1000	0.75	Yes	NO	Yes	Ex work
368	8276321	Epoxy Resin TM-51 Quickset	CHEMTEC INDUSTRIAL PRODUCTS CO.,LTD	SUBDIRECT	44.96	28	10	3.366	Yes	NO	No	Door to Door
369	9506331	Tubing Silicone 5/32"ID 7/32"OD 1/32"Wal	FIRST SILICON CO.,LTD	MECHANICAL	44960	28	1000	0.75	Yes	NO	Yes	Ex work
370	C01040007	Loctite 222 Adhesive	AVANEX CORPORATION-AEP	SUBDIRECT	25345.32	28	250	0.4178	Yes	NO	No	Ex Work
371	C01040010	Epoxy, Rtv Sealant, 734 Flowab	ELLSWORTH ADHESIVES ASIA LTD.	SUBDIRECT	8554.5	24	1080	0.12	Yes	NO	No	Ex Work
372	C01070011	Label, 2x1 Therm Trans W/ Acrylic Adhes	ADAMPAK (THAILAND) LTD.	SUBDIRECT	5703	21	1000	0.18	Yes	NO	Yes	FOB
373	C01070024	LABEL, PRINTER, 3"" x 1.5"" POLYTRANS 3000R	AVANEX CORPORATION-AEP	SUBDIRECT	545570	14	1000	0.0376	Yes	NO	Yes	Ex Work
374	C01070028	Label, Printer, Zebra 2.0156""	BRADY (THAILAND) CO.,LTD.	SUBDIRECT	2180	14	10000	0.0182	Yes	NO	Yes	CIF Bangkok
375	C01140004	Screw, 2-56 X 1/4 Ss, Sockethead Cap	COFFER INDUSTRIAL SUPPLIES	HARDWARE	21762	28	1000	0.055	Yes	NO	Yes	Ex Work
376	C01140005	Screw, 0-80 X 1/8 Ss, Sockethead Cap	BOSSARD (THAILAND) LTD.	HARDWARE	2797	28	1	0.039	Yes	NO	Yes	Door to Door
377	C01140031	RIVET, PLASTIC, SNAP	RICHCO INTERNATIONAL (THAILAND) CO.,LTD	HARDWARE	202524	28	1000	0.0438	Yes	YES	Yes	Ex Work
378	C01140033	Standoff, Hex 3/16""D, 3/8"" L S(100/Bag)	COFFER INDUSTRIAL SUPPLIES	HARDWARE	8760	28	1000	0.2675	Yes	YES	Yes	Ex Work
379	C01140040	Screw, 2-56 X 3/16, Nylon, Panhead	COFFER INDUSTRIAL SUPPLIES	HARDWARE	11188	28	1000	0.0155	Yes	NO	Yes	Ex Work
380	C01140047	Screw 2-56 X 5/32 Button Sockethead	COFFER INDUSTRIAL SUPPLIES	HARDWARE	65248	28	1	0.0222	Yes	NO	Yes	Ex Work
381	C01140058	SCREW, 2-56 X 3/16, SS, BUTTON HEAD, SOCKET	COFFER INDUSTRIAL SUPPLIES	HARDWARE	290763	28	5000	0.04	Yes	NO	Yes	Ex Work
382	C01200030	Dust Caps, Sc Connector Nortel	AVANEX CORPORATION-AEP	OPTICAL	20868	14	10000	0.02	No	NO	Yes	FOB
383	C02060007	Solder, .023 Diamter Resin Cor	AVANEX CORPORATION-AEP	SUBDIRECT	10654.5	28	5950	0.5	Yes	NO	No	Ex Work
384	C04050009	Label, Caution Sensitive	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	34470	14	1000	0.13	Yes	NO	Yes	FOB
385	C04050012	Label, Attention Static Senitive	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	7138	14	1000	0.26	Yes	NO	Yes	FOB
386	C04050016	Label, This End Up	IDEAL JACOBS (XIAMEN) CORPORATION	SUBDIRECT	27648	14	1000	0.11	Yes	NO	Yes	FOB
387	C07030005	BAG - STATIC SHIELD	HORIZON SOLUTIONS CORP.	SUBDIRECT	16473	45	1000	1.0	Yes	NO	Yes	FOB
388	MEC00000000787140132	Flange Smart - Machined - 95	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	1196	21	250	0	Yes	YES	Yes	Door to Door
389	MEC00000000787150071	Hub - 95mm w/faceholes	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	1196	21	250	0	Yes	YES	Yes	Door to Door
390	MEC00000007582548555	#4-24 X .38 LONG FLAT HEAD PHILLIPS THRE	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	14352	21	250	0	Yes	YES	Yes	Door to Door
391	MEC00007871500710006	HUB - 95X32.1 - WITH FACE HOLES	JINPAO PRECISION INDUSTRY CO.,LTD.	MECHANICAL	1196	21	250	0	Yes	YES	Yes	Door to Door

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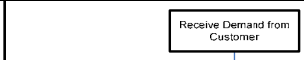
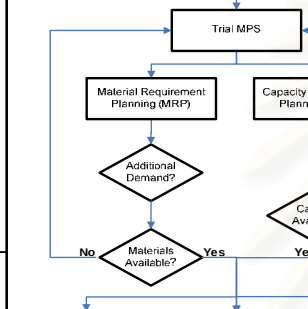
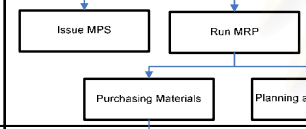
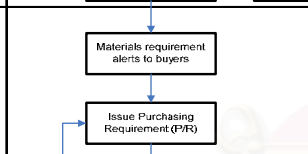
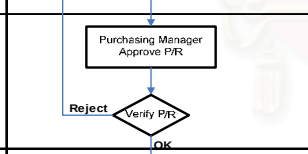
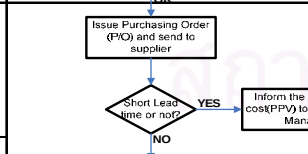
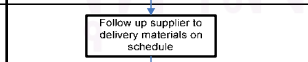
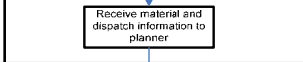
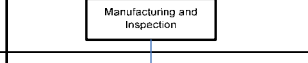
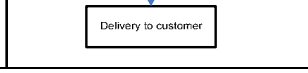
APPENDIX 2

WORKFLOW CHART

1. Workflow Chart of Original System

Supply Chain Workflow Chart

Step	Work Flow	Process	Lead time	Task	Responsibility
1		Receive demand and forecasting from customer	2 Days	- Receive the demand and order from customer	Customer and Program Coordinator
2		Check Availability of material		- Verify the material availability status for using in generating MPS	Planner
3		Master Production Schedule Trial	2 Days (Running in every Friday)	- Trial MPS - Generating MPS, MRP and CRP. - Checking Capacity	Planner
4		Generating MPS, MRP, and CRP			
5		Creating purchasing requirement	1 Day	- Issue P/R and send to PUR MGR for approval.	Buyer
6		Approve Purchasing requirement	2-3 Days	- Approving P/R	Purchasing Manager
7		Send purchasing order to suppliers	5 Days	- Issue P/O and send to suppliers - Inform expediting cost if happened. - Inform delivery date to planner	Buyer
8		Inform delivery commitment to planner			
9		Follow up supplier to delivery material	Corresponding to supplier lead time.	- Follow up supplier to send the material on schedule.	Buyer
10		Receiving material and incoming inspection	2 Days	- Receive material and keep them in warehouse	Buyer Incoming Quality Team
11		Manufacturing and Inspection	Corresponding to manufacturing lead time of each product.	- Manufacture product - Final inspection.	Production Engoneering Quality Assurance Enginerring
12		Delivery product to customer	3-5 Days (By Air)	- Packing as standard pack - Contact frieght forwarder to send product to customer	Traffic Team

2. Workflow Chart After Implementing Developed System

Supply Chain Workflow Chart

Step	Work Flow	Process	Lead time	Task	Responsibility
1	Receive Demand from Customer	Receiving demand and forecasting from customer	2 Days	- Receive demand and order from customer.	Program Coordinator
2	Check material availability	Check Availability of material		- Verify the material availability status for using in generating MPS	Planner
3	Trial MPS Material Requirement Planning (MRP) Capacity Requirement Planning (CRP) Additional Demand? Capacity Available? No Materials Available? No Yes Yes	Master Production Schedule Trial	2 Days (Running in every Friday)	- Trial MPS - Generating MPS, MRP and CRP. - Checking Capacity	Planner
4	Issue MPS Run MRP CRP Purchasing Materials Planning and Controlling	Generating MPS, MRP, and CRP			
5	Materials requirement alerts to buyers Create Requisition in GOLF Send Requisition via GOLF	Creating purchasing requirement	1 Day	- Issue P/R and send to PUR MGR for approval.	Buyer
6	Purchasing Manager Approve P/R Verify P/R Reject Send the requisition to requestor OK	Approve Purchasing requirement	1 Days	- Approving P/R	Purchasing Manager
7	Issue Purchasing Order (PO) and send to supplier Short Lead Time or not? YES Inform the expediting cost(PPV) to Purchasing Manager NO	Send purchasing order to suppliers	1 Day	- Issue P/O and send to suppliers - Inform expediting cost if happened. - Inform delivery date to planner	Buyer
8	Inform delivery commitment date to Planner	Inform delivery commitment to planner			
9	Follow up supplier to delivery materials on schedule	Follow up supplier to delivery material	Corresponding to supplier lead time.	- Follow up supplier to send the material on schedule.	Buyer
10	Receive material and dispatch information to planner	Receiving material and incoming inspection	2 Days	- Receive materials and keep them in warehouse	Buyer Incoming Quality Team
11	Manufacturing and Inspection	Manufacturing and Inspection	Corresponding to manufacturing lead time of each product.	- Manufacture product - Final inspection.	Production Engineering, Quality Assurance engineering
12	Delivery to customer	Delivery product to customer	3-5 Days (By Air)	- Packing as standard pack - Contact frieght forwarder to send product to customer	Traffic Team

APPENDIX 2

FMEA TABLE

FMEA Failure Modes and Effects Analysis												
Customer: AAA	**Part No: ALL**				**Description: -**			**Rev. 02**			**Date: 14 Aug 2007**	
No.	***Process***	***Function***	***Failure Modes***	***Failure Effects***	***Failure Causes***	***Failure Prevention***	***Failure Detection***	***S***	***O***	***D***	***RPN***	***Action R:\I:***
1	Receive demand and forecasting from customer	Apply information for generating MPS, MRP, and CRP	Inaccuracy of Forecasting	Order is dynamic and hard to control part available on production schedule.	Customer can not generate accuracy forecasting.	-	-	3	4	5	***60***	Establishing Demand Management policy
			Uncertainty Demand	Creating inaccuracy MPS	Customer no have certainty demand	-	-	3	4	5	***60***	Establishing Demand Management policy
			Demand does not upload into the system.	Company does not produce part according to customer order.	Forget to upload demand.	Upload demand daily rather than weekly	Daily check with demand uploaded report	5	1	1	5	N/A
2	Check Availability of material	Checking information	Using wrong information	Creating wrong MPS	Using no update information	Using updated informaiton	Checking the date of creation	2	2	1	4	N/A
3	Master Production Schedule Trial	Trial MPS	Using wrong aggregate plan	Trial mistake	Using no update information	Using updated informaiton	Checking the date of creation	2	2	1	4	N/A
			Using in accuracy capacity	Trial mistake	The current information is worng.	Using updated informaiton	Quarterly review by planning MGR	4	3	2	***24***	Using the real capacity information
4	Generating MPS, MRP, and CRP	Generating MPS, MRP, and CRP	Inaccuracy of MRP parameters	Creating wrong MRP	Using wrong MRP parameter	-	-	4	5	3	***60***	N/A
			Demand is changed even fixed order period	Product can not be delivered to customer on schedule.	Customer changes demand	-	-	4	3	3	***36***	Establishing Demand Management policy
			No have knowledge of performing MRP effectively	Can not create MPS, MRP and CRP smoothly.	No training provide for related person	Provide training	Training Matrix	1	4	1	4	N/A
5	Creating purchasing requirement	Issue PR	Issue incomplete PR	Can not issue PO	Buyer does not circumspect for issuing PR	Purchasing Manager daily check.	PR report	3	5	1	15	N/A
6	Approve Purchasing requirement	Approve PR for issuing PO	Long lead time to open PO.	Part is sent to company delay.	Manager uses more time to approve PO	-	-	4	3	2	***24***	Implement new EDI system

FMEA
Failure Modes and Effects Analysis

Customer: AAA	**Part No: ALL**	**Description: -**	**Rev. 02**	**Date: 14 Aug 2007**

No.	*Process*	*Function*	*Failure Modes*	*Failure Effects*	*Failure Causes*	*Failure Prevention*	*Failure Detection*	*S*	*O*	*D*	*RPN*	*Action R:\I:*
7	Send purchasing order to suppliers	Send PO	PO is sent to supplier quite late.	Part is sent to company delay.	Buyer issues PO too late.	Purchasing Manager daily check.	PO report	4	2	1	8	N/A
8	Inform delivery commitment to planner	Notify delivery schedule	Commit the wrong date to customer	Commit wrong product delivery date to customer	Inform wrong committed date to planner	Verify the information before sending to customer.	Commitment date report	1	2	1	2	N/A
9	Follow up supplier to delivery material	Expedite material to send as committed.	Quality problem	Need time to rework or re production	Supplier can not control quality of part.	Send supplier quality engineering team to solve the problem	100% check before sending to company.	5	2	1	10	N/A
			Make to order	Supplier can not support quick turn lot.	Supplier does not want to keep inventory since the forecasting is inaccuracy.	-	-	1	5	1	5	N/A
			Supplier cannot support fluctuated demand.	Part can not be sent before production lead time.	Wrong forecasting data	-	-	4	4	2	***32***	Establishing Demand Management policy
			Highly diversity of location of suppliers	Supplier is located far away from company.	Buy follow approved vendor list of customer.	-	-	4	4	2	***32***	Promoting Localization Project
10	Receive the parts from suppliers	Receive part and incoming inspection	The quanitity is less than PO.	Production Line is stopped.	Supplier does not check properly before dispatching	Check the quantity 100% before dispatching	Determined in work instruction.	5	3	1	15	N/A
11	Manufacturing and Inspection	Production and Inspection	Quality problem	Need time to rework or re production	Product can not be dipatched to customer on schedule	Applying pokayoke concept	100% check and detemine in procedure.	4	2	1	8	N/A
12	Delivery product to customer	Delivery product	Send the wrong product to customer	Customer complain and affect to the company performance	Do not verify product before sending	Control by adopting bar code system rather than manual checking	Barcode	1	1	2	2	N/A
			Do not send product on delivery plan		Forget to arrange the transportation car.	Hire the courier people to do transportation arrangement	Delivery report	2	1	1	2	N/A

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APPENDIX 3

EXAMPLE OF QUOTATIONS

X Request for quotation

Change enquiry

Contact persons => ***Ms. Suvaree Jetmahan***
Tel: **662-3260357**
Fax: **662-7394586**
Design: .
Telephone:
Title: Asst. Sales Manager

Drawing No./ Index: **9506331 Tubing Silicone 5/32"ID 7/32"OD 1/32"Wal**
Annual production:
EMPB deadline:

Caution! Cost details must be filled in!

Process and delivery terms must be documented according to the guidelines of QS 9000 and DA 6.1.

(A) raw material costs			(B) purchased parts/external procurement		
Raw material (type)	Silicon		Parts title	Vendor	Costs
Price/unit	$3.182/kg				
Deviation	-		2		
Gross weight (g)	82g		3		
Gross material costs	$ 0.260		4		
Scrap weight			5		
Scrap costs/ Unit			6		
Scrap costs/ Part	$0.0078		7		
Net material price	$ 0.268		Total		$ -

(C) process/installation costs

Process title	Machine type External/internal for external: name the vendor.	Setting time per part (sec)	Cycle time (sec)	Available capacity (units/AT)	Underlying layered Model	Hourly rate of machine (min.)		Hourly rate operator (min.)	Tool costs (USD)	Lot size (pcs)	Process costs (USD)
						depreciation	Miscellaneous				
1	Extrusion		830						-		$ 0.280
2	Cutting		2						-		$ 0.030
3											
4											
5											
6											
7											
8											
9											
Total											$ 0.310

(A) raw material costs	$ 0.268
(B) purchased parts/external procurements	$ -
(C) process/installation costs	$ 0.310
(D) Overhead	$ 0.008
(E) profit	$ 0.059
(F) packaging	$ 0.020
(G) transport costs	$ 0.080
Aggregate costs (USD)	**$ 0.75**

Remarks:
Delivery Leadtime: 28 days
Delivery Term: FOB
Minimum Order quantity: 1K
Price will be valided within 2 months
Issued Date: 30 April 2007
Vendor signature Ms. Suvaree

X Request for quotation

Change enquiry

Contact persons => ***Mr. Bala Raj***

Tel: **663-564-342**

Fax: **663-564-343**

Design: .

Telephone:

Title: Managing Director

Drawing No./ Index: **0+4966 Retainer-Wide**

Annual production:

EMPB deadline:

Caution! Cost details must be filled in!

Process and delivery terms must be documented according to the guidelines of QS 9000 and DA 6.1.

(A) raw material costs			(B) purchased parts/external procurement		
Raw material (type)	AL6061-T6		Parts title	Vendor	Costs
Price/unit	$10.15/Kg		1		
Deviation	-		2		
Gross weight (g)	232.000		3		
Gross material costs	$ 2.320		4		
Scrap weight	-		5		
Scrap costs/ Unit	-		6		
Scrap costs/ Part	$ 0.30		7		
Net material price	$ 2.620		Total		$ -

(C) process/installation costs

Process title	Machine type External/internal for external: name the vendor.	Setting time per part (sec)	Cycle time (sec)	Available capacity (units/AT)	Underlying layered Model	Hourly rate of machine (min.)		Hourly rate operator (min.)	Tool costs (USD)	Lot size (pcs)	Process costs (USD)
						depreciation	Miscellaneous				
1	Cutting	10	2	350000.0					-	100	$ 0.020
2	Machining	30	344	150000.0					-	100	$ 2.130
3	Deburring	30	23	600000.0					-	100	$ 0.120
4	Cleaning	30	10	600000.0					-	100	$ 0.040
5	Black Anodise	60	31	375000.0					-	100	$ 0.210
6	Packaging	10	8	534000.0					-	100	$ 0.010
7											
8											
9											
Total											$ 2.530

(A) raw material costs	$ 2.620
(B) purchased parts/external procurements	$ -
(C) process/installation costs	$ 2.530
(D) Overhead	$ 0.500
(E) profit	$ 0.339
(F) packaging	$ 0.200
(G) transport costs	$ 0.650
Aggregate costs (USD)	**$ 6.84**

Remarks: Delivery Term: Door to Door

Credit Term: 60 days after billing

Minimum Order Quantity: 100 Pcs

Lead time: 14 days

Issued Date: 3 May 2007

Vendor signature ***BALA RAJ***

APPENDIX 4

PRODUCTION YIELD

Production line	*Manufacturing(Bom #)*
Line AV-1	303660001

Mont.	*2006 Demand*	*Production*	*Defect*	*Yield(%)*
Jan	893	940	62	93.40%
Feb	962	1013	82	91.90%
Mar	478	503	35	93.04%
Apr	596	627	38	93.94%
May	686	722	51	92.94%
Jun	1653	1740	122	92.99%
Jul	1012	1065	83	92.21%
Aug	1087	1144	85	92.57%
Sep	1532	1613	103	93.61%
Oct	2589	2725	243	91.08%
Nov	2100	2211	139	93.71%
Dec	1840	1937	149	92.31%
				92.81%

Production line	*Manufacturing (Bom #)*
Line AV-2	PTB OSM5500-02

Mont.	2006 Demand	Production	Defect	Yield(%)
Jan	470	495	30	93.94%
Feb	1,051	1106	45	95.93%
Mar	2,885	3037	169	94.44%
Apr	812	855	43	94.97%
May	632	665	35	94.74%
Jun	1,326	1396	78	94.41%
Jul	518	545	29	94.68%
Aug	1,241	1306	71	94.56%
Sep	547	576	42	92.71%
Oct	865	911	53	94.18%
Nov	233	245	25	89.81%
Dec	189	199	34	82.91%
				93.11%

Production line	***Manufacturing (Bom #)***
Line AV-3	306510005ALT01

Mont.	2006 Demand	Production	Defect	Yield(%)
Jan	158	166	8	95.19%
Feb	274	288	12	95.84%
Mar	390	411	18	95.62%
Apr	510	537	22	95.90%
May	394	415	20	95.18%
Jun	356	375	24	93.60%
Jul	430	453	21	95.36%
Aug	402	423	24	94.33%
Sep	458	482	18	96.27%
Oct	430	453	18	96.02%
Nov	286	301	14	95.35%
Dec	253	266	19	92.87%
				95.13%

Production line	***Manufacturing (Bom #)***
Line AV-4	615709004Rev03

Mont.	2006 Demand	Production	Defect	Yield(%)
Jan	320	337	25	92.58%
Feb	310	326	23	92.95%
Mar	415	437	28	93.59%
Apr	315	332	23	93.06%
May	48	51	3	94.06%
Jun	275	289	23	92.05%
Jul	271	285	32	88.78%
Aug	560	589	32	94.57%
Sep	522	549	37	93.27%
Oct	551	580	26	95.52%
Nov	609	641	35	94.54%
Dec	311	327	23	92.97%
				93.16%

Production line	*Manufacturing (Bom #)*
Line AV-5	605500001 and PEFX001XCEV05P6

605500001

Mont.	2006 Demand	Production	Defect	Yield(%)
Jan	115	121	15	87.61%
Feb	63	66	5	92.46%
Mar	380	400	19	95.25%
Apr	128	135	13	90.35%
May	115	121	5	95.87%
Jun	203	214	10	95.32%
Jul	194	204	8	96.08%
Aug	235	247	11	95.55%
Sep	169	178	12	93.25%
Oct	186	196	17	91.32%
Nov	175	184	15	91.86%
Dec	217	228	14	93.87%
				93.23%

PEFX001XCEV05P6

Mont.	2006 Demand	Production	Defect	Yield(%)
Jan	268	282	20	92.91%
Feb	181	191	12	93.70%
Mar	41	43	2	95.37%
Apr	113	119	5	95.80%
May	26	27	1	96.35%
Jun	77	81	3	96.30%
Jul	297	313	21	93.28%
Aug	346	364	25	93.14%
Sep	263	277	13	95.30%
Oct	269	283	28	90.11%
Nov	216	227	15	93.40%
Dec	151	159	10	93.71%
				94.11%

Production line	*Manufacturing (Bom #)*
Line AV-6	610991001 and 608750002

610991001

Mont.	2006 Demand	Production	Defect	Yield(%)
Jan	68	72	5	93.01%
Feb	88	93	5	94.60%
Mar	184	194	10	94.84%
Apr	80	84	4	95.25%
May	101	106	4	96.24%
Jun	165	174	8	95.39%
Jul	125	132	6	95.44%
Aug	105	111	5	95.48%
Sep	170	179	9	94.97%
Oct	90	95	5	94.72%
Nov	10	11	0	100.00%
Dec	10	11	0	100.00%
				95.83%

608750002

Mont.	2006 Demand	Production	Defect	Yield(%)
Jan	76	80	4	95.00%
Feb	170	179	9	94.97%
Mar	79	83	4	95.19%
Apr	41	43	2	95.37%
May	63	66	3	95.48%
Jun	123	129	5	96.14%
Jul	65	68	3	95.62%
Aug	83	87	5	94.28%
Sep	155	163	9	94.48%
Oct	80	84	6	92.88%
Nov	60	63	3	95.25%
Dec	50	53	3	94.30%
				94.91%

Production line	*Manufacturing (Bom #)*
Line AV-7	308120002ALT03 and 792000090

308120002ALT03

Mont.	2006 Demand	Production	Defect	Yield(%)
Jan	150	158	15	90.50%
Feb	180	189	17	91.03%
Mar	227	239	14	94.14%
Apr	196	206	12	94.18%
May	168	177	10	94.35%
Jun	112	118	8	93.21%
Jul	150	158	12	92.40%
Aug	144	152	17	88.78%
Sep	148	156	11	92.94%
Oct	115	121	10	91.74%
Nov	87	92	5	94.54%
Dec	75	79	6	92.40%
				92.52%

792000090

Mont.	2006 Demand	Production	Defect	Yield(%)
Jan	95	100	5	95.00%
Feb	130	137	7	94.88%
Mar	229	241	12	95.02%
Apr	130	137	9	93.42%
May	236	248	15	93.96%
Jun	78	82	7	91.47%
Jul	64	67	3	95.55%
Aug	85	89	5	94.41%
Sep	25	26	3	88.60%
Oct	253	266	15	94.37%
Nov	78	82	3	96.35%
Dec	48	51	4	92.08%
				93.76%

APPENDIX 5

EXPEDITING COST BY MONTH OF YEAR 2006

M/DD/- Running no.

PPV Request No.	Customer	Part no.	Description	Supplier Name	Request by	Buyer send PPV to BUS	STATUS	MOQ	PO Q'TY	Std Cost	PO Price	Charge (%)	Expediting Costs (USD) Existing system	Expediting Costs (USD) Developed System
JAN10-178	AAA	0+4367	Coupler, 98/2 1X2 S-C	AOFR PTY LIMITED	Prapaporn	31/7/49	Approved	250	470	9.30	19.51	110	-4800.00	-2553.19
JAN10-178	AAA	0+4368	Coupler, 98/2 1X2 P-C	AVANEX CORPORATION-AEP	Prapaporn	31/7/49	Approved	100	1051	10.80	13.47	25	-2808.00	-267.17
JAN10-178	AAA	0+4784	Coupler, 90/10 1X2 S-C	AOFR PTY LIMITED	Prapaporn	31/7/49	Approved	50	585	11.50	14.44	26	-1717.40	-146.79
JAN10-179	AAA	0+4785	COUPLER, 99/ 01 1X2 S- C	AOFR PTY LIMITED	Prapaporn	31/7/49	Approved	50	470	10.80	20.67	91	-4639.75	-493.59
JAN10-182	AAA	0+40000638	HEAT SINK, W/ HEAT PIPES (MACHINED)	AAVID THERMALLOY (S) PTE LTD	Suttinee	30/6/49	Approved	100	150	105.00	186.83	78	-12275.00	-8183.33
JAN10-183	AAA	5009160	Crystal 25.0 MHz 18pF SMT	DIGI-KEY CORPORATION	Suttinee	27/4/49	Approved	5000	363	0.59	2.24	280	-600.00	0.00
JAN11-181	AAA	5010493	VOA Broad Band Vertical	LIGHTCONNECT, INC	Nutthakarn	12/4/49	Approved	1	268	279.00	305.22	9	-7027.68	-2622.27
JAN11-186	AAA	0+1097	Lc Bulkhead Cleaner	AVANEX CORPORATION-AEP	Nutthakarn	12/4/49	Approved	50	95	152.00	193.34	27	-3927.47	-2067.09
JAN11-187	AAA	0+3444	Coupler	OPLINK COMMUNICATION INC.	Nutthakarn	12/4/49	Approved	100	470	60.00	75.75	26	-7404.38	-1575.40
JAN16-191	AAA	5010499-300	VOA Medium Band Vertical 1541.70~1553.27	LIGHTCONNECT, INC	Suttinee	27/4/49	Approved	1	268	175.00	187.30	7	-3295.26	-1229.57
JAN16-191	AAA	C04050016	Label, This End Up	GM NAMEPLATE	Nutthakarn	12/4/49	Approved	1000	1411	0.11	0.11	1	-2.12	0.00
JAN16-191	AAA	40002456	Label, Blank 5x3" Matte White Perm Paper	GM NAMEPLATE	Apawadee	1/8/49	Cancelled	1000	588	0.08	0.08	0	0.00	0.00
JAN16-191	AAA	5012425	Box Barolo Overwrap (Korrvu)	ATLAS BOX& CRATING CO.,INC	Apawadee	1/8/49	Approved	500	268	4.10	6.61	61	-673.66	0.00
JAN16-191	AAA	0+5000872	Screw, #2-56 X .75 Lg., Shcs	HARDWARE SPECILATY CO.,INC	Apawadee	1/8/49	Approved	3000	790	0.65	0.66	2	-8.13	0.00
JAN16-191	AAA	0+5246	SCREW, 2- 56 X 3/ 8 SHCS, SS	HARDWARE SPECILATY CO.,INC	Apawadee	1/8/49	Approved	1000	885	0.59	0.59	0	-0.31	0.00
JAN16-192	AAA	0+5001408	HOLDER, PIGTAIL	GERMAN MACHINE INC.	Prapaporn	8/8/49	Cancelled	100	230	5.31	5.31	0	0.00	0.00
JAN16-193	AAA	5009160	Crystal 25.0 MHz 18pF SMT	DIGI-KEY CORPORATION	Nutthakarn	8/8/49	Approved	5000	363	0.59	2.12	259	-555.59	0.00
JAN16-193	AAA	5010314	Dummy Coupler	GERMAN MACHINE INC.	Nutthakarn	8/8/49	Approved	500	418	4.75	10.39	119	-2357.73	0.00
JAN16-193	AAA	631130701	COVER F10 GOLD LID	Hi-Rel Lids Ltd	Nutthakarn	8/8/49	Approved	500	115	2.70	2.95	9	-28.81	0.00
JAN17-195	AAA	0+3596	Pcb, Assy	AVANEX CORPORATION-AEP	Nutthakarn	8/8/49	Approved	1	158	776.06	824.16	6	-7599.01	-4809.50
JAN17-195	AAA	0+40001525	EMA, PG5500, P-Board, 758(lla), 4 Pump	JDS UNIPHASE CORPORATION	Nutthakarn	8/8/49	Approved	800	470	353.20	452.83	28	-46827.48	0.00
JAN17-195	AAA	0+4995	PCBA, PG2600 E-Board No IIC, P/N 0+4995, Rev B	CTS CORPORATION	Nutthakarn	8/8/49	Approved	1000	585	58.33	63.34	9	-2931.37	0.00
JAN17-195	AAA	0+5001408	HOLDER, PIGTAIL	GERMAN MACHINE INC.	Nutthakarn	8/8/49	Approved	100	230	5.31	5.40	2	-19.66	0.00
JAN17-195	AAA	0+4966	Retainer-Wide	GERMAN MACHINE INC.	Prapaporn	10/8/49	Approved	100	158	6.84	16.93	148	-1594.06	0.00
JAN17-195	AAA	0+50015220006	PIGTAIL, BIFUR, SC/UPC, RED/BLUE *	CORNING CABLE SYSTEMS PTY LTD	Prapaporn	10/8/49	Approved	1	150	38.65	41.51	7	-428.34	-165.62
JAN17-196	AAA	0+50015220009	PIGTAIL, BIFUR, LC/UPC, RED/BLUE *	CORNING CABLE SYSTEMS PTY LTD	Prapaporn	10/8/49	Approved	1	150	38.44	47.68	24	-1385.37	-637.27
JAN22-197	AAA	0+50015220010	PIGTAIL, BIFUR, LC/UPC, RED/BLUE *	CORNING CABLE SYSTEMS PTY LTD	Prapaporn	10/8/49	Approved	1	150	38.47	57.27	49	-2820.38	-188.03
JAN22-198	AAA	0+5001405	Base, Assembly, Mts	HIGH TECH MACHINISTS INC.	Duangporn	15/8/49	Approved	500	115	38.43	62.78	63	-2800.00	0.00
JAN22-198	AAA	5009165	Label, Pizza Box Barolo	GM NAMEPLATE	Suttinee	16/8/49	Cancelled	3000	268	0.08	0.08	0	0.00	0.00
JAN22-198	AAA	0+50015220006	PIGTAIL, BIFUR, SC/UPC, RED/BLUE *	CORNING CABLE SYSTEMS PTY LTD	Prapaporn	16/8/49	Approved	1	150	38.65	50.12	30	-1720.62	-975.02
JAN22-198	AAA	0+50015220007	PIGTAIL, BIFUR, LC/UPC, RED/BLUE *	CORNING CABLE SYSTEMS PTY LTD	Prapaporn	16/8/49	Approved	42	150	41.48	43.42	5	-290.40	-81.31
JAN22-198	AAA	0+50015220009	PIGTAIL, BIFUR, LC/UPC, RED/BLUE *	CORNING CABLE SYSTEMS PTY LTD	Prapaporn	16/8/49	Approved	1	150	38.44	42.18	10	-560.66	-336.40
JAN22-198	AAA	0+50015220010	PIGTAIL, BIFUR, LC/UPC, RED/BLUE *	CORNING CABLE SYSTEMS PTY LTD	Prapaporn	16/8/49	Approved	1	150	38.47	46.66	21	-1228.00	-818.66
JAN22-198	AAA	5012424	Box Barolo Insert (Korrvu)	ATLAS BOX& CRATING CO.,INC	Chalermluck	21/8/49	Approved	200	268	8.10	8.33	3	-62.53	0.00
JAN22-199	AAA	C04050012	Label, Attention Static Senitive	GM NAMEPLATE	Duangporn	22/8/49	Cancelled	1000	384	0.26	0.26	0	0.00	0.00
JAN23-205	AAA	7875200160001	Bracket, VOA	JINPAO PRECISION INDUSTRY CO.,LTD.	Nutthakarn	7/12/49	Approved	100	470	2.69	3.67	37	-462.21	-98.34
JAN23-206	AAA	5009165	Label, Pizza Box Barolo	GM NAMEPLATE	Chalermluck	7/12/49	Approved	3000	268	0.08	0.26	230	-49.26	0.00
JAN23-207	AAA	0+4393	Isolator, 1480, S	KONCENT COMMUNICATION, INC.	Chalermluck	7/12/49	Approved	10	470	35.00	35.20	1	-93.17	-11.89
JAN23-212	AAA	0+5077	Amp Label, No Die Cut, Laser Class 3B	GM NAMEPLATE	Chalermluck	7/12/49	Approved	1000	349	0.80	0.84	4	-12.34	0.00
JAN24-209	AAA	0+4389	Isolator, Ss, P-C	BROWAVE CORPORATION	Maetinee	7/12/49	Cancelled	1	1146	26.50	26.50	0	0.00	0.00
JAN24-210	AAA	0+907	Label, Dcm 4 X 1.75 Zebra (3000/Roll)	GM NAMEPLATE	Duangporn	11/12/49	Approved	1000	708	0.15	0.18	19	-20.65	0.00
JAN24-211	AAA	5009160	Crystal 25.0 MHz 18pF SMT	DIGI-KEY CORPORATION	Chalermluck	11/12/49	Approved	5000	363	0.59	2.24	280	-599.19	0.00
JAN25-215	AAA	0+4867	Standoff, M/F #2-56 Thread .875 3/16Hex	HARDWARE SPECILATY CO.,INC	Chalermluck	14/12/49	Approved	1000	585	0.60	0.62	3	-9.98	0.00
JAN25-216	AAA	5009543	IC PS29FS001 128Kx8 Ultra High-Speed Fla	AVANEX CORPORATION-AFM	Chalermluck	14/12/49	Approved	1000	268	4.50	4.56	1	-17.30	0.00
JAN25-218	AAA	0+4874	Case, Shipping, 550	ATLAS BOX& CRATING CO.,INC	Chalermluck	15/12/49	Approved	200	115	5.52	5.85	6	-37.39	0.00
JAN26-219	AAA	0+5001405	Base, Assembly, Mts	HIGH TECH MACHINISTS INC.	Duangporn	18/12/49	Approved	500	115	38.43	65.09	69	-3065.84	0.00
JAN26-220	AAA	C04050012	Label, Attention Static Senitive	GM NAMEPLATE	Nutthakarn	18/12/49	Cancelled	1000	384	0.26	0.26	0	0.00	0.00
JAN31-224	AAA	5006730	Foam Silicone 1/16" Thk w/Adhesive Back	MCMASTER-CARR SUPPLY COMPANY	Chalermluck	26/12/49	Approved	500	268	16.20	16.22	0	-5.75	0.00
JAN31-233	AAA	0+4765	PCB, V- BOARD, ILA	SCE ELECTRONICS(S) PTE LTD	Duangporn	28/12/49	Approved	100	470	591.01	624.20	6	-15600.00	-3319.15
													-142362.27	**-30579.61**

//DD/- Running no.

PPV Request No.	Customer	Part no.	Description	Supplier Name	Request by	Buyer send PPV to BUS	STATUS	MOQ	PO Q'TY	Std Cost	PO Price	Charge (%)	Expediting Costs (USD) Existing system	Expediting Costs (USD) Developed System
FEB02-229	AAA	0+40002140	PCBA, PG1500, 366 Variant, P/N 40002140	SANMINA-SCI SYSTEMS SINGAPORE PTE LTD	Duangporn	28/12/49	Approved	1000	962	156.24	169.55	9	-12800.00	0.00
FEB02-231	AAA	0+4784	Coupler, 90/10 1X2 S-C	AOFR PTY LIMITED	Maetinee	2/2/50	Approved	50	1114	11.50	11.61	1	-125.00	0.00
FEB02-232	AAA	7875200140001	Heatsink, Base PG5500 Extruded	AVANEX CORPORATION-AEP	Duangporn	2/2/50	Approved	50	1051	30.25	30.35	0	-110.19	0.00
FEB02-233	AAA	0+907	Label, Dcm 4 X 1.75 Zebra (3000/Roll)	GM NAMEPLATE	Duangporn	2/2/50	Approved	1000	408	0.15	0.19	29	-17.96	0.00
FEB02-234	AAA	C04050009	Label, Caution Sensitive	GM NAMEPLATE	Duangporn	2/2/50	Approved	1000	1779	0.13	0.15	16	-37.66	0.00
FEB02-237	AAA	5013122	Bracket Bottom 2-VOA	MMI PRECISION (THAILAND) LTD.	chalermluck	2/2/50	Approved	100	181	2.83	5.53	95	-489.04	0.00
FEB05-241	AAA	0+5365	Coupler, 80/20 1X2 P-C	AOFR PTY LIMITED	Maetinee	8/2/50	Approved	100	180	12.50	16.94	36	-800.00	0.00
FEB07-243	AAA	0+1178	Pump, 1487nm, 150mW	FURUKAWA AMERICA, INC.	chalermluck	6/2/50	Approved	20	1051	14.85	15.01	1	-167.91	0.00
FEB07-244	AAA	5012425	Box Barolo Overwrap (Korrvu)	ATLAS BOX& CRATING CO.,INC	Apawadee	7/2/50	Approved	500	181	4.10	8.89	117	-866.59	0.00
FEB07-245	AAA	40002455	Label, Outer carton Barolo Product	GM NAMEPLATE	Nutthakarn	7/2/50	Approved	1000	491	0.73	2.49	241	-863.41	0.00
FEB08-247	AAA	631130701	COVER F10 GOLD LID	Hi-Rel Lids Ltd	Nutthakarn	8/2/50	Approved	500	180	2.70	6.75	150	-729.07	0.00
FEB12-249	AAA	0+4647	Photodiode, Sff-Ldc	BROWAVE CORPORATION	Duangporn	8/2/50	Approved	100	2193	54.00	55.45	3	-3170.91	0.00
FEB12-249	AAA	0+4784	Coupler, 90/10 1X2 S-C	AOFR PTY LIMITED	Maetinee	12/2/50	Approved	50	1111	11.50	11.95	4	-500.00	0.00
FEB12-249	AAA	0+4785	COUPLER, 99/ 01 1X2 S- C	AOFR PTY LIMITED	Maetinee	12/2/50	Approved	50	1051	10.80	11.18	4	-399.00	0.00
FEB13-250	AAA	0+5365	Coupler, 80/20 1X2 P-C	AOFR PTY LIMITED	Maetinee	12/2/50	Approved	100	180	12.50	16.94	36	-800.00	0.00
FEB14-254	AAA	0+4746	Shipping Case, 8Xx	ATLAS BOX& CRATING CO.,INC	Nutthakarn	13/2/50	Approved	100	480	2.89	2.98	3	-43.68	0.00
FEB15-255	AAA	0+5312	GFF	BROWAVE CORPORATION	Duangporn	16/2/50	Approved	1	170	127.63	138.60	9	-1866.24	0.00
FEB19-257	AAA	C07030005	BAG - STATIC SHIELD	HORIZON SOLUTIONS CORP.	Nutthakarn	19/2/50	Approved	1000	1132	1.0	1.04	4	-47.17	0.00
FEB20-258	AAA	5009215	DWDM Dummy	GERMAN MACHINE INC.	Duangporn	19/2/50	Approved	300	181	0.08	0.47	493	-71.34	0.00
FEB20-259	AAA	0+4647	Photodiode, Sff-Ldc	BROWAVE CORPORATION	Duangporn	20/2/50	Approved	100	2193	54.00	63.85	18	-21600.00	0.00
FEB20-259	AAA	0+4784	Coupler, 90/10 1X2 S-C	AOFR PTY LIMITED	Maetinee	20/2/50	Approved	50	1114	11.50	11.84	3	-375.00	0.00
FEB20-259	AAA	0+4785	COUPLER, 99/ 01 1X2 S- C	AOFR PTY LIMITED	Maetinee	20/2/50	Approved	50	1051	10.80	11.55	7	-786.00	0.00
FEB20-260	AAA	0+5365	Coupler, 80/20 1X2 P-C	AOFR PTY LIMITED	Maetinee	20/2/50	Approved	100	180	12.50	20.37	63	-1416.00	0.00
FEB20-263	AAA	7875200160001	Bracket, VOA	JINPAO PRECISION INDUSTRY CO.,LTD.	Duangporn	20/2/50	Cancelled	100	1051	2.69	2.69	0	0.00	0.00
FEB21-265	AAA	5009170	IC MC74HC1G08 Single 2-Input AND Gate SO	NUCLEUS ELECTRONICS LTD.	Chalermluck	20/2/50	Approved	1500	181	0.05	0.08	56	-5.08	0.00
FEB27-269	AAA	0+4874	Case, Shipping, 550	ATLAS BOX& CRATING CO.,INC	Duangporn	26/2/50	Approved	200	63	5.52	5.74	4	-13.92	0.00
FEB27-270	AAA	0+40002866005	Pigtail Bifur,827&830 Mu/Upc,Blu/Red	CORNING CABLE SYSTEMS PTY LTD	Nutthakarn	27/2/50	Approved	1	170	51.16	127.92	150	-13048.67	0.00
FEB27-272	AAA	611003701	GPO MALE FLANGE MOUNT A001-N33-05	CORNING GILBERT INC.	Apawadee	27/2/50	Approved	500	170	4.75	4.81	1	-10.00	0.00
FEB27-273	AAA	0+0347	Pump, Thermal Shim	HENKEL (THAILAND) LTD.	Chalermluck	27/2/50	Approved	1500	2700	0.35	0.37	6	-60.49	0.00
FEB27-273	AAA	40003642	SD Plug Tube Flash Tifi	AVANEX FRANCE S.A	Maetinee	27/2/50	Approved	150	63	1.29	3.27	154	-125.00	0.00
FEB27-273	AAA	400007460001	FACEPLATE, SMALL, BLACK, NO LOGO	UNITED PRECISION	Maetinee	27/2/50	Approved	100	310	12.28	12.76	4	-150.00	0.00
FEB28-274	AAA	0+5365	Coupler, 80/20 1X2 P-C	AOFR PTY LIMITED	Maetinee	27/2/50	Approved	100	180	12.50	14.72	18	-400.00	0.00
FEB28-274	AAA	400007480001	COVER, SMALL, BLACK, 19in DCM RACK	UNITED PRECISION	Chalermluck	28/2/50	Approved	100	310	5.80	8.54	47	-850.34	0.00
													-62745.68	**0.00**
MAR01-275	AAA	7590010043039	Pump, 974.5+/-0.5nm, 390mW, JDSU	JDS UNIPHASE CORPORATION	Prapaporn	10/1/50	Approved	10	227	530.00	588.72	11	-13330.00	0.00
MAR01-275	AAA	0+4647	Photodiode, Sff-Ldc	BROWAVE CORPORATION	Prapaporn	10/1/50	Approved	100	3590	54.00	54.78	1	-2788.00	0.00
MAR01-276	AAA	0+5009798	Photodiode InGaAs PIN Hgh-Speed Dia 5.5	FERMIONICS OPTO-TECHNOLOGY	Prapaporn	10/1/50	Approved	90	459	23.00	24.29	6	-591.00	0.00
MAR01-277	AAA	0+4765	PCB, V- BOARD, ILA	SCE ELECTRONICS(S) PTE LTD	Chalermluck	10/1/50	Approved	100	2885	591.01	597.38	1	-18390.00	0.00
MAR01-277	AAA	0+4767	Voa, Mems, Epoxy Free	JDS UNIPHASE CORPORATION	Prapaporn	10/1/50	Approved	10	3112	232.00	232.48	0	-1488.00	0.00
MAR01-278	AAA	0+4784	Coupler, 90/10 1X2 S-C	AOFR PTY LIMITED	Maetinee	15/1/50	Approved	50	3265	11.50	11.94	4	-1450.00	0.00
MAR01-279	AAA	0+4785	COUPLER, 99/ 01 1X2 S- C	AOFR PTY LIMITED	Maetinee	15/1/50	Approved	50	2885	10.80	11.61	7	-2325.00	0.00
MAR01-280	AAA	0+5365	Coupler, 80/20 1X2 P-C	AOFR PTY LIMITED	Maetinee	15/1/50	Approved	100	227	12.50	18.35	47	-1328.00	0.00
MAR03-281	AAA	0+5077	Amp Label, No Die Cut, Laser Class 3B	GM NAMEPLATE	Chalermluck	15/1/50	Approved	1000	849	0.80	0.82	3	-18.77	0.00
MAR05-282	AAA	7590010042020	Pump, 974.5+/-0.5nm, 200mW, JDSU	JDS UNIPHASE CORPORATION	Prapaporn	16/1/50	Approved	10	390	383.00	386.08	1	-1200.00	0.00
MAR05-283	AAA	7590010043039	Pump, 974.5+/-0.5nm, 390mW, JDSU	JDS UNIPHASE CORPORATION	Prapaporn	16/1/50	Approved	10	227	530.00	543.93	3	-3162.00	0.00
MAR05-284	AAA	7590010043045	Pump, 980Nm, 450Mw	JDS UNIPHASE CORPORATION	Prapaporn	16/1/50	Approved	10	2885	610.00	610.18	0	-533.00	0.00
MAR05-285	AAA	0+40000788	ASSEMBLY, SPOOL, 202X95X30	UNITED PRECISION	Prapaporn	16/1/50	Approved	100	415	49.20	53.45	9	-1763.00	0.00
MAR09-286	AAA	0+4767	Voa, Mems, Epoxy Free	JDS UNIPHASE CORPORATION	Prapaporn	16/1/50	Approved	10	3112	232.00	232.54	0	-1680.00	0.00
MAR09-287	AAA	0+5009798	Photodiode InGaAs PIN Hgh-Speed Dia 5.5	FERMIONICS OPTO-TECHNOLOGY	Prapaporn	16/1/50	Approved	90	459	23.00	25.07	9	-950.00	0.00
													-50996.77	**0.00**
APR01-122	AAA	5009215	DWDM Dummy	GERMAN MACHINE INC.	Chalermluck	11/1/50	Cancelled	300	113	0.08	0.08	0	0.00	0.00
APR04-123	AAA	0+40002863004	Assy, Pigtail Bifurcated 900Um Blk&Wht	CORNING CABLE SYSTEMS PTY LTD	Maetinee	17/1/50	Approved	1	128	38.81	39.44	2	-80.92	0.00
APR01-124	AAA	0+40002863005	Assy, Pigtail Bifurcated 900Um Blk&Wht	CORNING CABLE SYSTEMS PTY LTD	Maetinee	17/1/50	Approved	1	128	38.81	39.63	2	-104.72	0.00
APR04-125	AAA	0+4746	Shipping Case, 8Xx	ATLAS BOX& CRATING CO.,INC	Maetinee	17/1/50	Approved	100	456	2.89	3.02	5	-60.84	0.00
APR04-125	AAA	0+5000810	Cover, Coil Pocket, Ila	GERMAN MACHINE INC.	Maetinee	17/1/50	Approved	100	1255	2.56	2.56	0	-2.76	0.00
													-249.24	**0.00**

//DD/- Running no.

PPV Request No.	Customer	Part no.	Description	Supplier Name	Request by	Buyer send PPV to BUS	STATUS	MOQ	PO Q'TY	Std Cost	PO Price	Charge (%)	Expediting Costs (USD) Existing system	Expediting Costs (USD) Developed System
MAY14-126	AAA	0+40002863001	Assy, Pigtail Bifurcated 900Um Blk& Wht	CORNING CABLE SYSTEMS PTY LTD	Maetinee	22/1/50	Approved	1	115	38.81	41.09	6	-261.80	0.00
MAY15-127	AAA	0+40002863002	Assy, Pigtail Bifurcated 900Um Blk&Wht	CORNING CABLE SYSTEMS PTY LTD	Maetinee	22/1/50	Approved	1	115	38.81	39.52	2	-81.09	0.00
MAY16-128	AAA	0+40002863003	Assy, Pigtail Bifurcated 900Um Blk&Wht	CORNING CABLE SYSTEMS PTY LTD	Maetinee	22/1/50	Approved	1	115	38.81	39.93	3	-128.52	0.00
MAY20-129	AAA	0+40002863004	Assy, Pigtail Bifurcated 900Um Blk&Wht	CORNING CABLE SYSTEMS PTY LTD	Maetinee	22/1/50	Approved	1	115	38.81	42.33	9	-404.60	0.00
MAY21-130	AAA	0+40002863005	Assy, Pigtail Bifurcated 900Um Blk&Wht	CORNING CABLE SYSTEMS PTY LTD	Maetinee	22/1/50	Approved	1	115	38.81	42.37	9	-409.36	0.00
MAY22-131	AAA	0+50015220009	PIGTAIL, BIFUR, LC/UPC, RED/BLUE *	CORNING CABLE SYSTEMS PTY LTD	Maetinee	22/1/50	Approved	1	168	38.44	40.48	5	-343.00	0.00
MAY22-132	AAA	0+50015220010	PIGTAIL, BIFUR, LC/UPC, RED/BLUE *	CORNING CABLE SYSTEMS PTY LTD	Maetinee	22/1/50	Approved	1	168	38.47	42.30	10	-644.16	0.00
MAY22-133	AAA	5012425	Box Barolo Overwrap (Korrvu)	ATLAS BOX& CRATING CO.,INC	Duangporn	22/1/50	Approved	500	26	4.10	38.41	837	-892.00	0.00
MAY22-134	AAA	0+4182	20dB C-Band 1x1	AVANEX CORPORATION-AEP	Duangporn	22/1/50	Approved	1	632	274.12	277.97	1	-2434.00	0.00
MAY22-135	AAA	400006280001	WINDOW, BULKHEAD, SC DUPLEX, BLACK	UNITED PRECISION	Nutthakarn	23/1/50	Approved	100	315	24.10	34.10	41	-3148.51	0.00
MAY22-136	AAA	0+40000813	GFF, Single, Standard, C-Band II, G42	BROWAVE CORPORATION	Nutthakarn	23/1/50	Approved	1	115	157.20	158.28	1	-124.05	0.00
MAY22-137	AAA	631130701	COVER F10 GOLD LID	Hi-Rel Lids Ltd	Nutthakarn	23/1/50	Approved	500	168	2.70	3.02	12	-53.81	0.00
MAY22-138	AAA	0+4742	Splice Protector,Heat Shrink,15Mm,No Rod	CORNING CABLE SYSTEMS PTY LTD	Nutthakarn	23/1/50	Approved	1000	917	0.34	2.47	626	-1951.20	0.00
													-10876.10	**0.00**
JUN23-001	AAA	0+0347	Pump, Thermal Shim	HENKEL (THAILAND) LTD.	Chalermluck	23/1/50	Approved	1500	3773	0.35	0.38	11	-141.15	0.00
JUN23-001	AAA	0+4647	Photodiode, Sff-Ldc	BROWAVE CORPORATION	Duangporn	23/1/50	Approved	100	3091	54.00	55.63	3	-5044.17	0.00
JUN23-001	AAA	0+4874	Case, Shipping, 550	ATLAS BOX& CRATING CO.,INC	Chalermluck	23/1/50	Approved	200	203	5.52	5.71	3	-37.57	0.00
JUN23-001	AAA	7590010042027	Pump, 974.5+/-0.5nm, 250mW, JDSU, 2700	JDS UNIPHASE CORPORATION	Duangporn	23/1/50	Approved	10	1653	425.00	451.83	6	-44346.50	0.00
JUN24-002	AAA	0+40000638	HEAT SINK, W/ HEAT PIPES (MACHINED)	AAVID THERMALLOY (S) PTE LTD	Apawadee	24/1/50	Approved	100	112	105.00	170.60	62	-7346.78	0.00
JUN24-002	AAA	40000397	Fiber, DCM SMF-28-e .40.30 (1528-2 50km)	DRAKA COMTEQ FRANCE	Chalermluck	25/1/50	Approved	150	165	5.05	6.09	21	-171.48	0.00
JUN24-002	AAA	0+4867	Standoff, M/F #2-56 Thread .875 3/16Hex	HARDWARE SPECILATY CO.,INC	chalermluck	25/1/50	Approved	1000	1529	0.60	0.61	2	-15.83	0.00
JUN26-003	AAA	5012502	Broadband VOA	SANTEC USA CORP	Prapaporn	26/1/50	Approved	1	77	267.00	279.99	5	-1000.00	0.00
JUN26-003	AAA	0+4383	WDM, 980/1550 BS-C	AOFR PTY LIMITED	Duangporn	29/1/50	Approved	14	1653	19.50	25.79	32	-10394.46	0.00
JUN26-003	AAA	0+5000187	PCBA, PG1500 P-BOARD, P/N 5000187	SANMINA-SCI SYSTEMS SINGAPORE PTE LTD	Duangporn	29/1/50	Approved	1500	1653	215.60	218.07	1	-4090.49	0.00
JUN26-003	AAA	7590010042027	Pump, 974.5+/-0.5nm, 250mW, JDSU, 2700	JDS UNIPHASE CORPORATION	Duangporn	31/1/50	Approved	10	1653	425.00	438.91	3	-22998.56	0.00
JUN27-004	AAA	0+5147	Gff, Single Standard C-Band Ii, G29	BROWAVE CORPORATION	Duangporn	12/7/49	Approved	1	1326	93.64	128.66	37	-46440.00	0.00
JUN27-004	AAA	0+1382	Wdm, 980/1550 P-C	AOFR PTY LIMITED	Prapaporn	11/7/49	Approved	10	1326	36.00	41.60	16	-7420.00	0.00
JUN27-004	AAA	0+2073	15dB C-Band 1x1	AVANEX CORPORATION-AEP	Prapaporn	11/7/49	Approved	1	356	274.91	300.71	9	-9184.06	0.00
													-158631.05	**0.00**
JUL03-013	AAA	0+4388	Isolator, Ss, S-C	KONCENT COMMUNICATION, INC.	Duangporn	13/7/49	Approved	1	1292	22.93	37.86	65	-19290.00	-1269.08
JUL03-013	AAA	0+307490001	PCB, Customer Interface Module, PG5500	MPL INC.	Nutthakarn	14/7/49	Approved	25	518	104.55	121.04	16	-8543.21	-412.32
JUL03-013	AAA	0+4181	Splice Protector, 15Mm,No Rod	CORNING CABLE SYSTEMS PTY LTD	Nutthakarn	14/7/49	Approved	1000	1142	0.56	3.06	446	-2849.88	-2495.52
JUL03-013	AAA	0+4686	Pigtail Assy, Bifurcated, Lc/Upc, 8Xx	CORNING CABLE SYSTEMS PTY LTD	Nutthakarn	14/7/49	Approved	1	518	34.52	85.95	149	-26641.15	-5143.08
JUL03-013	AAA	C07030005	BAG - STATIC SHIELD	HORIZON SOLUTIONS CORP.	Nutthakarn	14/7/49	Approved	1000	1077	1.0	1.03	3	-36.80	0.00
JUL03-013	AAA	5009160	Crystal 25.0 MHz 18pF SMT	DIGI-KEY CORPORATION	Duangporn	14/7/49	Approved	5000	361	0.59	2.25	281	-599.11	0.00
JUL04-014	AAA	0+4383	WDM, 980/1550 BS-C	AOFR PTY LIMITED	Duangporn	14/7/49	Approved	14	1012	19.50	33.14	70	-13800.00	-190.91
JUL11-018	AAA	0+4995	PCBA, PG2600 E-Board No IIC, P/N 0+4995, Rev B	CTS CORPORATION	Suttinee	18/7/49	Cancelled	1000	777	58.33	58.33	0	0.00	0.00
JUL11-019	AAA	7875000090001	Cover, Pg1500, Skirted	GERMAN MACHINE INC.	Prapaporn	19/7/49	Cancelled	100	1012	25.13	25.13	0	0.00	0.00
JUL11-020	AAA	8069031	Tubing Silicone 1.98x3.18mm	MCMASTER-CARR SUPPLY COMPANY	Apawadee	21/7/49	Approved	1000	297	0.75	6.43	758	-1688.00	0.00
JUL12-021	AAA	0+5000145019	Pigtail, MZ, LC, 1071, Blu	CORNING CABLE SYSTEMS PTY LTD	Prapaporn	24/7/49	Approved	1	1012	21.99	22.10	1	-114.00	-9.46
JUL12-022	AAA	0+40000788	ASSEMBLY, SPOOL, 202X95X30	UNITED PRECISION	Apawadee	24/7/49	Cancelled	100	271	49.20	49.20	0	0.00	0.00
JUL12-023	AAA	400006280001	WINDOW, BULKHEAD, SC DUPLEX, BLACK	UNITED PRECISION	Prapaporn	24/7/49	Cancelled	100	271	24.10	24.10	0	0.00	0.00
JUL13-024	AAA	0+5001405	Base, Assembly, Mts	HIGH TECH MACHINISTS INC.	Suttinee	24/7/49	Cancelled	500	194	38.43	38.43	0	0.00	0.00
JUL13-025	AAA	400007460001	FACEPLATE, SMALL, BLACK, NO LOGO	UNITED PRECISION	Duangporn	25/7/49	Cancelled	100	271	12.28	12.28	0	0.00	0.00
JUL13-026	AAA	400007470001	BASEPLATE, SMALL, BLACK, 19in DCM RACK	UNITED PRECISION	Duangporn	25/7/49	Cancelled	100	271	13.40	13.40	0	0.00	0.00
JUL13-027	AAA	0+4966	Retainer-Wide	GERMAN MACHINE INC.	Duangporn	25/7/49	Cancelled	100	430	6.84	6.84	0	0.00	0.00
JUL13-027	AAA	5010314	Dummy Coupler	GERMAN MACHINE INC.	Duangporn	25/7/49	Cancelled	500	447	4.75	4.75	0	0.00	0.00
JUL13-027	AAA	5012423	Box Pizza Barolo (Korrvu)	ATLAS BOX& CRATING CO.,INC	Duangporn	25/7/49	Cancelled	200	361	12.20	12.20	0	0.00	0.00
JUL13-027	AAA	0+5000810	Cover, Coil Pocket, Ila	GERMAN MACHINE INC.	Duangporn	25/7/49	Cancelled	100	983	2.56	2.56	0	0.00	0.00
JUL13-027	AAA	0+5246	SCREW, 2- 56 X 3/ 8 SHCS, SS	HARDWARE SPECILATY CO.,INC	Apawadee	25/7/49	Cancelled	1000	853	0.69	0.69	0	0.00	0.00
JUL18-032	AAA	0+40000813	GFF, Single, Standard, C-Band II, G42	BROWAVE CORPORATION	Nutthakarn	31/7/49	Cancelled	1	194	157.20	157.20	0	0.00	0.00
JUL18-033	AAA	0+5000145019	Pigtail, MZ, LC, 1071, Blu	CORNING CABLE SYSTEMS PTY LTD	Nutthakarn	31/7/49	Cancelled	1	1012	21.99	21.99	0	0.00	0.00
JUL19-034	AAA	0+5000145020	Pigtail, MZ, LC, 731, Red	CORNING CABLE SYSTEMS PTY LTD	Nutthakarn	31/7/49	Cancelled	1	1012	21.94	21.94	0	0.00	0.00

//DD/- Running no.

PPV Request No.	Customer	Part no.	Description	Supplier Name	Request by	Buyer send PPV to BUS	STATUS	MOQ	PO Q'TY	Std Cost	PO Price	Charge (%)	Expediting Costs (USD) Existing system	Expediting Costs (USD) Developed System
JUL24-037	AAA	5012425	Box Barolo Overwrap (Korrvu)	ATLAS BOX& CRATING CO.,INC	Nutthakarn	1/6/49	Approved	500	297	4.10	6.96	70	-850.20	0.00
JUL24-039	AAA	40002455	Label, Outer carton Barolo Product	GM NAMEPLATE	Nutthakarn	1/6/49	Approved	1000	568	0.73	2.52	246	-1018.14	0.00
JUL25-040	AAA	631130701	COVER F10 GOLD LID	Hi-Rel Lids Ltd	Nutthakarn	1/6/49	Approved	500	150	2.70	32.83	1116	-4519.48	0.00
JUL25-043	AAA	7590010042014	Pump, 974.5+/-0.5nm, 140mW, JDSU	JDS UNIPHASE CORPORATION	Apawadee	21/6/49	Approved	10	430	300.00	342.77	14	-18390.00	-3421.40
JUL31-045	AAA	7590010042014	Pump, 974.5+/-0.5nm, 140mW, JDSU	JDS UNIPHASE CORPORATION	Nutthakarn	1/6/49	Approved	10	430	300.00	329.76	10	-12798.75	-2976.45
JUL31-046	AAA	7872710150001	Ring, Fiber Management, Molded	LANNA LAMPHUN PRECISION LTD.	Suttinee	15/6/49	Approved	300	150	1.47	3.34	127	-280.00	-560.00
JUL31-047	AAA	7875000090001	Cover, Pg1500, Skirted	GERMAN MACHINE INC.	Nutthakarn	1/6/49	Approved	100	1012	25.13	27.20	8	-2098.74	0.00
JUL31-049	AAA	7875200140001	Heatsink, Base PG5500 Extruded	AVANEX CORPORATION-AEP	Apawadee	15/6/49	Cancelled	50	518	30.25	30.25	0	0.00	0.00
JUL31-049	AAA	0+1218	1465/1487 Pump Combiner	AVANEX CORPORATION-AEP	Apawadee	15/6/49	Cancelled	20	518	27.50	27.50	0	0.00	0.00
JUL31-049	AAA	0+1382	Wdm, 980/1550 P-C	AOFR PTY LIMITED	Duangporn	21/6/49	Approved	10	518	36.00	50.66	41	-7593.60	-835.59
JUL31-049	AAA	0+307490001	PCB, Customer Interface Module, PG5500	MPL INC.	Nutthakarn	1/6/49	Approved	25	518	104.55	118.02	13	-6976.25	-336.69
JUL31-049	AAA	0+307490001	PCB, Customer Interface Module, PG5500	MPL INC.	Nutthakarn	1/6/49	Approved	25	518	104.55	112.21	7	-3965.42	-191.38
													-132052.73	**-17841.88**
AUG01-050	AAA	0+3444	Coupler	OPLINK COMMUNICATION INC.	Nutthakarn	1/6/49	Approved	100	1241	60.00	64.39	7	-5452.09	0.00
AUG01-051	AAA	0+40000253	PCBA, PG2600, T-BOARD-II, SINGLE SLOT	BRECONRIDGE MANUFACTURING SOLUTIONS	Apawadee	15/6/49	Approved	500	144	326.13	365.85	12	-5720.00	0.00
AUG01-051	AAA	0+4995	PCBA, PG2600 E-Board No IIC, P/N 0+4995, Rev B	CTS CORPORATION	Duangporn	21/6/49	Approved	1000	1559	58.33	63.31	9	-7768.00	0.00
AUG01-051	AAA	0+5000145021	Pigtail, MZ, LC, 731 Blk	CORNING CABLE SYSTEMS PTY LTD	Duangporn	3/7/49	Cancelled	1	1087	21.94	21.94	0	0.00	0.00
AUG01-051	AAA	0+5165	Gff, Ila Rev 2 (Old 5092)	BROWAVE CORPORATION	Apawadee	21/6/49	Approved	1	235	150.60	150.60	0	0.00	0.00
AUG08-053	AAA	4438321	Fusion Sleeve 40mm Mini	PRO-STAINLESS ,INC.	Apawadee	26/6/49	Approved	300	906	0.28	1.62	474	-1215.01	0.00
AUG08-053	AAA	0+3857	Heater, Coil	MINCO PRODUCTS INC.	Apawadee	26/6/49	Approved	1000	1476	55.23	56.85	3	-2400.00	0.00
AUG08-053	AAA	0+40000048	Coil Heater Assy, CR, PG2600	MINCO PRODUCTS INC.	Apawadee	26/6/49	Approved	1000	704	44.75	56.47	26	-8250.00	0.00
AUG08-053	AAA	5009784	IC MC74HC1G04 Single InverterSOT23-5	NUCLEUS ELECTRONICS LTD.	Nutthakarn	27/6/49	Cancelled	1000	431	0.05	0.05	0	0.00	0.00
AUG15-058	AAA	4438321	Fusion Sleeve 40mm Mini	PRO-STAINLESS ,INC.	Nutthakarn	9/3/49	Approved	300	906	0.28	1.94	585	-1500.00	0.00
AUG15-059	AAA	5009160	Crystal 25.0 MHz 18pF SMT	DIGI-KEY CORPORATION	Nutthakarn	31/3/49	Approved	5000	431	0.59	1.82	208	-529.00	0.00
AUG16-061	AAA	5009294	Kit MECH, Barolo SOADM 1 Band Mdl Ass'y	AVANEX CORPORATION-AEP	Nutthakarn	9/3/49	Approved	300	346	17.90	23.20	30	-1832.16	0.00
AUG16-062	AAA	631130701	COVER F10 GOLD LID	Hi-Rel Lids Ltd	Nutthakarn	9/3/49	Approved	500	144	2.70	10.80	300	-1166.00	0.00
AUG21-064	AAA	0+40000253	PCBA, PG2600, T-BOARD-II, SINGLE SLOT	BRECONRIDGE MANUFACTURING SOLUTIONS	Nutthakarn	31/3/49	Approved	500	144	326.13	368.56	13	-6110.03	0.00
AUG21-064	AAA	0+4686	Pigtail Assy, Bifurcated, Lc/Upc, 8Xx	CORNING CABLE SYSTEMS PTY LTD	Nutthakarn	31/3/49	Approved	1	1241	34.52	51.40	49	-20953.05	0.00
AUG22-065	AAA	0+4746	Shipping Case, 8Xx	ATLAS BOX& CRATING CO.,INC	Nutthakarn	30/3/49	Approved	100	643	2.89	2.94	2	-30.00	0.00
AUG22-066	AAA	0+4966	Retainer-Wide	GERMAN MACHINE INC.	Nutthakarn	9/3/49	Approved	100	402	6.84	14.56	113	-3104.10	0.00
AUG22-067	AAA	0+5254	Splicing Compound (2 Oz Bottle)	HORIZON SOLUTIONS CORP.	Nutthakarn	9/3/49	Approved	1	4373	24.50	26.31	7	-7893.75	0.00
AUG25-068	AAA	0+5165	Gff, Ila Rev 2 (Old 5092)	BROWAVE CORPORATION	Chalermluck	1/3/50	Approved	1	235	150.60	151.08	0	-112.31	0.00
AUG29-070	AAA	40003550	SD BB TBuffer F 1.5x1.5x3 SM BIP	FUJIKURA ASIA LTD.	Chalermluck	1/3/50	Approved	100	144	1.18	1.65	40	-68.06	0.00
													-74103.56	**0.00**
SEP05-071	AAA	400006280001	WINDOW, BULKHEAD, SC DUPLEX, BLACK	JINPAO PRECISION INDUSTRY CO.,LTD.	Chalermluck	1/3/50	Approved	150	170	1.12	1.70	51	-97.84	-86.33
SEP06-072	AAA	0+40001397	PCBA, PG2600, P-BOARD, PLAT 8, 802-2	AVANEX CORPORATION-AEP	Chalermluck	1/3/50	Approved	1	148	157.54	162.91	3	-794.10	-112.68
SEP06-072	AAA	0+4647	Photodiode, Sff-Ldc	BROWAVE CORPORATION	Chalermluck	1/3/50	Approved	100	2227	54.00	54.00	0	-5.68	-0.26
SEP08-073	AAA	7590010090001	Photodiode, JDSU, C-Band	AVANEX CORPORATION-AEP	Chalermluck	1/3/50	Approved	100	1153	35.00	35.04	0	-42.55	-3.69
SEP08-075	AAA	611003701	GPO MALE FLANGE MOUNT A001-N33-05	CORNING GILBERT INC.	Chalermluck	1/3/50	Approved	500	148	4.75	7.04	48	-338.18	0.00
SEP08-075	AAA	0+40001342	PCBA, PG2600, P-BOARD, PLAT 8, 875	BRECONRIDGE MANUFACTURING SOLUTIONS	Chalermluck	1/3/50	Approved	1	155	343.18	346.20	1	-467.96	-126.80
SEP08-075	AAA	400007470001	BASEPLATE, SMALL, BLACK, 19in DCM RACK	UNITED PRECISION	Duangporn	1/3/50	Approved	100	522	13.40	21.86	63	-4414.69	0.00
SEP12-076	AAA	4438321	Fusion Sleeve 40mm Mini	PRO-STAINLESS ,INC.	Nutthakarn	11/5/49	Approved	300	685	0.28	2.20	677	-1313.00	0.00
SEP13-077	AAA	5010314	Dummy Coupler	GERMAN MACHINE INC.	Nutthakarn	10/5/49	Approved	500	411	4.75	7.57	59	-1160.48	0.00
SEP13-078	AAA	5010493	VOA Broad Band Vertical	LIGHTCONNECT, INC	Nutthakarn	10/5/49	Approved	1	263	279.00	305.14	9	-6875.04	-2300.39
SEP13-079	AAA	8069031	Tubing Silicone 1.98x3.18mm	MCMASTER-CARR SUPPLY COMPANY	Apawadee	31/5/49	Approved	1000	263	0.75	3.96	428	-844.00	0.00
SEP13-079	AAA	9506331	Tubing Silicone 5/32"ID 7/32"OD 1/32"Wal	MCMASTER-CARR SUPPLY COMPANY	Apawadee	31/5/49	Approved	1000	263	0.75	12.51	1569	-3094.00	0.00
SEP14-080	AAA	631130701	COVER F10 GOLD LID	Hi-Rel Lids Ltd	Nutthakarn	11/5/49	Approved	500	148	2.70	13.00	381	-1524.41	0.00
SEP14-080	AAA	631130701	COVER F10 GOLD LID	Hi-Rel Lids Ltd	Nutthakarn	11/5/49	Approved	500	148	2.70	10.37	284	-1134.98	0.00

MDD/- Running no.

PPV Request No.	Customer	Part no.	Description	Supplier Name	Request by	Buyer send PPV to BUS	STATUS	MOQ	PO Q'TY	Std Cost	PO Price	Charge (%)	Expediting Costs (USD) Existing system	Expediting Costs (USD) Developed System
SEP18-082	AAA	7590010042027	Pump, 974.5+/-0.5nm, 250mW, JDSU, 2700	JDS UNIPHASE CORPORATION	Suttinee	29/5/49	Approved	10	169	389.00	425.71	9	-6204.39	-3414.25
SEP18-083	AAA	7590010043045	Pump, 980Nm, 450Mw	JDS UNIPHASE CORPORATION	Nutthakarn	10/5/49	Approved	10	155	610.00	728.14	19	-18312.00	-11223.48
SEP18-083	AAA	0+3857	Heater, Coil	MINCO PRODUCTS INC.	Suttinee	4/5/49	Approved	1000	716	55.23	59.91	8	-3353.55	-4683.73
SEP19-084	AAA	0+40000048	Coil Heater Assy, CR, PG2600	MINCO PRODUCTS INC.	Suttinee	5/5/49	Approved	500	670	44.75	57.06	28	-8250.00	-6156.72
SEP19-085	AAA	0+40001352	COIL HEATER, PG2600	MINCO PRODUCTS INC.	Suttinee	31/5/49	Approved	100	155	90.25	106.70	18	-2550.00	-1645.16
SEP20-086	AAA	0+4181	Splice Protector, 15Mm,No Rod	CORNING CABLE SYSTEMS PTY LTD	Nutthakarn	10/5/49	Approved	1000	1174	0.56	3.53	530	-3481.62	-2965.60
SEP26-087	AAA	0+4382	Wdm, 980/1550 P-C	AOFR PTY LIMITED	Nutthakarn	10/5/49	Approved	14	775	20.80	20.91	1	-81.74	-1.48
SEP26-088	AAA	0+4391	ISOLATOR, DS, S- C	BROWAVE CORPORATION	Nutthakarn	10/5/49	Approved	1	169	31.71	43.67	38	-2020.40	-466.25
SEP27-089	AAA	0+4995	PCBA, PG2600 E-Board No IIC, P/N 0+4995, Rev B	CTS CORPORATION	Suttinee	22/5/49	Approved	1000	871	58.33	60.72	4	-2080.80	0.00
SEP29-093	AAA	5005898-002	Screw Pan Hd 1-72x3/16 Phil SST	COFFER INDUSTRIAL SUPPLIES	Apawadee	31/5/49	Approved	5000	263	0.08	0.44	482	-95.00	-1806.08
													-68536.40	**-34992.90**
OCT05-096	AAA	C04050009	Label, Caution Sensitive	GM NAMEPLATE	Apawadee	31/5/49	Approved	1000	3653	0.13	0.14	8	-40.08	0.00
OCT11-099	AAA	5009784	IC MC74HC1G04 Single InverterSOT23-5	NUCLEUS ELECTRONICS LTD.	Chalermluck	1/11/49	Approved	1000	522	0.05	0.09	79	-20.71	0.00
OCT16-102	AAA	7590010042027	Pump, 974.5+/-0.5nm, 250mW, JDSU, 2700	JDS UNIPHASE CORPORATION	Nutthakarn	1/11/49	Approved	10	186	389.00	431.18	11	-7844.91	-4217.69
OCT16-103	AAA	0+4994	Pcba, Pg2600, E-Board, Baseline, Iic	AVANEX CORPORATION-AEP	Apawadee	1/11/49	Cancelled	300	115	155.21	155.21	0	0.00	0.00
OCT16-104	AAA	5006281-300	WDM Dvc 3PCX1F 1547.465 3.19nm PB C Typ	KONCENT COMMUNICATION, INC.	Maetinee	1/11/49	Cancelled	50	269	115.00	115.00	0	0.00	0.00
OCT16-104	AAA	C04050016	Label, This End Up	GM NAMEPLATE	Chalermluck	2/11/49	Approved	1000	3653	0.11	0.11	0	-1.24	0.00
OCT16-105	AAA	0+1218	1465/1487 Pump Combiner	AVANEX CORPORATION-AEP	Chalermluck	6/11/49	Approved	20	865	27.50	27.63	0	-108.30	-2.50
OCT16-106	AAA	5012505-300	Medium-Band VOA 1539.17-1553.27	SANTEC USA CORP	Chalermluck	6/11/49	Approved	1	269	163.00	163.35	0	-93.68	-34.83
OCT17-108	AAA	0+40000788	ASSEMBLY, SPOOL, 202X95X30	UNITED PRECISION	Duangporn	6/11/49	Approved	100	551	49.20	55.08	12	-3240.00	0.00
OCT17-110	AAA	5009220	Kit B&P, Barolo SOADM 1 Band Mdl Ass'y	AVANEX CORPORATION-AEP	Chalermluck	6/11/49	Cancelled	100	269	15.30	15.30	0	0.00	0.00
OCT17-111	AAA	0+40002880	Jumper, SC/UPC 900um Buffer - 10M	SEIKOH GIKEN HONG KONG CO., LIMITED	Chalermluck	6/11/49	Cancelled	50	894	32.76	32.76	0	0.00	0.00
OCT18-112	AAA	0+4868	Coupler, 95/5 1X2 P-C	AOFR PTY LIMITED	Chalermluck	6/11/49	Cancelled	100	2890	9.90	9.90	0	0.00	0.00
OCT18-113	AAA	0+5294	Wdm, 980/1550 L-Band	AOFR PTY LIMITED	Chalermluck	6/11/49	Cancelled	50	80	28.00	28.00	0	0.00	0.00
OCT19-114	AAA	5009070-300	WDM Dvc 3PCX1F 1547.465 3.19nm PB C Typ	BROWAVE CORPORATION	Nutthakarn	8/11/49	Cancelled	1	269	102.00	102.00	0	0.00	0.00
OCT19-116	AAA	0+40000788	ASSEMBLY, SPOOL, 202X95X30	UNITED PRECISION	Nutthakarn	8/11/49	Cancelled	100	551	49.20	49.20	0	0.00	0.00
OCT24-117	AAA	0+4382	Wdm, 980/1550 P-C	AOFR PTY LIMITED	Apawadee	9/11/49	Approved	14	731	20.80	20.91	1	-79.26	-1.52
OCT24-118	AAA	0+0347	Pump, Thermal Shim	HENKEL (THAILAND) LTD.	Chalermluck	9/11/49	Approved	1500	4265	0.35	0.38	9	-135.24	-47.56
OCT24-118	AAA	0+3851	Tray, Component	GLOBAL-THAIXON PRECISION INDUSTRY CO.,LT	Apawadee	10/11/49	Cancelled	500	1051	8.54	8.54	0	0.00	0.00
OCT24-119	AAA	0+4874	Case, Shipping, 550	ATLAS BOX& CRATING CO.,INC	Chalermluck	15/11/49	Approved	200	186	5.52	5.70	3	-33.53	0.00
OCT30-120	AAA	0+4873	Coupler, 50/50 1X2 P-C	AVANEX CORPORATION-AEP	Chalermluck	15/11/49	Cancelled	100	3134	9.50	9.50	0	0.00	0.00
OCT31-121	AAA	5012424	Box Barolo Insert (Korrvu)	ATLAS BOX& CRATING CO.,INC	Chalermluck	16/11/49	Approved	200	269	8.10	8.32	3	-58.02	0.00
													-11654.96	**-4304.10**
NOV01-122	AAA	5012426	Box Barolo Shipping Overpack(Korrvu)	ATLAS BOX& CRATING CO.,INC	Chalermluck	16/11/49	Approved	300	825	1.82	1.87	3	-41.20	0.00
NOV01-123	AAA	0+4368	Coupler, 98/2 1X2 P-C	AVANEX CORPORATION-AEP	Chalermluck	16/11/49	Cancelled	100	2386	10.80	10.80	0	0.00	0.00
NOV01-124	AAA	0+5009798	Photodiode InGaAs PIN Hgh-Speed Dia 5.5	FERMIONICS OPTO-TECHNOLOGY	Chalermluck	16/11/49	Cancelled	90	235	23.00	23.00	0	0.00	0.00
NOV01-125	AAA	0+40000638	HEAT SINK, W/ HEAT PIPES (MACHINED)	AAVID THERMALLOY (S) PTE LTD	Duangporn	16/11/49	Cancelled	100	87	105.00	105.00	0	0.00	0.00
NOV01-126	AAA	40000397	Fiber, DCM SMF-28-e .40.30 (1528-2 50km)	DRAKA COMTEQ FRANCE	Apawadee	21/11/49	Cancelled	3000	10	5.05	5.05	0	0.00	0.00
NOV01-127	AAA	5010493	VOA Broad Band Vertical	LIGHTCONNECT, INC	Nutthakarn	21/11/49	Approved	1	216	279.00	310.28	11	-6755.98	0.00
NOV02-126	AAA	0+40001525	EMA, PG5500, P-Board, 758(IIa), 4 Pump	JDS UNIPHASE CORPORATION	Nutthakarn	21/11/49	Approved	800	233	353.20	404.93	15	-12052.86	0.00
NOV06-128	AAA	0+4867	Standoff, M/F #2-56 Thread .875 3/16Hex	HARDWARE SPECILATY CO.,INC	Chalermluck	23/11/49	Approved	1000	408	0.60	0.63	5	-12.57	0.00
NOV06-128	AAA	0+5077	Amp Label, No Die Cut, Laser Class 3B	GM NAMEPLATE	Chalermluck	23/11/49	Approved	1000	521	0.80	0.82	3	-12.11	0.00
NOV06-129	AAA	5012423	Box Pizza Barolo (Korrvu)	ATLAS BOX& CRATING CO.,INC	Chalermluck	23/11/49	Approved	200	294	12.20	12.21	0	-2.31	0.00
NOV06-130	AAA	5012426	Box Barolo Shipping Overpack(Korrvu)	ATLAS BOX& CRATING CO.,INC	Chalermluck	23/11/49	Approved	300	825	1.82	1.85	2	-28.04	0.00
NOV06-131	AAA	0+4382	Wdm, 980/1550 P-C	AOFR PTY LIMITED	Chalermluck	23/11/49	Approved	14	548	20.80	20.94	1	-79.34	0.00
NOV06-131	AAA	0+40000808	GFF, Single, Standard, C-Band II, G23	AUXORA INC.	Apawadee	27/11/49	Cancelled	1	87	95.97	95.97	0	0.00	0.00
NOV06-132	AAA	0+1178	Pump, 1487nm, 150mW	FURUKAWA AMERICA, INC.	Chalermluck	27/11/49	Cancelled	20	233	14.85	14.85	0	0.00	0.00
NOV08-133	AAA	5009215	DWDM Dummy	GERMAN MACHINE INC.	Chalermluck	28/11/49	Approved	300	216	0.08	0.42	428	-74.04	0.00
NOV09-136	AAA	0+3481	Pigtail, #3 White, Length 102.5 Cm	AVANEX CORPORATION-AEP	Chalermluck	28/11/49	Cancelled	1	895	17.62	17.62	0	0.00	0.00
NOV16-141	AAA	5012425	Box Barolo Overwrap (Korrvu)	ATLAS BOX& CRATING CO.,INC	Chalermluck	5/10/49	Approved	500	216	4.10	7.83	91	-804.92	0.00
NOV16-141	AAA	7.59001E+12	Photodiode, JDSU, C-Band	JDS UNIPHASE CORPORATION		28/11/49	Cancelled	100	175	35.00	35.00	0	0.00	0.00
NOV16-142	AAA	0+4784	Coupler, 90/10 1X2 S-C	AOFR PTY LIMITED	Sudajan	5/10/49	Cancelled	50	408	11.50	11.50	0	0.00	0.00
NOV21-146	AAA	0+40000808	GFF, Single, Standard, C-Band II, G23	AUXORA INC.	Prapaporn	10/10/49	Approved	1	87	95.97	97.90	2	-168.00	0.00
NOV21-147	AAA	0+5000872	Screw, #2-56 X .75 Lg., Shcs	HARDWARE SPECILATY CO.,INC	Chalermluck	11/10/49	Approved	3000	842	0.65	0.65	0	-1.91	0.00
NOV23-149	AAA	0+907	Label, Dcm 4 X 1.75 Zebra (3000/Roll)	GM NAMEPLATE	Chalermluck	16/10/49	Approved	1000	1228	0.15	0.16	10	-18.06	0.00
NOV23-149	AAA	0+4972	Foam, Splice Holder	RIMCO PLASTICS CORP.	Chalermluck	16/10/49	Approved	100	1070	0.05	0.07	45	-24.18	0.00
NOV23-151(A)	AAA	0+5000145021	Pigtail, MZ, LC, 731 Blk	CORNING CABLE SYSTEMS PTY LTD	Chalermluck	16/10/49	Approved	1	2100	21.94	21.99	0	-112.84	0.00
NOV27-151	AAA	0+40000048	Coil Heater Assy, CR, PG2600	MINCO PRODUCTS INC.	Apawadee	17/10/49	Approved	500	696	44.75	56.60	26	-8250.00	0.00
NOV28-153	AAA	0+5000145020	Pigtail, MZ, LC, 731, Red	CORNING CABLE SYSTEMS PTY LTD	Chalermluck	17/10/49	Approved	1	2100	21.94	21.99	0	-113.79	0.00
NOV28-154	AAA	5006730	Foam Silicone 1/16" Thk w/Adhesive Back	MCMASTER-CARR SUPPLY COMPANY	Chalermluck	18/10/49	Approved	500	216	16.20	16.21	0	-1.91	0.00
													-28554.09	**0.00**

M/DD/- Running no.

PPV Request No.	Customer	Part no.	Description	Supplier Name	Request by	Buyer send PPV to BUS	STATUS	MOQ	PO Q'TY	Std Cost	PO Price	Charge (%)	Expediting Costs (USD) Existing system	Expediting Costs (USD) Developed System
DEC07-159	AAA	0+3444	Coupler	OPLINK COMMUNICATION INC.	Nuttakarn	24/10/49	Approved	100	189	60.00	82.83	38	-4315.26	-2283.21
DEC07-159	AAA	0+40002446	TRAT, PG1500, COMPONENT, TAPPED	MMI PRECISION (THAILAND) LTD.	Chalermluck	30/10/49	Approved	200	1840	18.90	19.00	1	-179.03	-19.46
DEC11-163	AAA	0+40000048	Coil Heater Assy, CR, PG2600	MINCO PRODUCTS INC.	Apawadee	12/9/49	Cancelled	3000	386	44.75	44.75	0	0.00	0.00
DEC14-167	AAA	0+5254	Splicing Compound (2 Oz Bottle)	HORIZON SOLUTIONS CORP.	Prapaporn	13/9/49	Approved	1	3192	24.50	25.48	4	-3122.56	-97.82
DEC26-172	AAA	4438321	Fusion Sleeve 40mm Mini	PRO-STAINLESS ,INC.	Chalermluck	18/9/49	Cancelled	300	462	0.28	0.28	0	0.00	0.00
DEC27-173	AAA	0+4867	Standoff, M/F #2-56 Thread .875 3/16Hex	HARDWARE SPECILATY CO.,INC	Chalermluck	18/9/49	Cancelled	1000	217	0.60	0.60	0	0.00	0.00
DEC28-177	AAA	0+4383	WDM, 980/1550 BS-C	AOFR PTY LIMITED	Prapaporn	26/9/49	Approved	14	1840	19.50	25.32	30	-10710.56	-81.49
DEC28-182	AAA	5007662	Rubber Boot (1F) 1Fiber Silicone UL94	KENT H LANDSBERG	Chalermluck	29/9/49	Approved	5000	199	0.30	0.41	35	-21.00	0.00
DEC28-183	AAA	5012426	Box Barolo Shipping Overpack(Korrvu)	ATLAS BOX& CRATING CO.,INC	Chalermluck	29/9/49	Approved	300	462	1.82	1.87	2	-21.00	0.00
													-18369.41	-2481.98
												Total PPV (USD)	-759,132.27	-90,200.47

Biography

Mr. Aekarin Burapachayanont was born in 1977 in Bangkok, Thailand. He graduated from Kasetsart University in the Faculty of Engineering majoring in Mechanical engineering in 1999. He had started working at Thai Yamaha Motor Co.,Ltd for one year and eight months, and then moved to work at Honda Automobile Thailand Co.,Ltd. He worked there for two years. He decided to move to work at Fabrinet Co.,Ltd. Currently, he works at Robert Bosch Limited in the position of senior project buyer for diesel system. In year 2005, he studied Master of Engineering in Engineering Management and Master of Science in Engineering Business Management at the Regional Center for Manufacturing Systems Engineering, Chulalongkorn University.