Chapter 5

Program Design

From the data mentioned in chapter three and four, we can design program which contains five parts:

1. Master File part
2. Preventive Maintenance part (P.M.)
3. Job Allocation Plan part
4. Reporting and Monitoring part
5. Inventory Control part

Each part will be described in details as topics follow:

5.1 Master File

This part is to input initial data for processing in the second, third, and fourth part. Details of this part are shown as table and figures as follows:

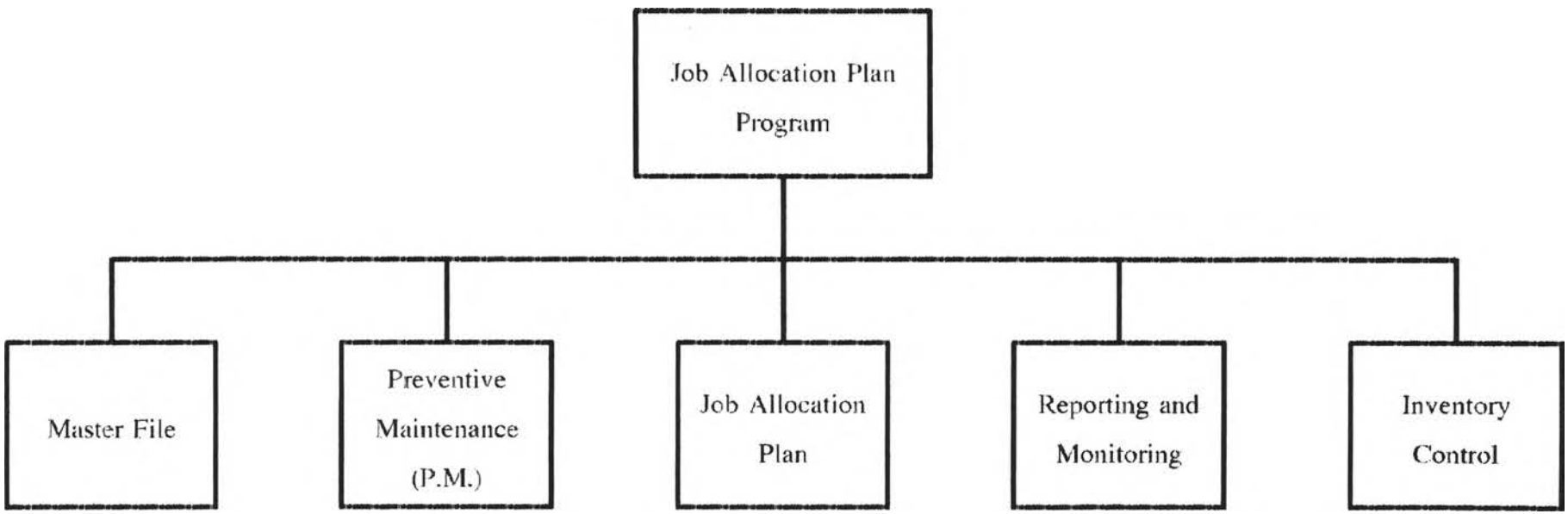


Figure 5-1 : Job Allocation Plan Program Chart

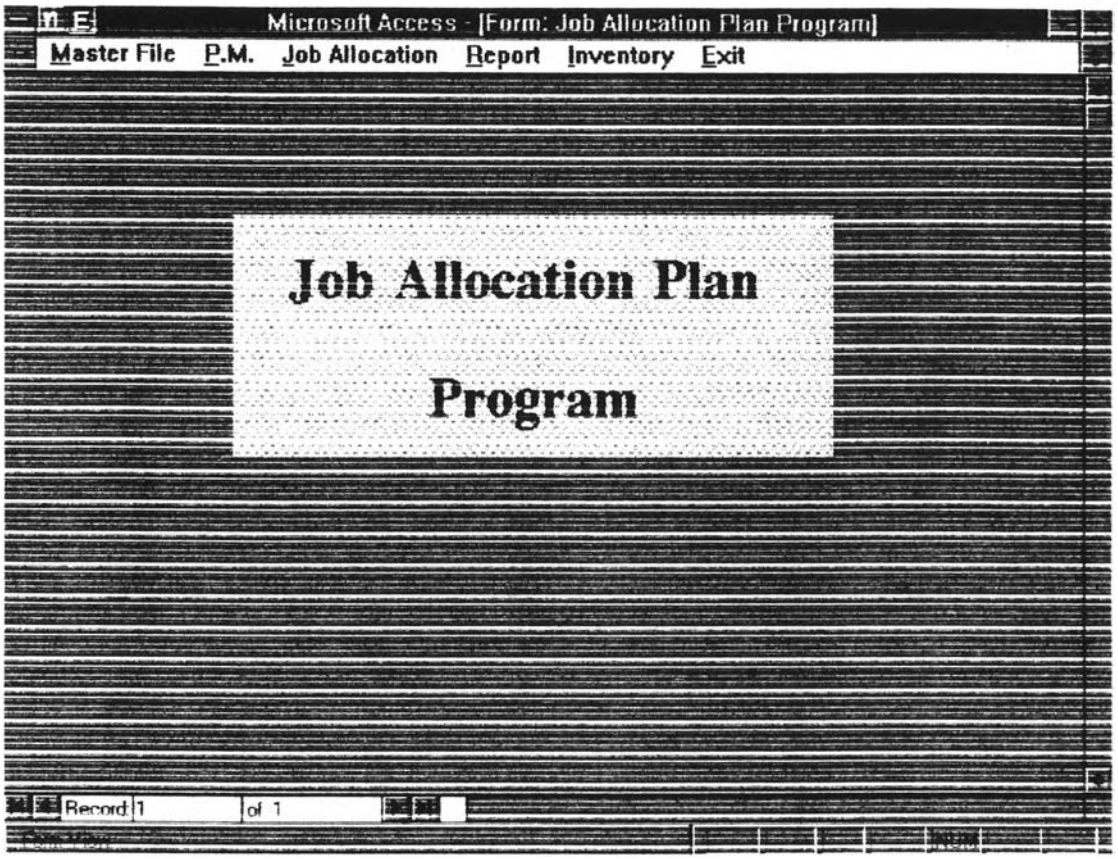


Figure 5-2 : Main window of Job Allocation Plan Program

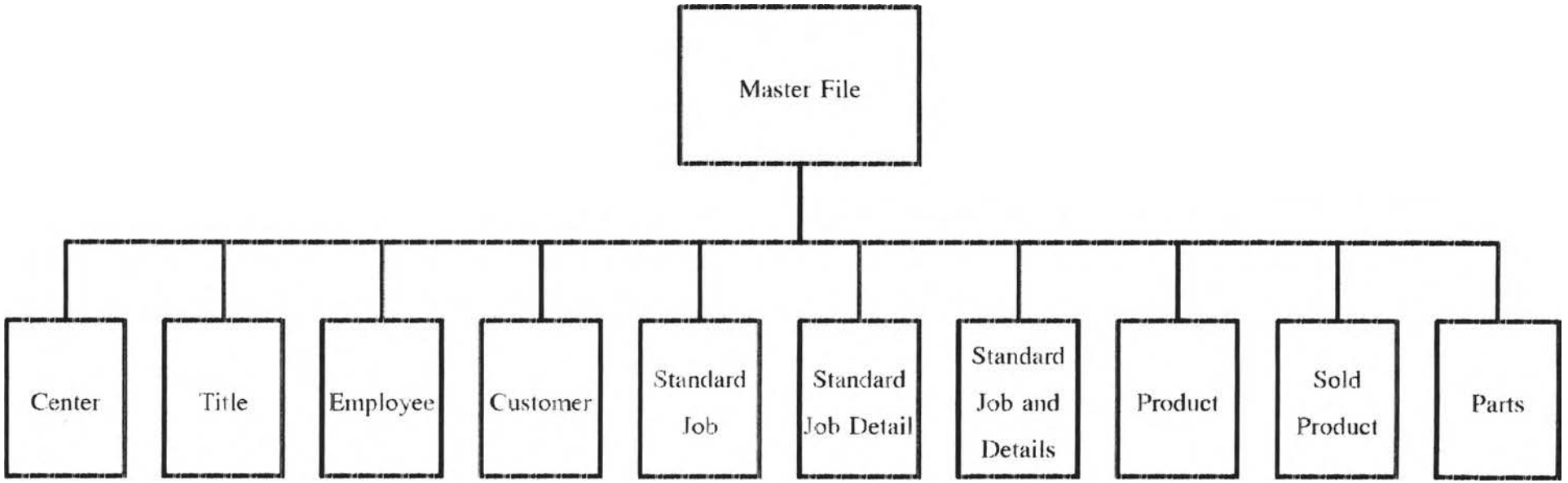


Figure 5-3 : Master File Chart

Table 5-1 : Details in Master file Menu

No.	Sub Menu	Data	Remark
1	Center	1. Center Code	
		2. Center Name	
		3. Number of bays	
2	Title	1. Title Code	
		2. Title Name	
		3. Quantity	Total quantity of this title
3	Employee	1. Employee Code	
		2. Salutation	Mr..Mrs..Ms.
		3. Employee Name	
		4. Employee Surname	
		5. Title	Title of this employee
		6. Center	Center this employee works for
4	Customer	1. Customer Code	
		2. Customer Name	
		3. Province	
		4. Attention	
		5. Telephone Number	
5	Standard Job	1. Standard Job Code	
		2. Standard Job Name	
		3. Job Pattern	Installation.P.M.
		4. Bay (Y/N)	Has to be operated in bay or not
		5. Welders	Number of welders required
		6. Mechanics	Number of mechanics required
		7. Electricians	Number of electricians required
		8. Days	Total expected time to operate this job
6	Standard Job Details	1. Standard Job Code	
		2. Standard Job Name	
		3. Interval Number	
		4. Title	Title required for this interval

Table 5-1 : Details in Master file Menu (Continued)

No.	Sub Menu	Data	Remark
6	Standard Job Details	5. Quantity	Number of employees of above title required
		6. Days	Expected time used for this interval
7	Standard Job and details	List of each standard job and detials	
8	Product	1. Product Name	
		2. Product Name	
		3. Number of P.M.	Number of P.M. that will be operated to this job
9	Sold Product	1. Product Name	
		2. Customer Name	Name of customer who bought this product
		3. Serial Number	Serial Number of this product
		4. Installation Pattern	Installation pattern operated to this product
		5. First P.M. Date	Expected first P.M. date
10	Parts	1. Part Number	
		2. Part Name	
		3. Cost	Cost per unit
		4. Tax (%)	Tax charged to this part
		5. Plus (%)	Mark up to define price
		6. Unit Price	Price per unit
		7. On Hand	Total on hand quantity at that day
		8. '97 Demand Forecasting	

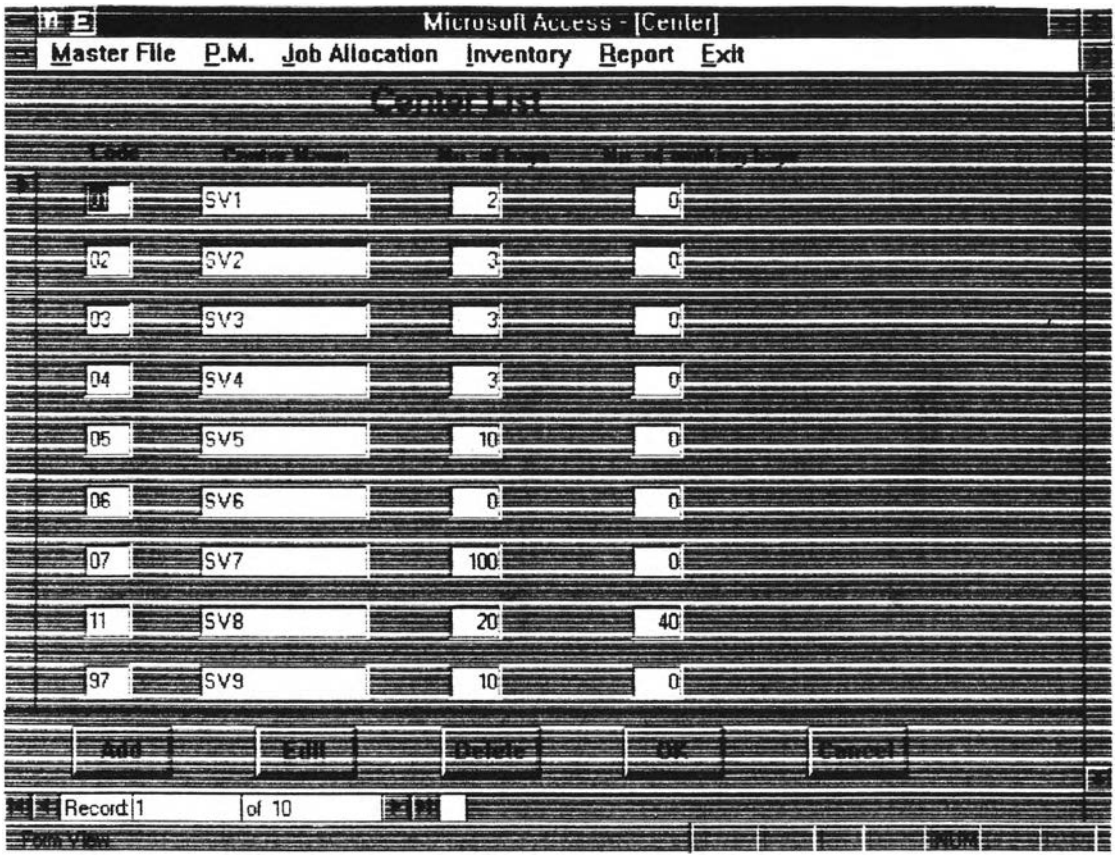


Figure 5-4 : Service Center list screen

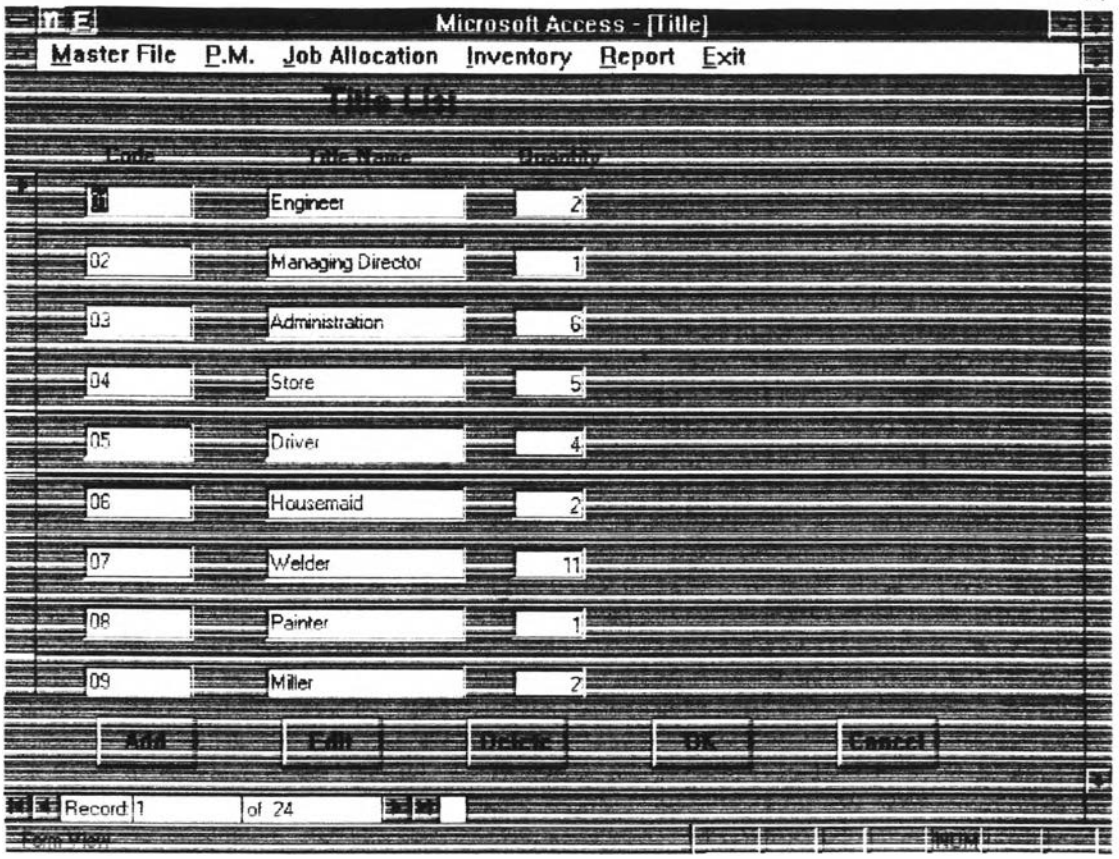


Figure 5-5 : Title list screen

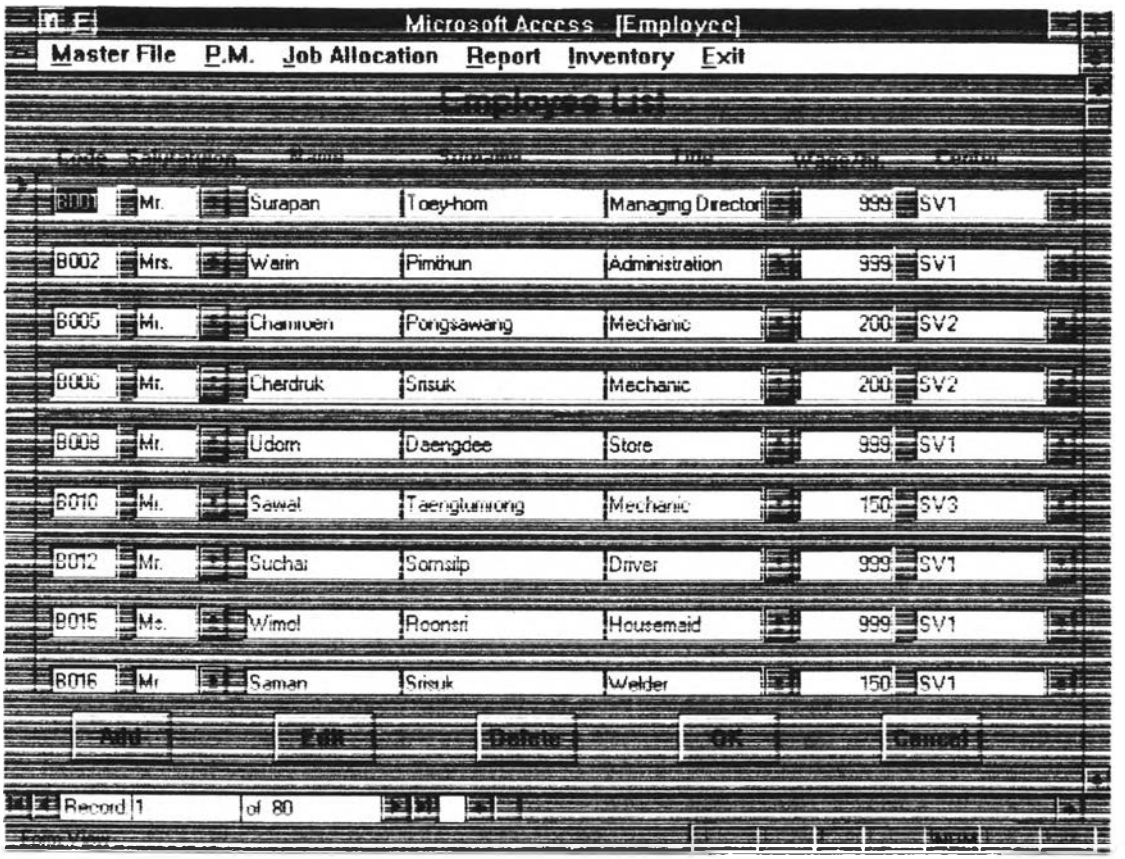


Figure 5-6 : Employee list screen

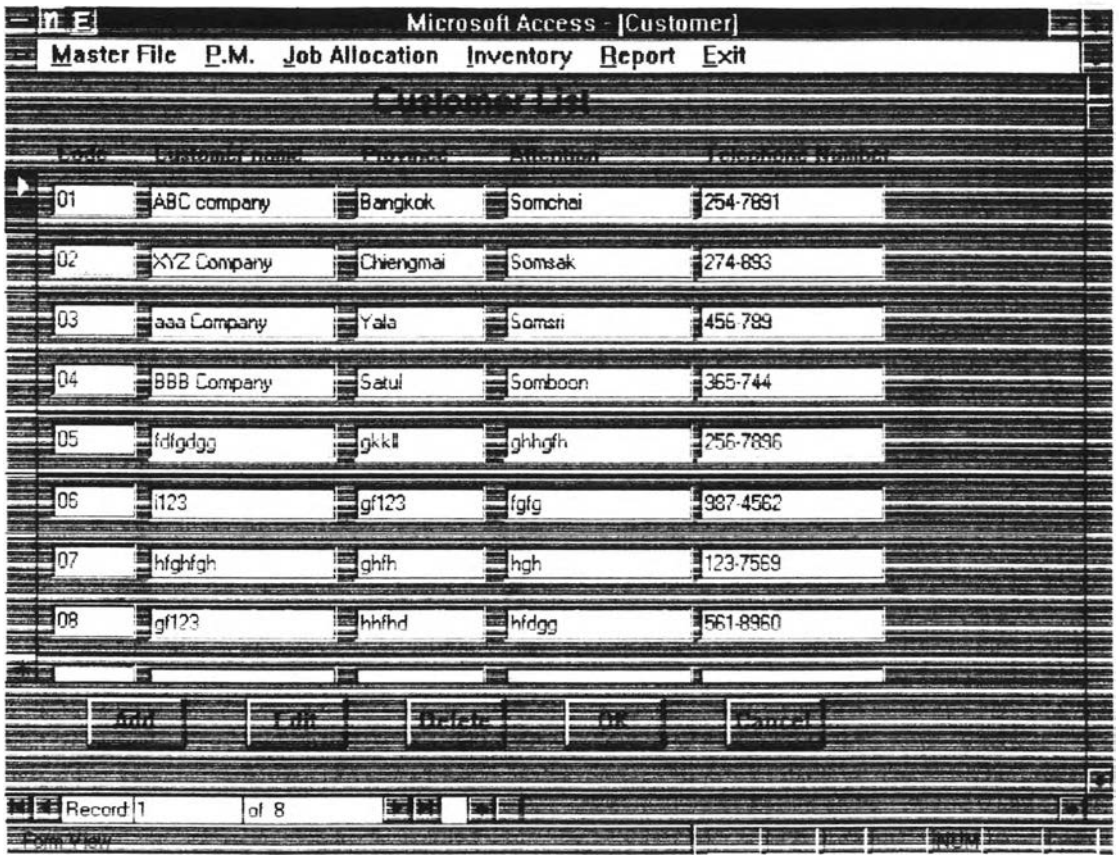


Figure 5-7 : Customer list screen

Standard and Non-standard job pattern

At present time, all jobs operated by this company are not yet be defined exact employee and time used per job. However, from discussion with engineering manager, five installation patterns operated at service center can be broken into operation steps and defined employee and time used in each step. After that, existing installation patterns were re-defined to more systematically by assign employee to work in time slots. Each time slot is operated by a set of employees (one or two persons) and takes a half day duration.(4 hours in morning or afternoon). Summary of existing and re-defined installation patterns are shown in figure A-1 to A-11 in appendix section.

Preventive maintenance pattern can not be defined to be standard pattern because most of P.M. jobs are operated at customer place. It can not definitely define transportation time. Nevertheless, this pattern can be specified details of operator such as change hydraulic oil filter, change hydraulic oil, etc. So, this pattern can be only defined Job code and Job description. In case that preventive maintenance is operated at service center, the program is designed to determine operating time as same as installation pattern.

Break down maintenance pattern can not be classified to be standard pattern because, though service manual specifies number of employee and time used, it can not control time used as service manual specify.

Finally, all three main patterns can be summarized as table below:

Table 5-2 : Summary of Job patterns

Pattern	Type	Job code	Job Des.	Emp. used	Time used
Installation at service center	Std.	Yes	Yes	Yes	Yes
Preventive Maintenance	Non-std.	Yes	Yes	No	No
Break down Maintenance	Non-std.	No	No	No	No

Remark : Installation at customer place is rarely operated

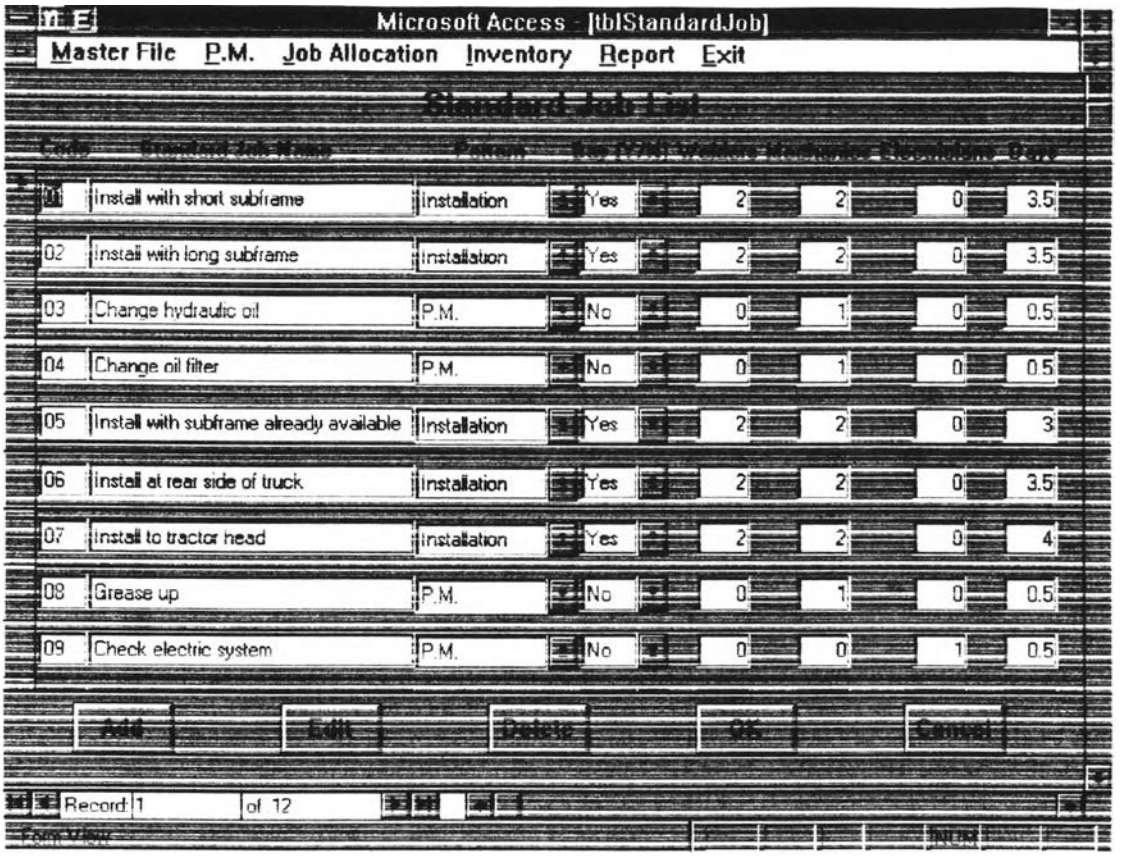


Figure 5-8 : Standard Job list screen

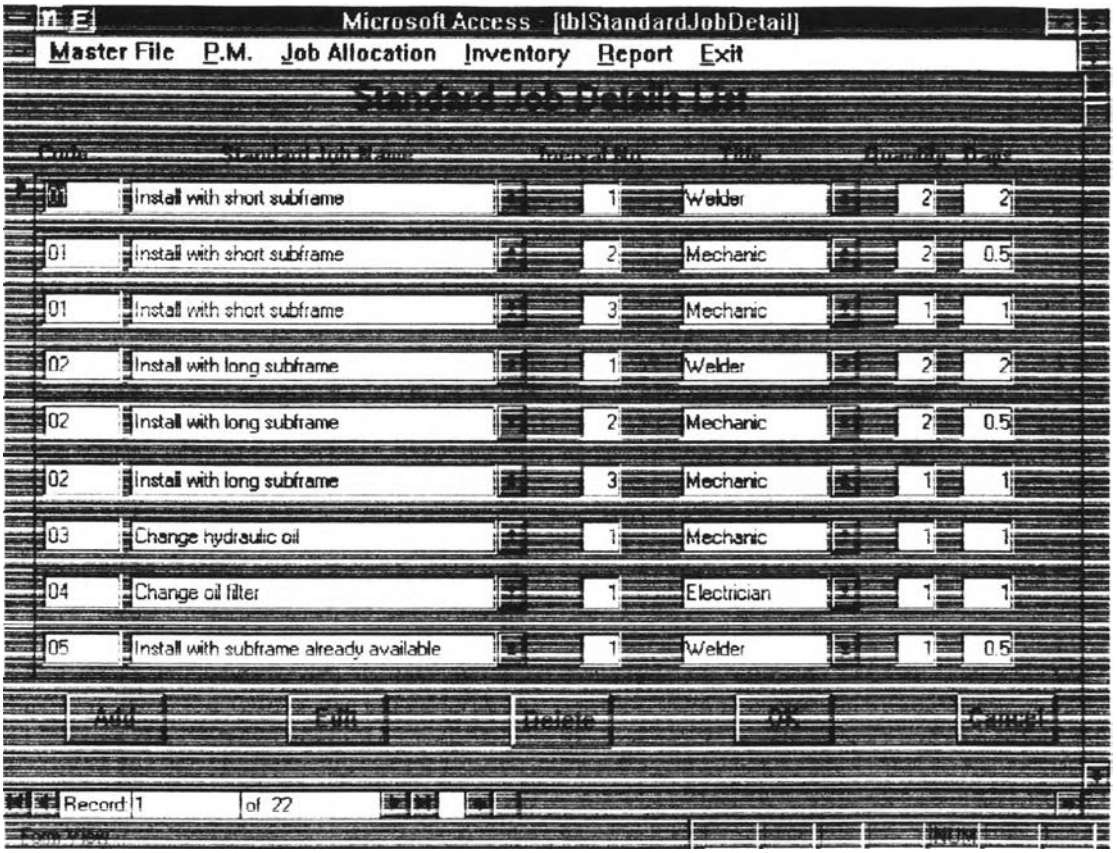


Figure 5-9 Standard Job Details list screen

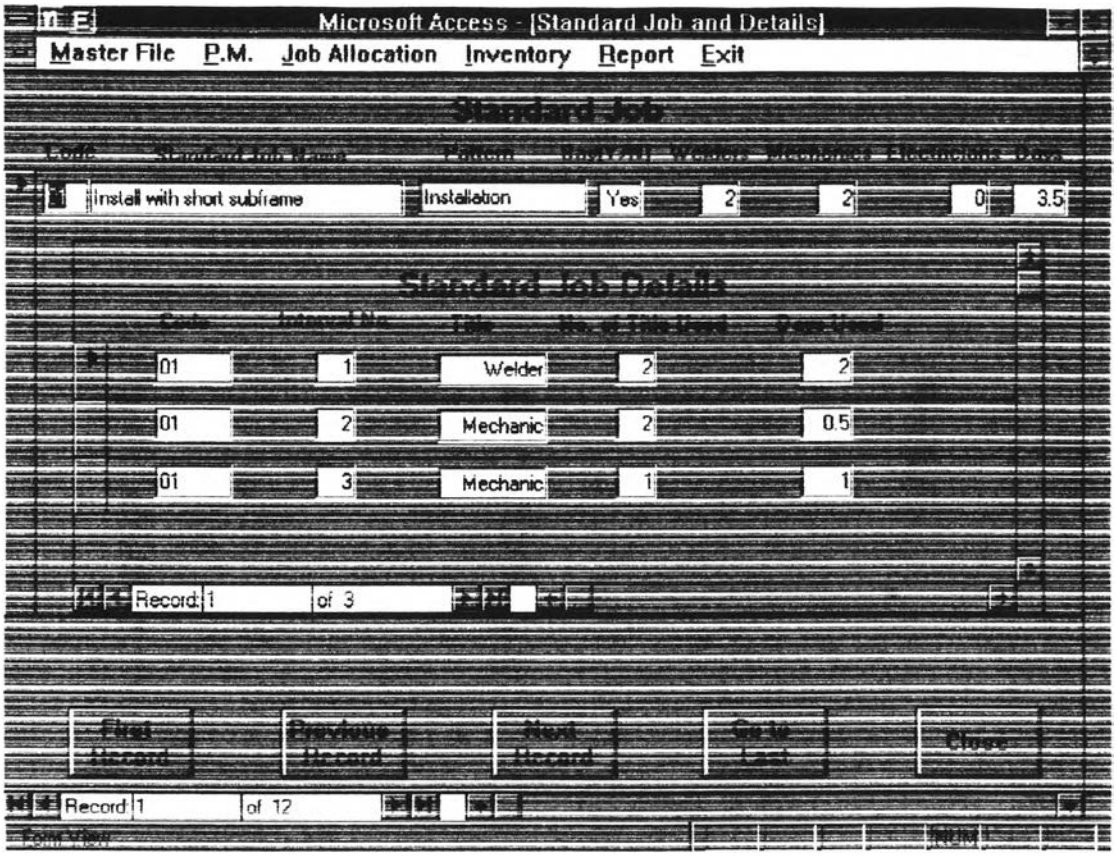


Figure 5-10 : Standard Job and Details list screen

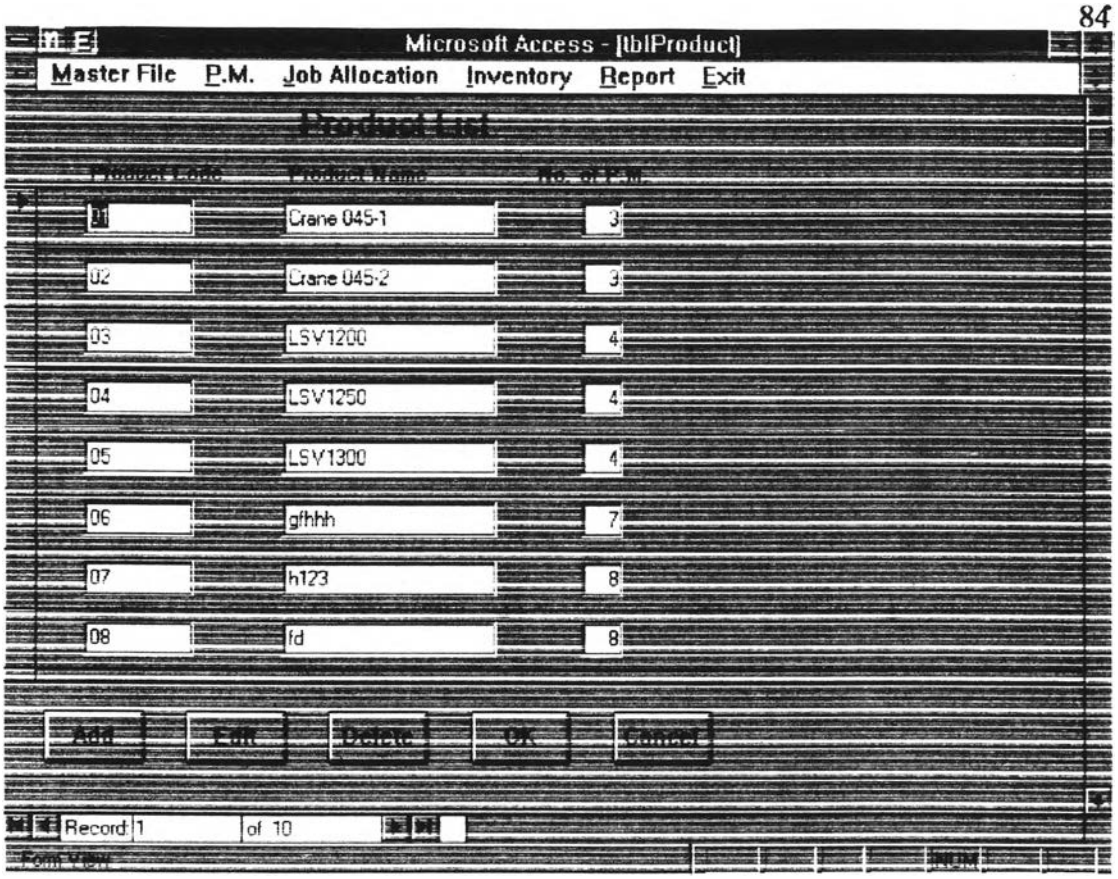


Figure 5-11 : Product list screen

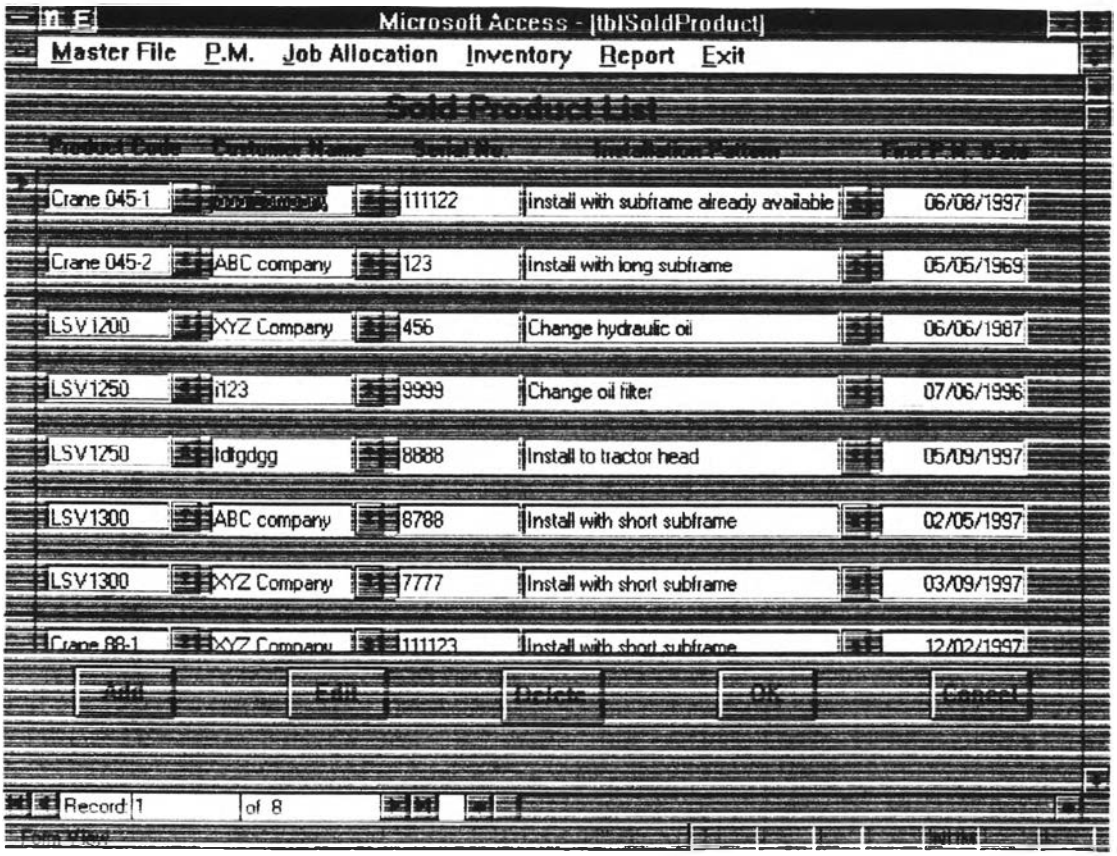


Figure 5-12 : Sold Product list screen

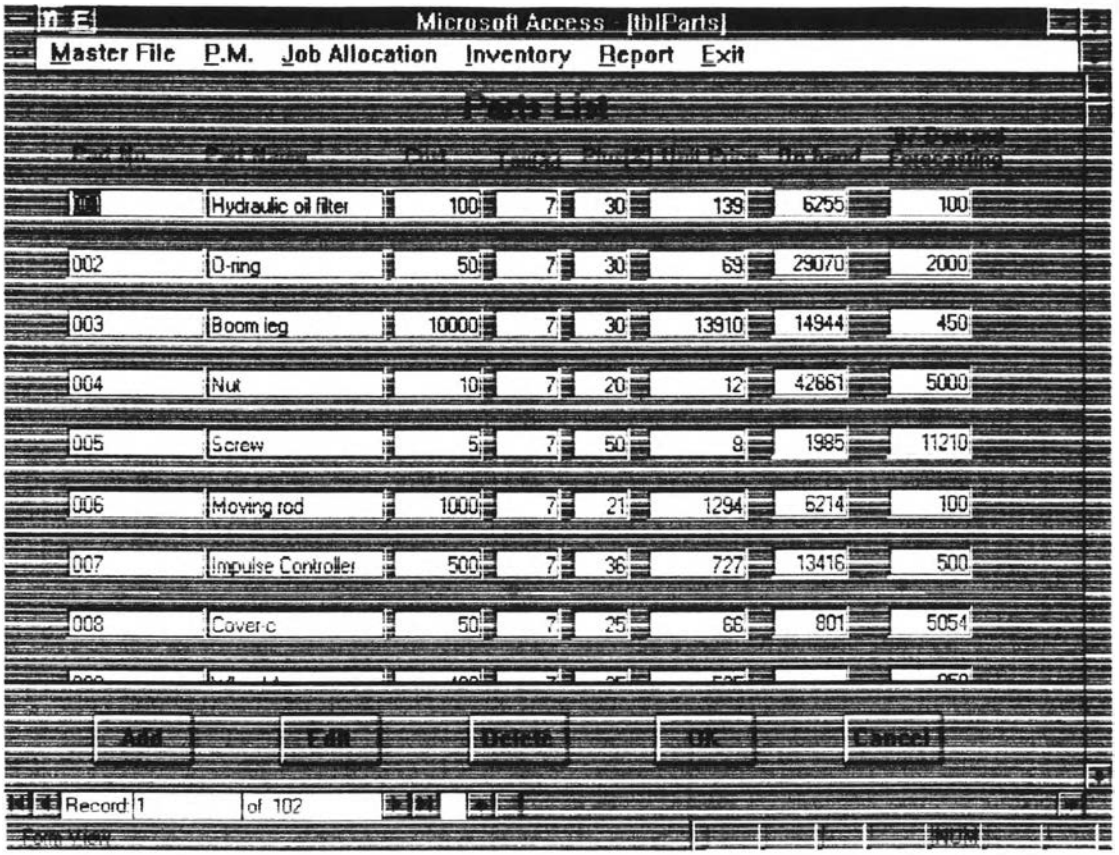


Figure 5-13 : Parts list screen

5.2 Preventive Maintenance (P.M.)

Preventive Maintenance (P.M.) is a planned activity. It can be known in advance. This function can be defined date to take first action based on the data from the sales company. All products are expected to operate preventive maintenance three or four times within one year warranty period. So, these data can be brought to determine planned schedule of sold products. The schedule will show date to operate the first, the second, the third and/or the fourth preventive maintenance. In actual situation, the acted preventive maintenance may be operated sooner or later than the schedule. The program, therefore, is separated into three parts. The first part is P.M. History. It shows details of customer name, product name, serial number of the product, number of planned preventive maintenance of the product, acted preventive maintenance number, actual service date, and description of acted preventive maintenance description. It collects data of all acted preventive maintenance. The operator can make use of the data of acted preventive maintenance from this part. The second part is Pass P.M. - No Action. It shows details of customer name, product name, serial number of the product, number of planned preventive maintenance, planned preventive maintenance number, planned preventive maintenance date. The purpose of this part is to warn the operator that there is overdue preventive maintenance. When the operator check this part, he will be known the priority of preventive maintenance that should be taken action. Also, this part is designed for the operator to record preventive maintenance that has already acted. He can record the preventive maintenance description and actual service date at the bottom of the screen. The last part is Next P.M. Action. It shows details of customer name, product name, serial number of the product, number of planned preventive maintenance, the next preventive maintenance number, and the next preventive maintenance date. The last two details are calculated from the previous preventive maintenance action. The purpose of this part is similar to the

second part. But it shows the next preventive maintenance that are planned to operate in the future. When the operator check data from this part. he will be warned to prepare the priority of preventive maintenance to be taken action in the nearest planned date. If any next preventive maintenance has already operated. the operator can also record data of preventive maintenance detail and actual service date at the bottom of the screen.

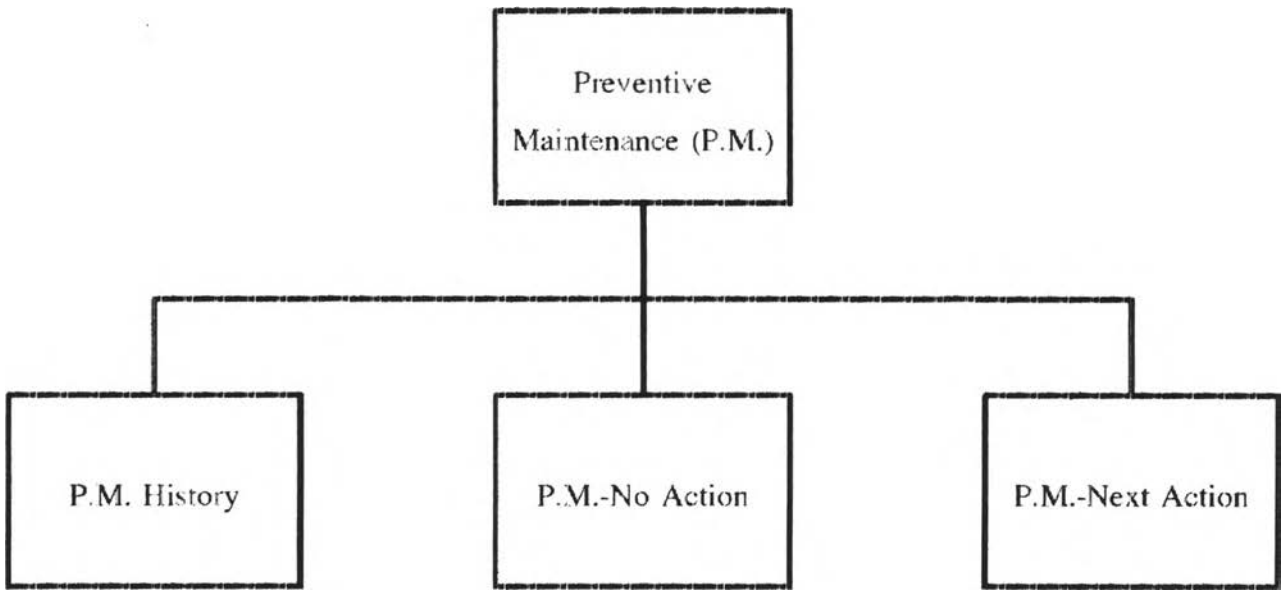
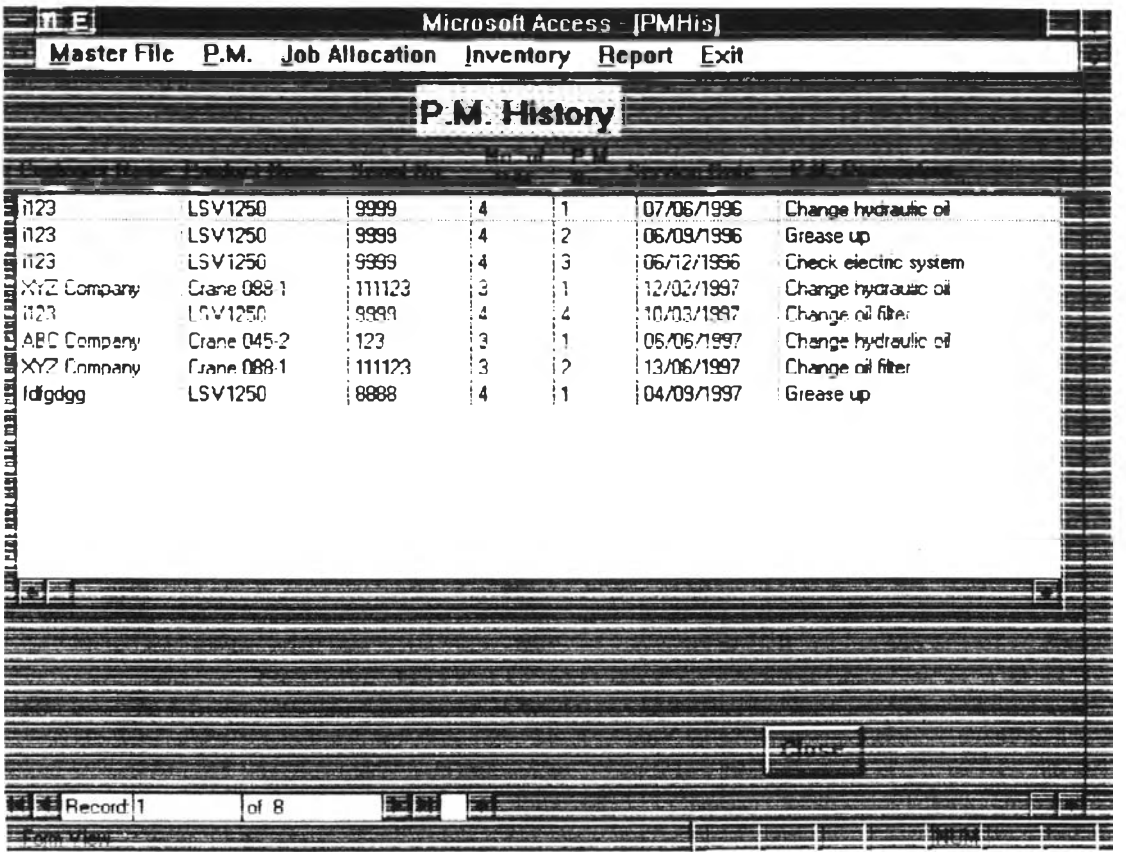


Figure 5-14 : Preventive Maintenance Chart



i123	LSV1250	9999	4	1	07/06/1996	Change hydraulic oil
i123	LSV1250	9999	4	2	06/09/1996	Grease up
i123	LSV1250	9999	4	3	06/12/1996	Check electric system
XYZ Company	Crane 088-1	111123	3	1	12/02/1997	Change hydraulic oil
i123	LSV1250	9999	4	4	10/03/1997	Change oil filter
ABC Company	Crane 045-2	123	3	1	06/06/1997	Change hydraulic oil
XYZ Company	Crane 088-1	111123	3	2	13/06/1997	Change oil filter
fdfgdgg	LSV1250	8888	4	1	04/09/1997	Grease up

Figure 5-15 : P.M. History list screen

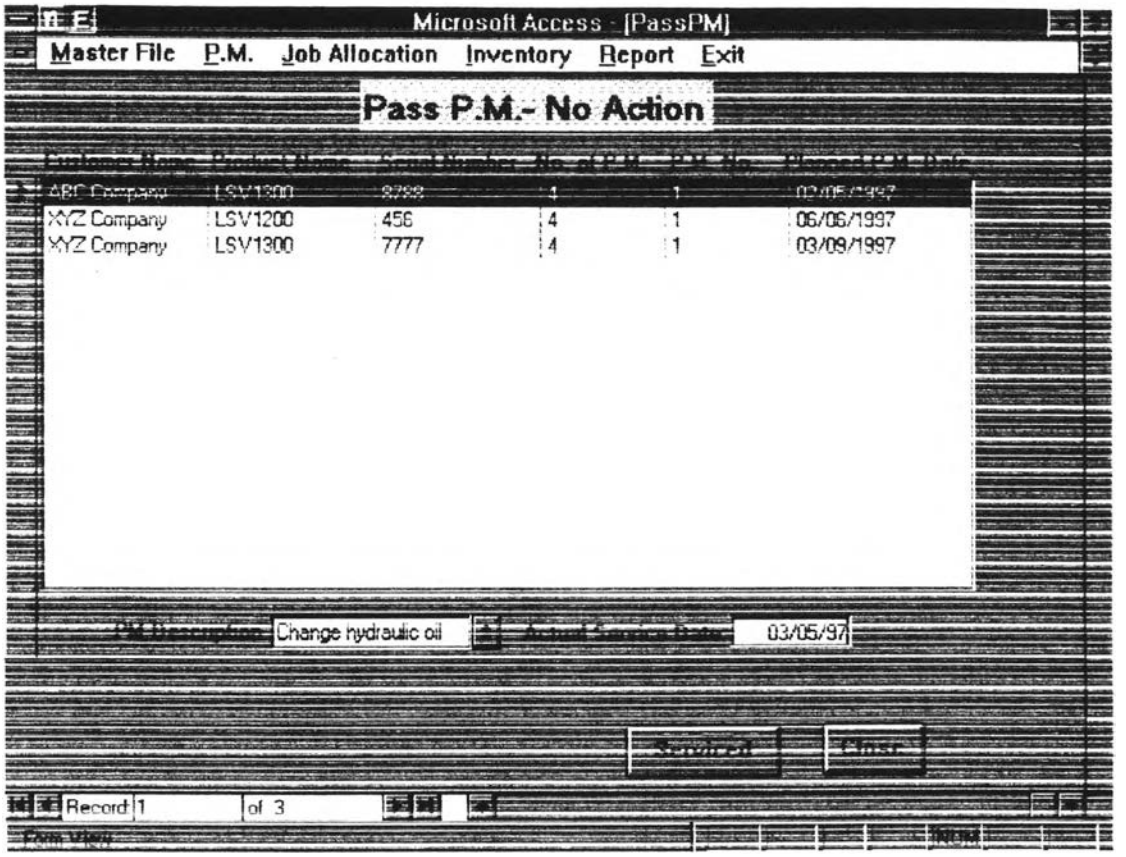


Figure 5-16 : P.M. - No Action list screen

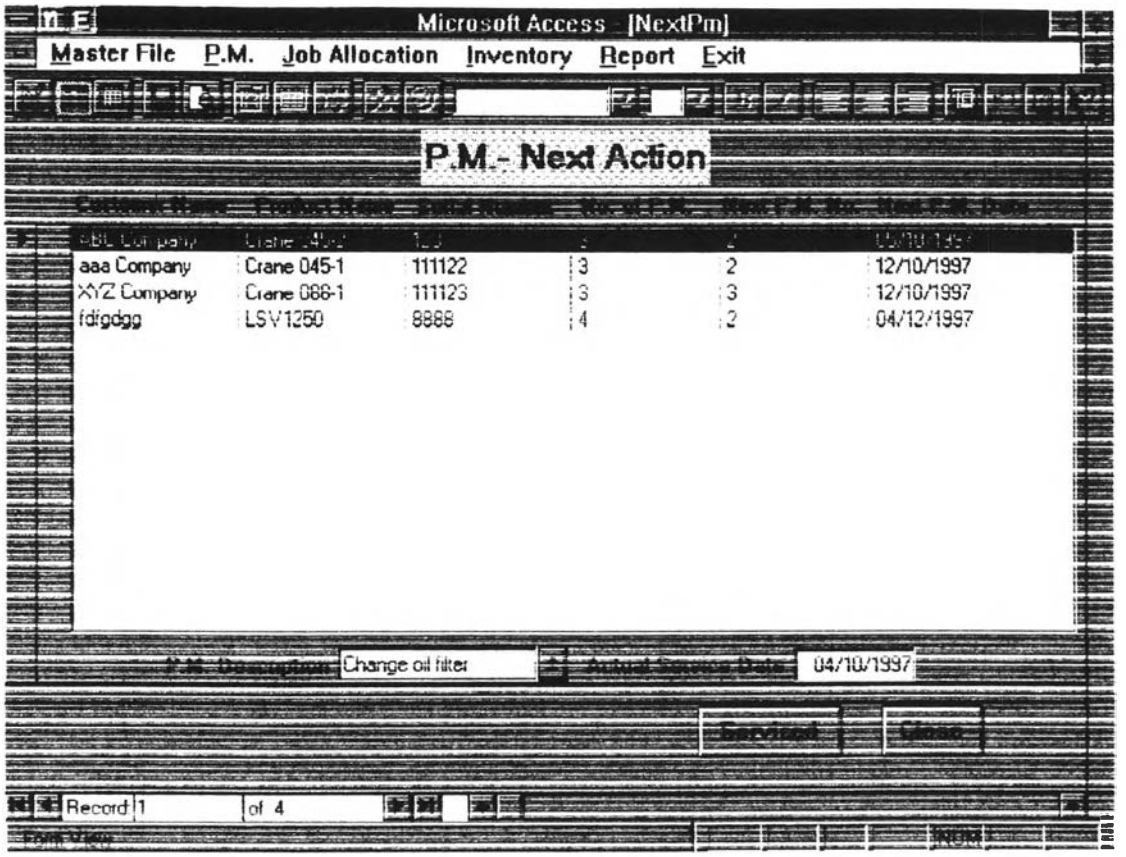


Figure 5-17 : P.M. -Next Action list screen

5.3 Job Allocation Plan

Job Allocation Plan part is designed to allocate incoming jobs of multiple service centers. Data of customers and their requirements are input for the program to assign job to the available service center. The assignment is based on the availability of required facilities such as employee and bay. The program will check **Status** of facilities. If the status of the facilities is available, the job is assigned to the service center that customer required. If the status of required facilities is not available, the program will suggest other choices and time to service of available service centers. Some status have to be recorded together with **Remark** to give more information to users. Like facilities, job is also defined status to all stages of its operation. Three main stages are used to divided job operation. They are Reserve, Processing, and Finish. During processing stage, **Job Progress** in term of percentage is another parameter used to indicate job operation. The following tables will explain the status of facilities and job.

Table 5-3 : Employee status

Status	Meaning
Operating	Operating
Pending	Can not operate the current problem job and can work other job
Reserved	Reserved to operate reserved job
Free	No job to operate at that time

Table 5-4 : Bay status

Status	Meaning
Operating	Being operated
Reserved	Reserved to operate reserved job
Free	No job to operate at that time

Table 5-5 : Job status

Stage	Status	Meaning
Reserve	Can't service	Can not service because the product is not sold by the company
	Cancel	Customer cancel because he can not accept the proposed choice or there is no available service center.
	Reserve	Reserve facility to operate in the near future.
	Wait	Customer is not ready to receive service at appointed time.
	Queue	Service center is not ready to service at appointed time
Processing	Operating	Job can be operated without any problem
	Pending	Job can not be operated with some remark.
Finish	Closed	Job is closed with 100 % of completeness
	Cancel	Job is closed with less than 100% of progress.

Table 5-6 : Remark list

Remark	Meaning
No welder	Welder is not available at that time.
No mechanic	Mechanic is not available at that time.
No electrician	Electrician is not available at that time.
No spare parts	Spare parts is not available at that time.
Outsourcing	Some components are fixed by sub contractor.
No response	No response from the customer.
No remark	No remark to record

When customers' data and their requirement has been already changed into job input data. the next is to edit job progress and its status. Status of job. employee. bay are shown in form of **Gantt chart** for investigation. Start and finish time together with different colors to show different status are used to present

characteristic of the data. The reason to use this form is that it is easy to investigation.

Most jobs consume spare parts. The program is designed to have a screen to record spare parts used by each job. Finally, if user wants to check details of each job. the program provides a screen to present the required data.

Four screens are designed to serve this part of the model. **They are Job control, Job Schedule, Employee Schedule, Bay Schedule, Parts Used, and Job Summary**. The first screen functions to receive the data of open job. update job, and close job. The operator can input customer data in **Data Box**, choose center from **Edit Box**, and input expected start date in **Date Box** when he open job. If the required service center is available, the program will accept this data. On the other hand, if the required center is not available, the program will propose other choices. When the operator wants to update job status and progress or wants to close job. he can search the data from the **Search Box** and edit data in the **Edit Box**. (For more information, see user manual in appendix section)

The second, the third, and the fourth is designed to present data in the form of Gantt chart. The operator can scope time interval from the **From-To Box**, scope center from the **Center** combo box. Then Gantt chart will show details of data in the scope criterias in different colors and lengths of bar chart. Also, the data located below Gantt chart will give more information of selected data.

The fourth screen is designed to record spare parts consumed by each job. The user can know the available on hand items and quantity in his service center. He can issue spare parts from data in the list and can know the price and total price of spare parts consumed by each job.

The last screen shows details of each job. It can be opened to show data of job any time the user want. Cost data are also in this screen. They are labor cost which is calculated by multiple number of operating hours with wage per hour of

all employees who operate this job. Parts cost is calculated from total price of spare parts consumed by this job. Other cost is calculated from the cost which can not be categorized to the two previous costs. Total cost of three types of cost is shown in the last line. It is useful for administration officer when he want to close job..

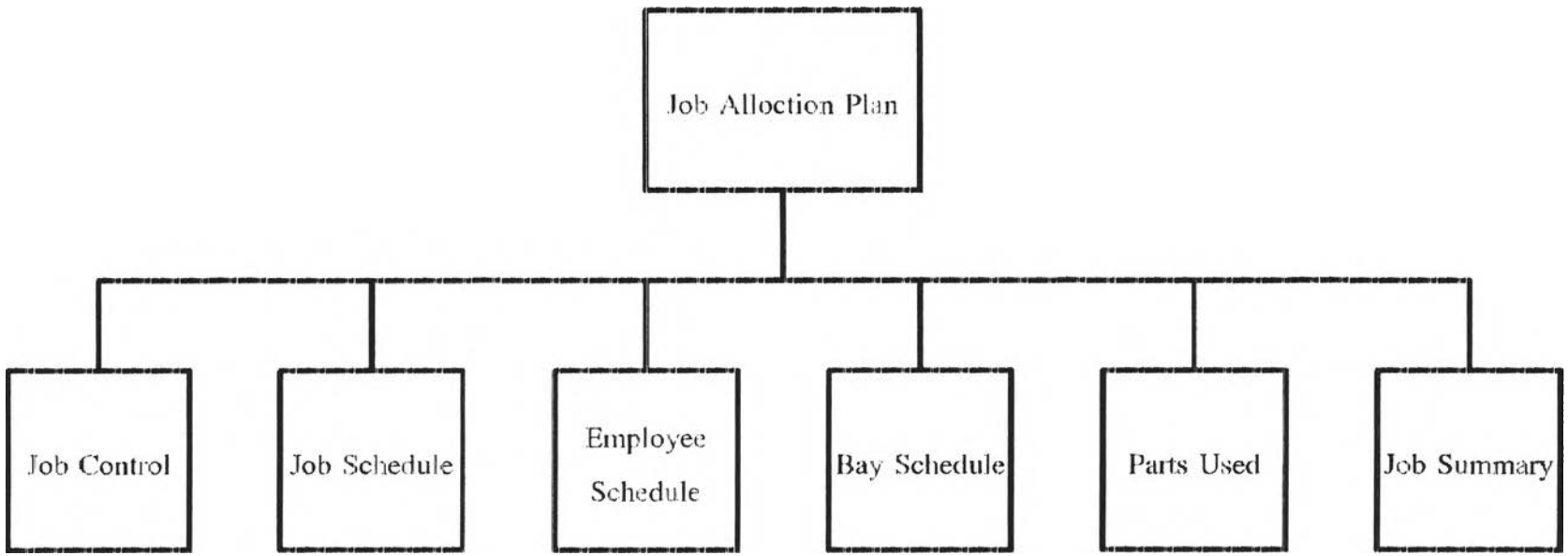


Figure 5-18 : Job Allocation Plan Chart

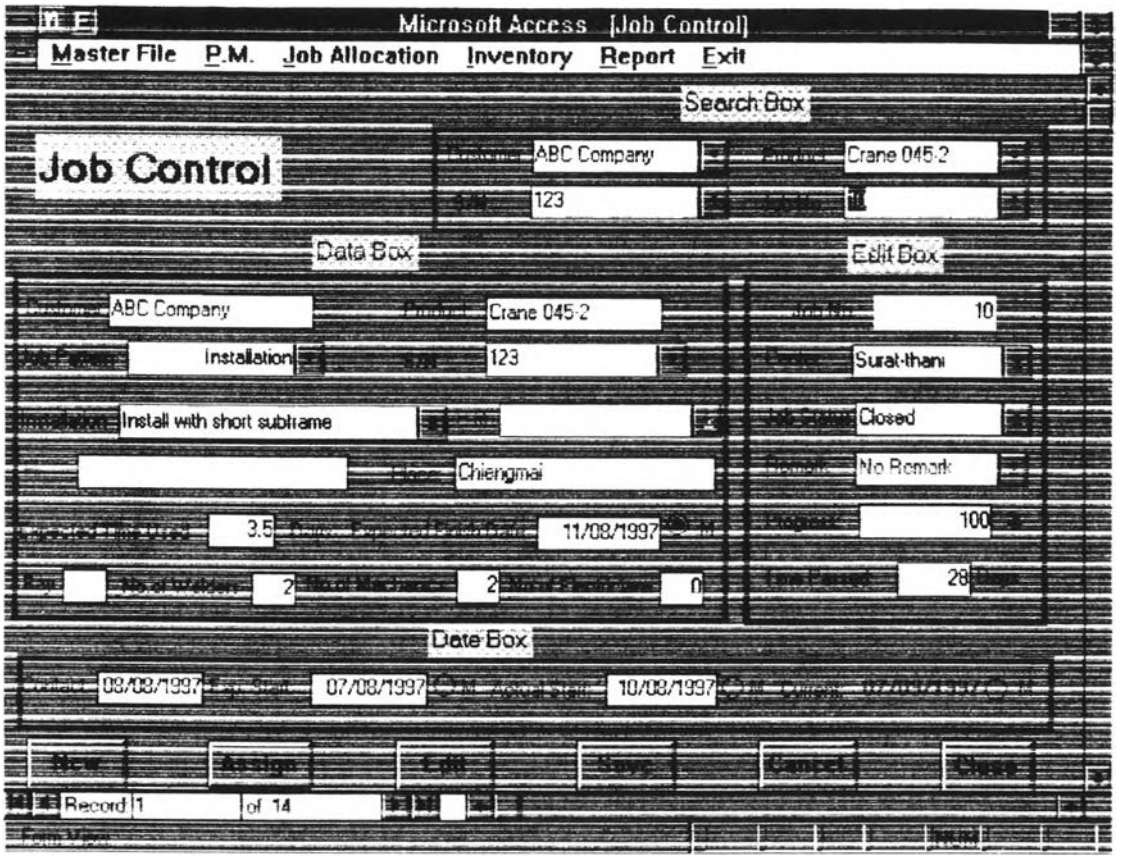


Figure 5-19 : Job Control screen

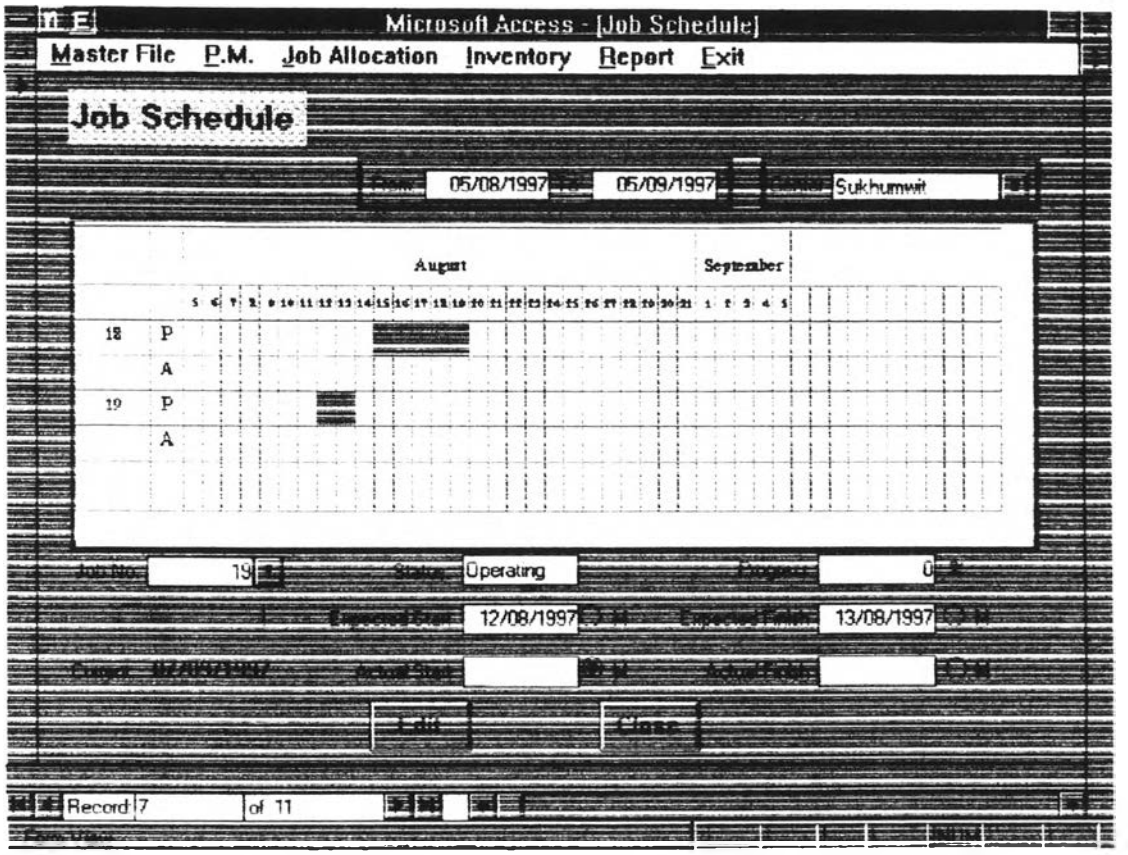


Figure 5-20 : Job Schedule screen

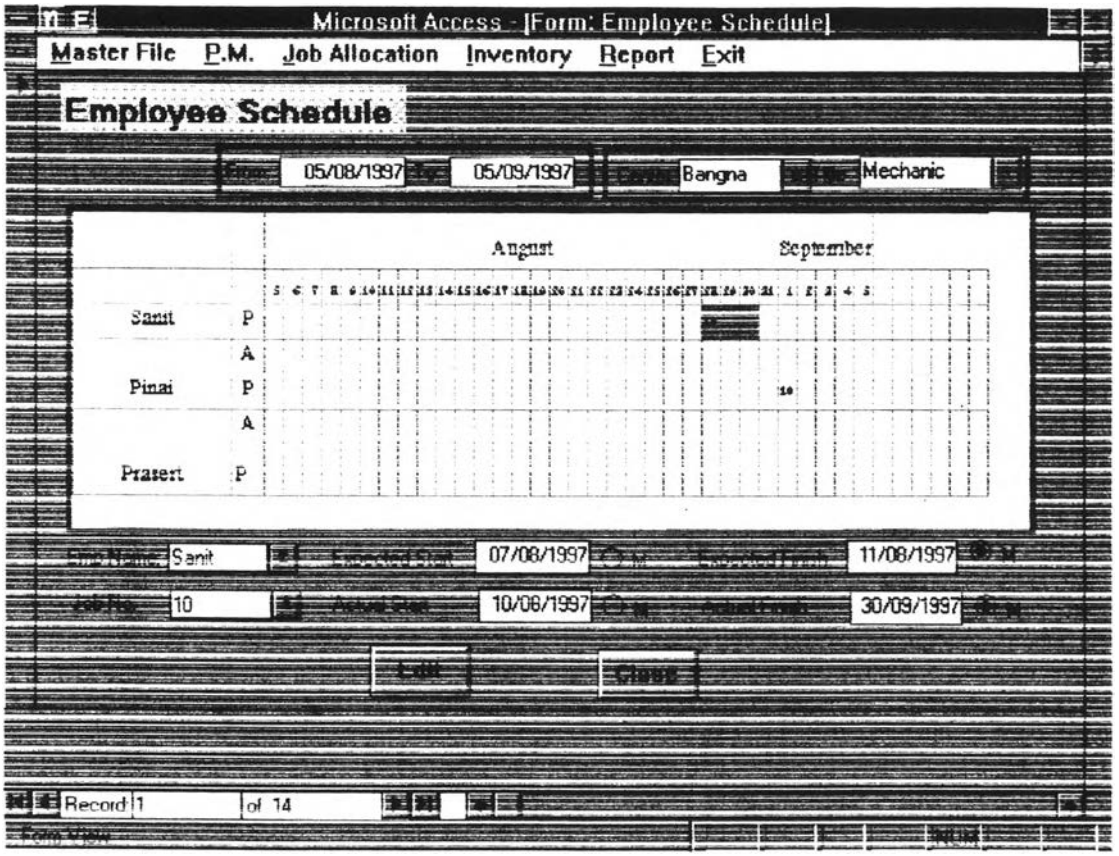


Figure 5-21 : Employee Schedule screen

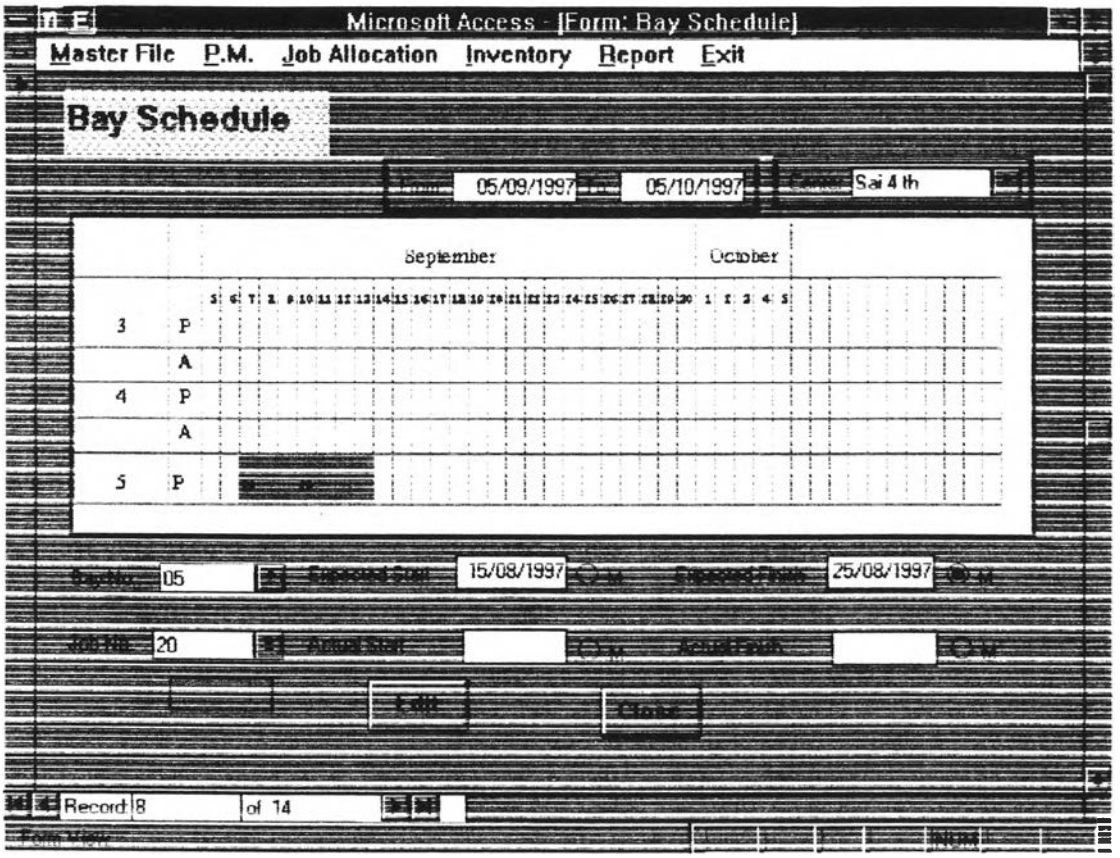


Figure 5-22 : Bay Schedule screen

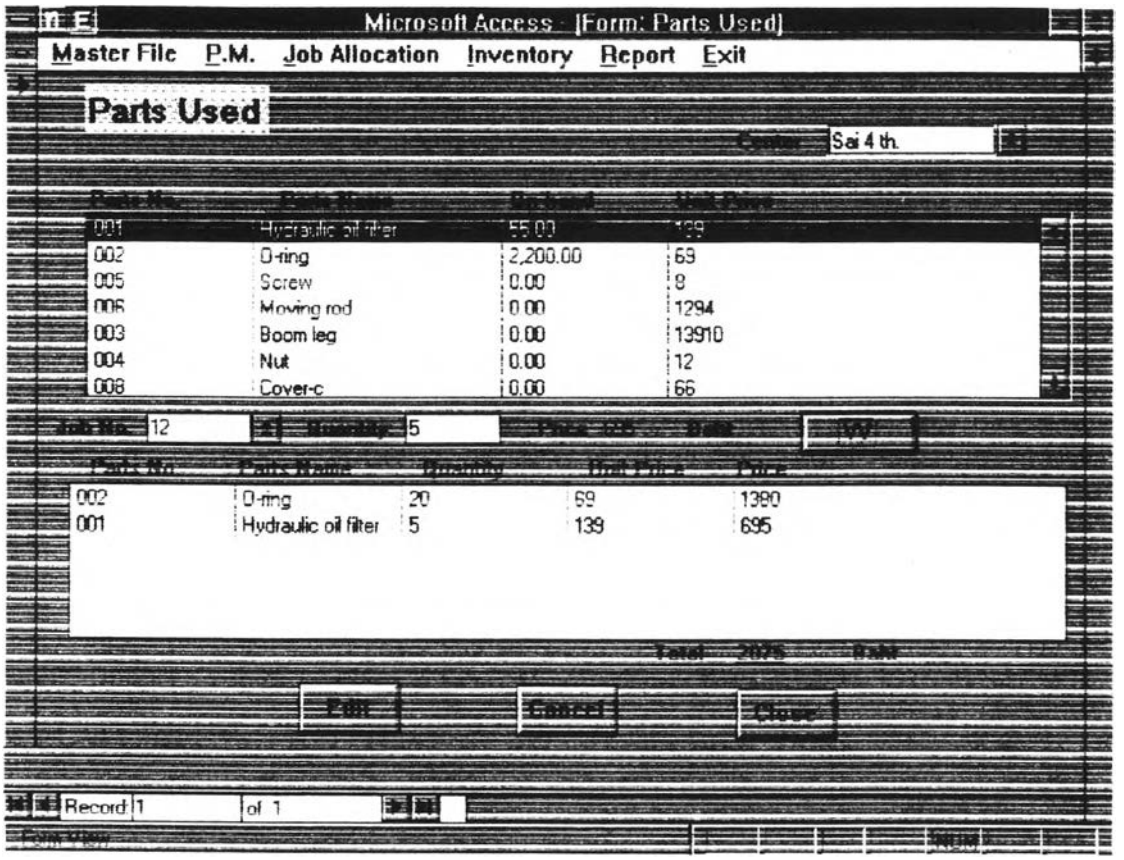


Figure 5-23 : Parts Used screen

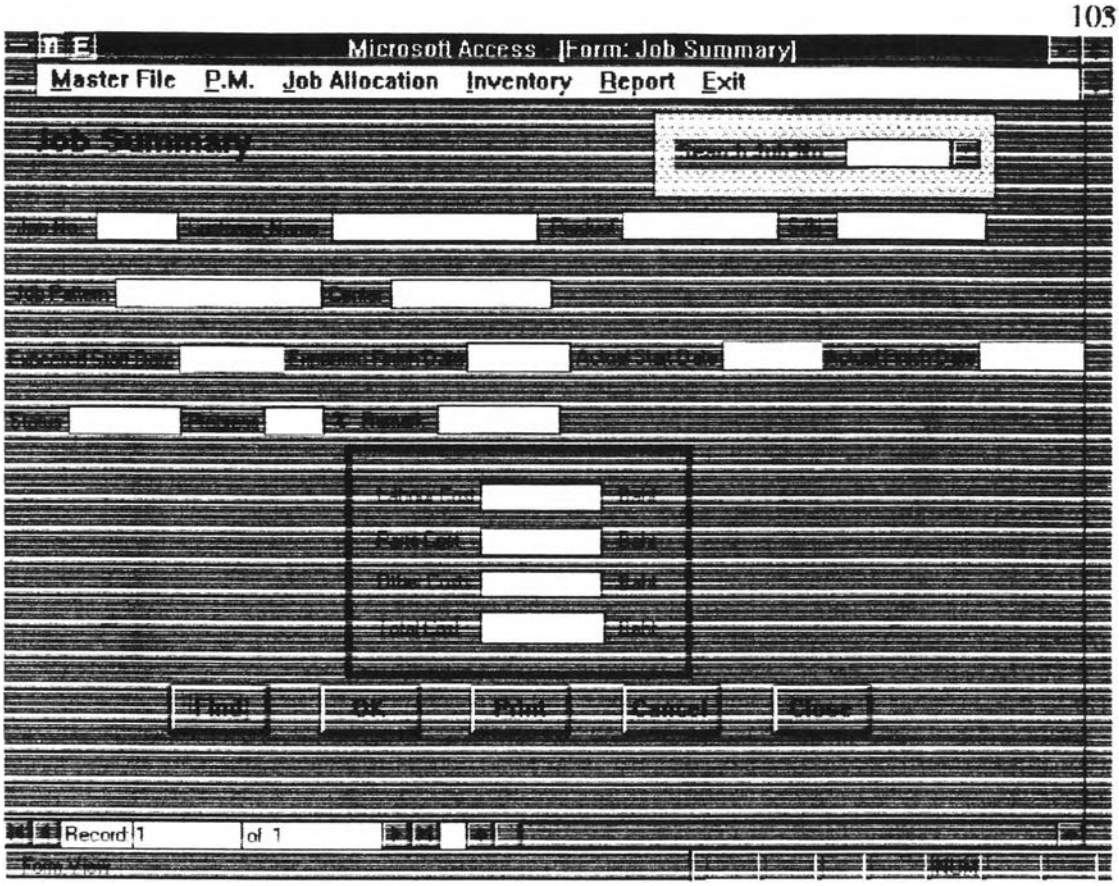


Figure 5-24 : Job Summary screen

5.4 **Reporting** and Monitoring

This part of the model will show output of the processing of part number 5.3 and 5.4. So, the program in this part can be categorized into two main groups. They are report for the data in time interval and report for the data at one point of time. The first group the user has to input the starting time (**From**) and ending time (**To**) in the program. Then the program will show result of the operation in that interval. Reports in this group are **Job Normal Report, Job Exception Report, Job Order Pattern Report, Employee Capacity Report, Bay Capacity Report**. The second group shows data of each job at one moment. Reports in this group are **Employee Report, Bay Report, Parts Used Report, Job Summary Report.** Each report will be discussed in the following details

Job Normal Report shows list of jobs operated by each service center in the focus interval. Job listed in this report is operated without any problem. So, job listed in this report will have the status of **Reserved, Operating, and Closed.** Details of each record in this report are Job Number, Customer name, Job Pattern, Expected start date, Expected finish date, Actual start date, Actual finish date, Job progress, Status. User has to input focused time interval. Then, the program will show list of job of mentioned status. If the user wants to print this report out into hard copy, He can click **Print** button to get the list of job shown on the monitor.

Job Exception Report is only different from the first report in the status of job. The status are Can't Service, Wait, Queue, and Pending. This report is designed for management to pay special attention because jobs shown in this report have got some problems.

Job Order Pattern Report is designed to show proportion of all job patterns in the focused interval. Details of record shown in this report are center name, Number of installation jobs, Number of Preventive Maintenance jobs,

Number of Fix jobs. This purpose of this report is to be the data for adjusting job pattern taken by each center balanced with the facility.

Employee Report is designed to show the operation of employee of each service center at current time. User can select to investigate employee of each or all status such as Reserved, Operating, Pending, Free. Details of each record are Employee Name. Title. Expected start date. Expected finish date. Actual start date. Actual finish date. Job Number that the employee was assigned to. Job status. Job progress, and Status of this employee.

Bay Report is similar to Employee Report. It show the operation of bay of each service center at current time. User can select to investigate bay of each or all status of Reserved. Operating. Free. Details of each record are Bay number. Expected start. Expected finish. Actual start. Actual finish. Job number that the bay was assigned to. Job status. Job progress. Bay status.

Employee Capacity Report shows the percentage of employee operation of each service center in the focused interval. The operation of employees is divided by their status. Details of each record are Employee name. Employee surname. Employee Title. Number of reserved days and percentage. Number of pending days and percentage. Number of operating days and percentage. Total working day.

Bay Capacity Report shows the percentage of bay operation of each service center in the focused interval. The operation of bay is divided by its status. Details of each record are Bay Number. Number of free days and percentage. Number of reserved days and percentage. Number of operating days and percentage. Total working days

Parts Used Report shows list of spare parts consumed by each job. User can choose job number from Job No. combo box. List of the parts will be shown. If the user want to get hard copy of this report. He can click **Print** button. the program will print out the required hard copy report.

Job Summary Report shows the same data appeared in Job Summary screen of Job Allocation Plan menu. User can search for Job Number and the details of job summary will be appeared. If the user wants to print hard copy report by clicking **Print** button.

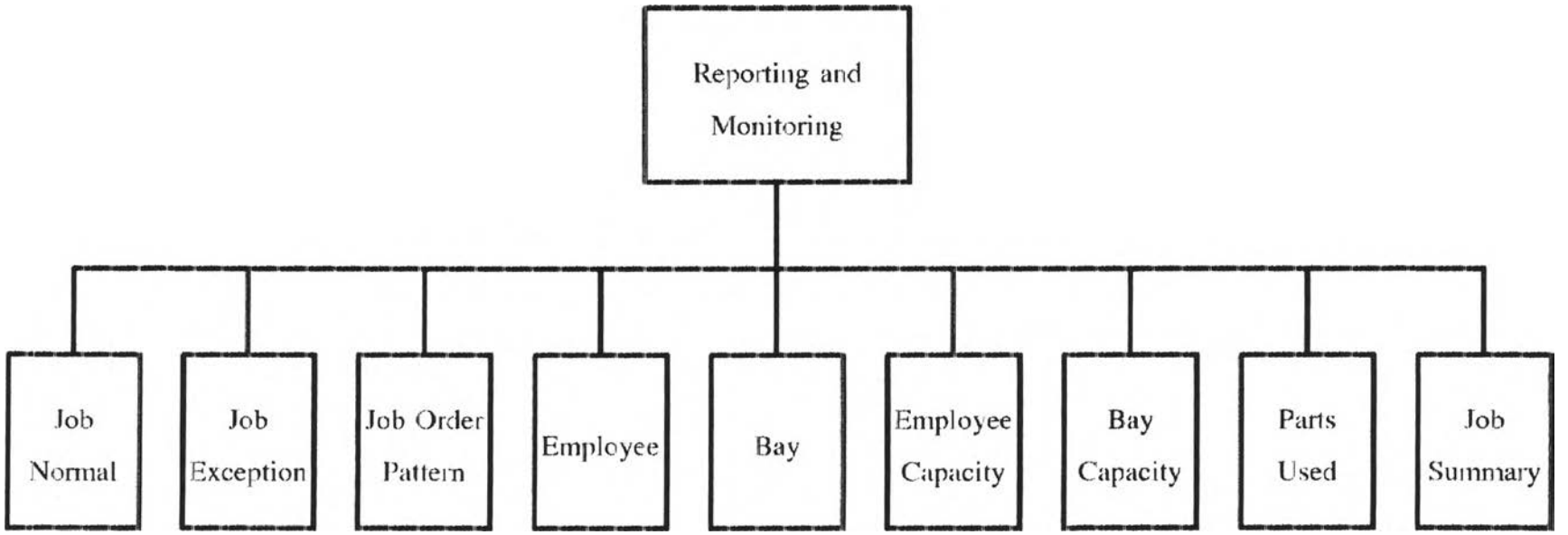


Figure 5-25 : Reporting and Monitoring Chart

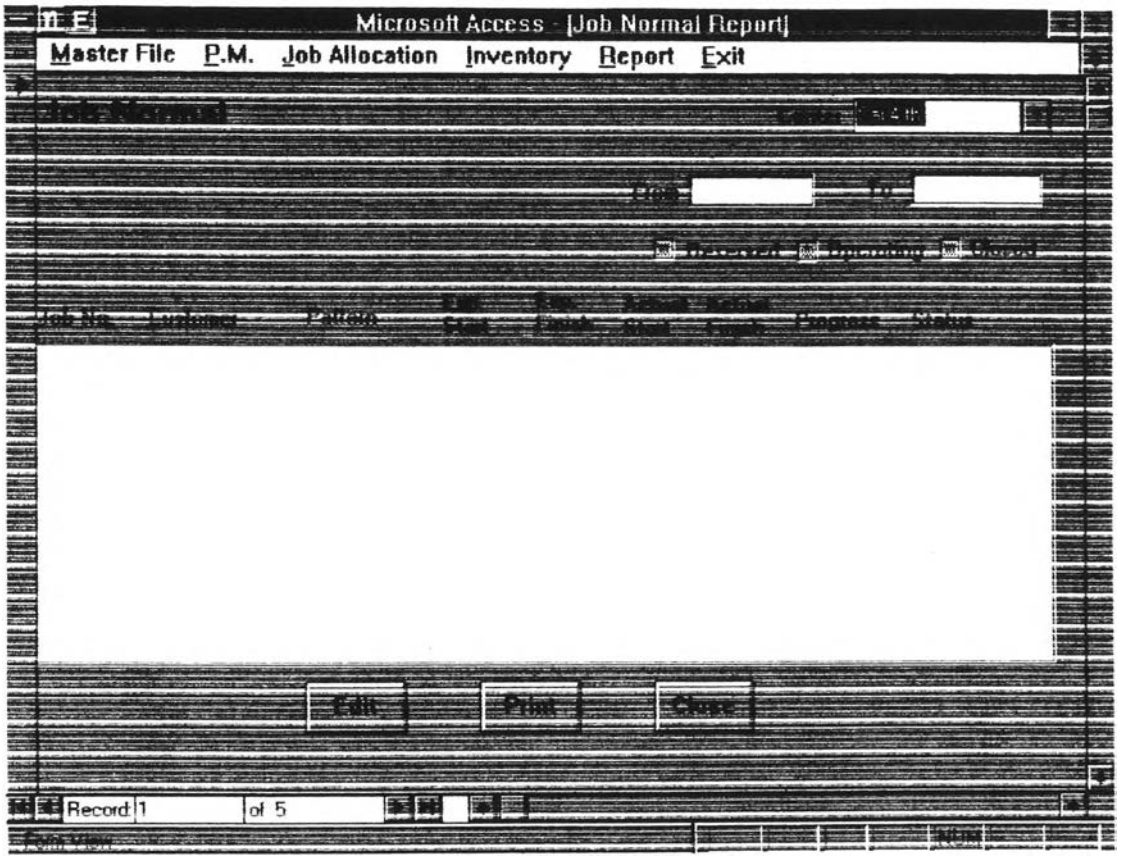


Figure 5-26 : Job Normal Report screen

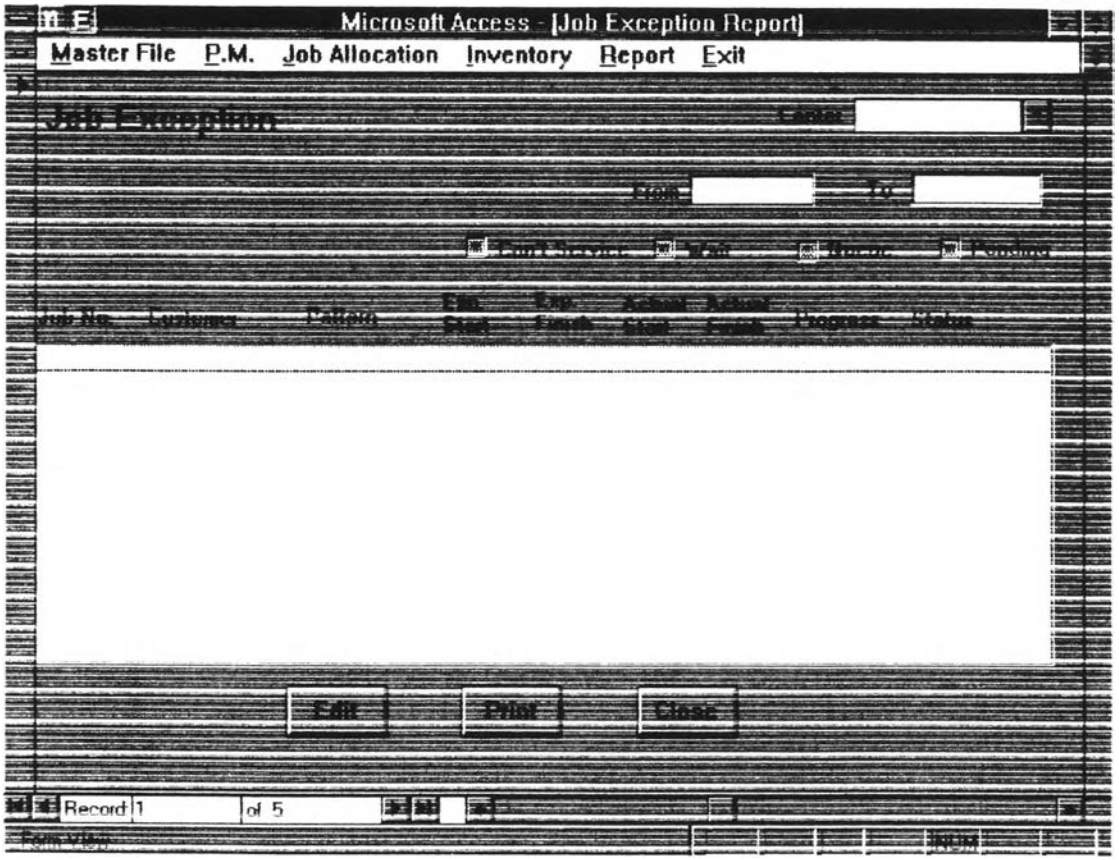


Figure 5-27 : Job Exception Report screen

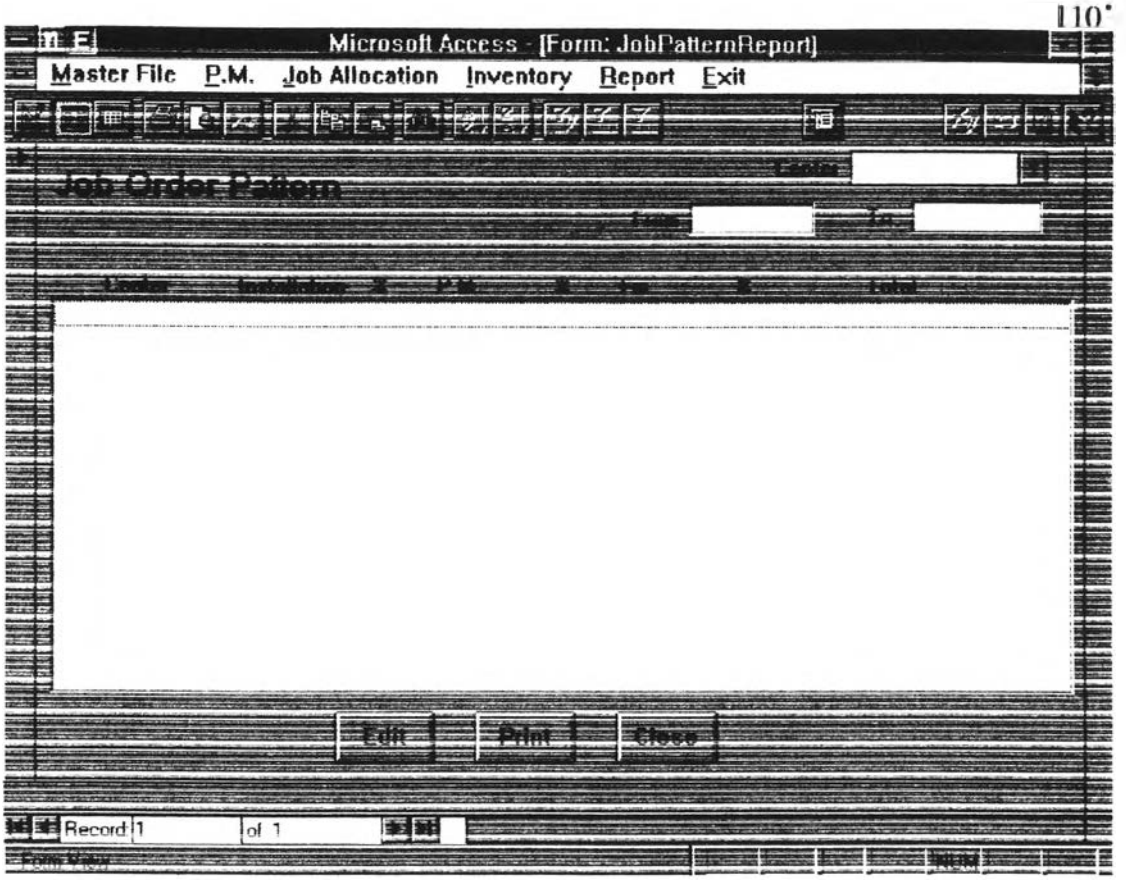


Figure 5-28 : Job Order Pattern Report screen

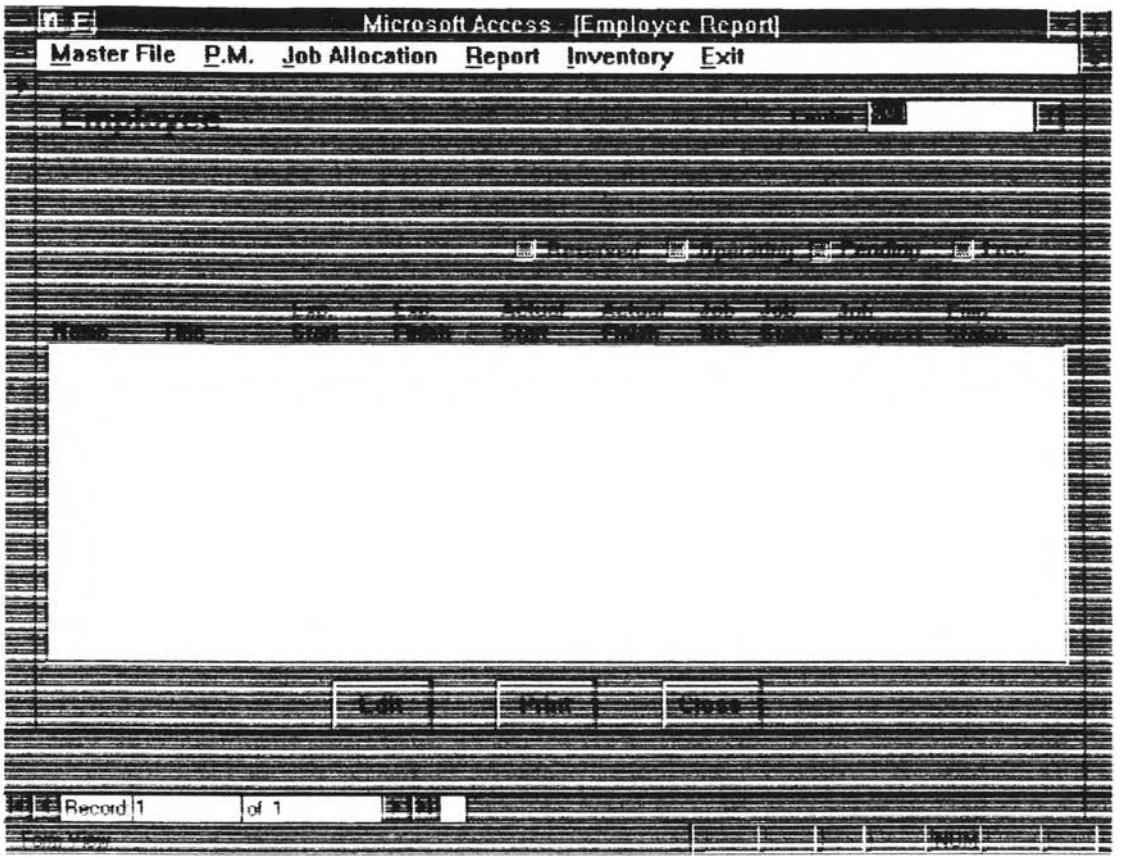


Figure 5-29 : Employee Report screen

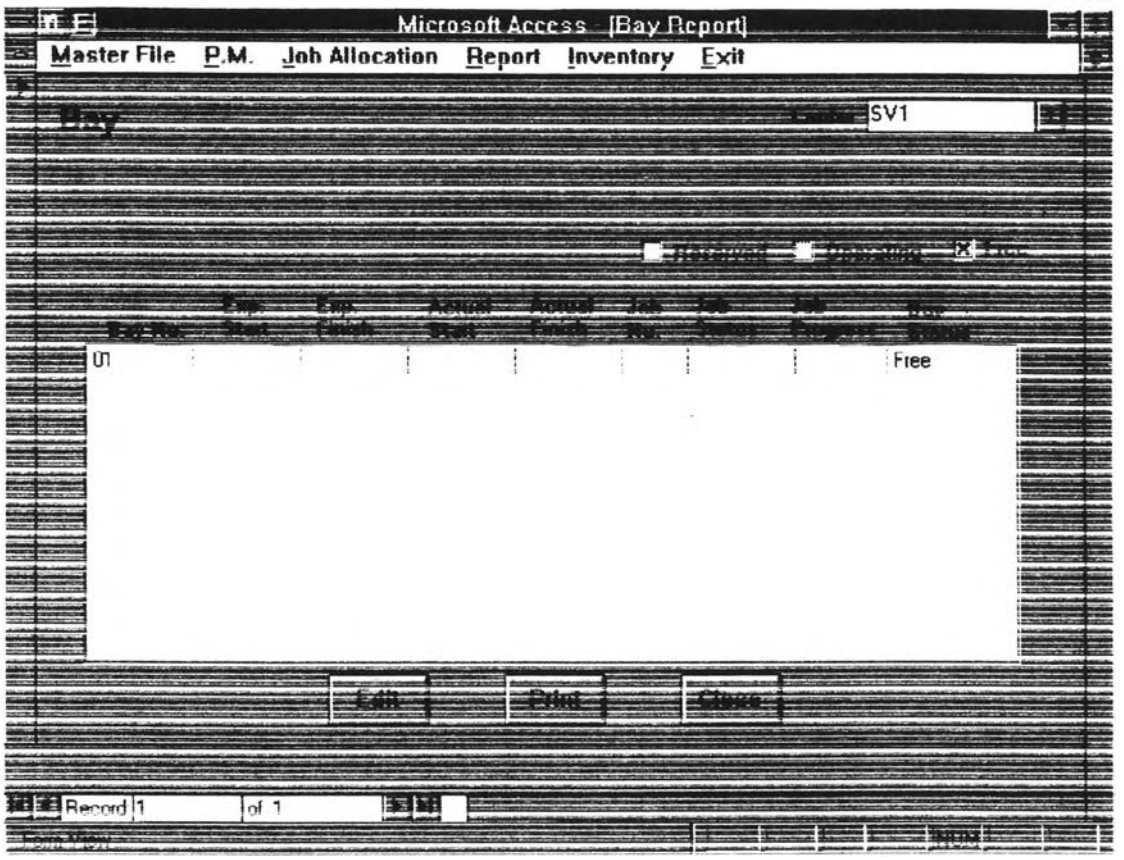


Figure 5-30 : Bay Report screen

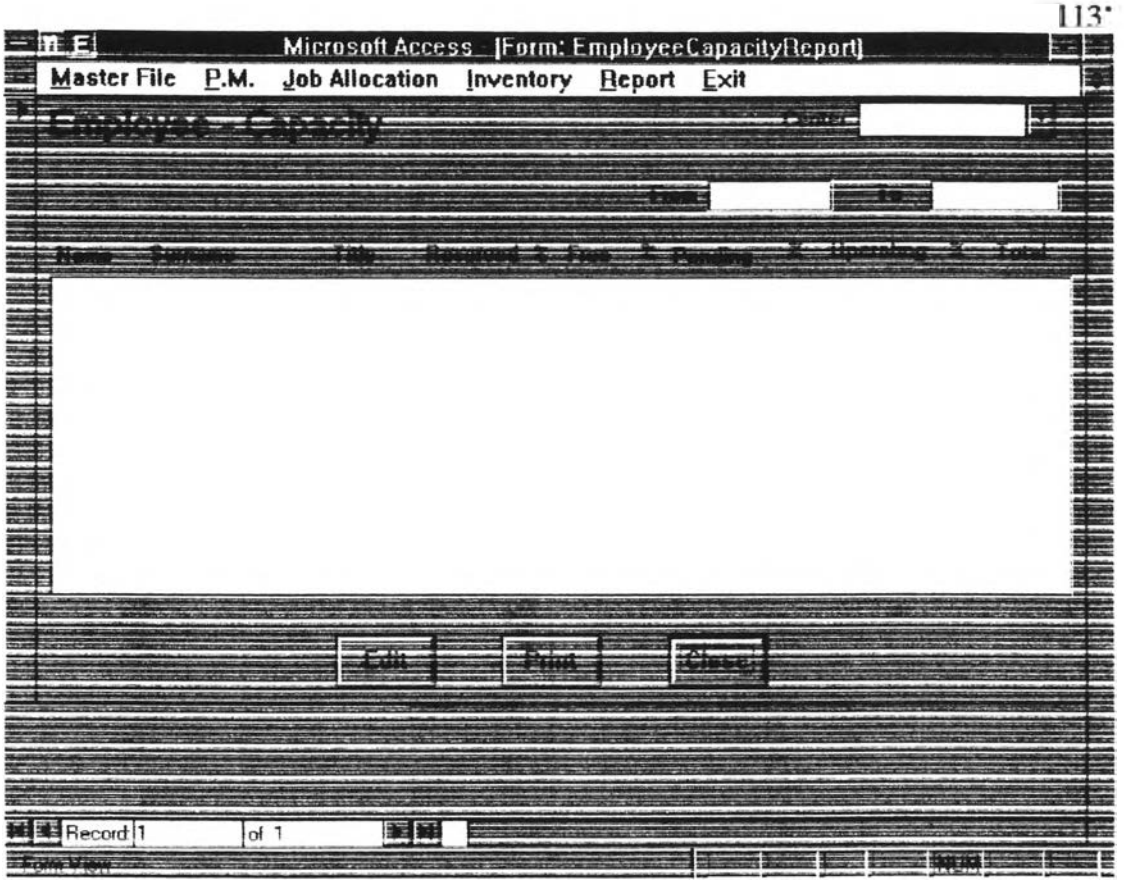


Figure 5-31 : Employee Capacity Report screen

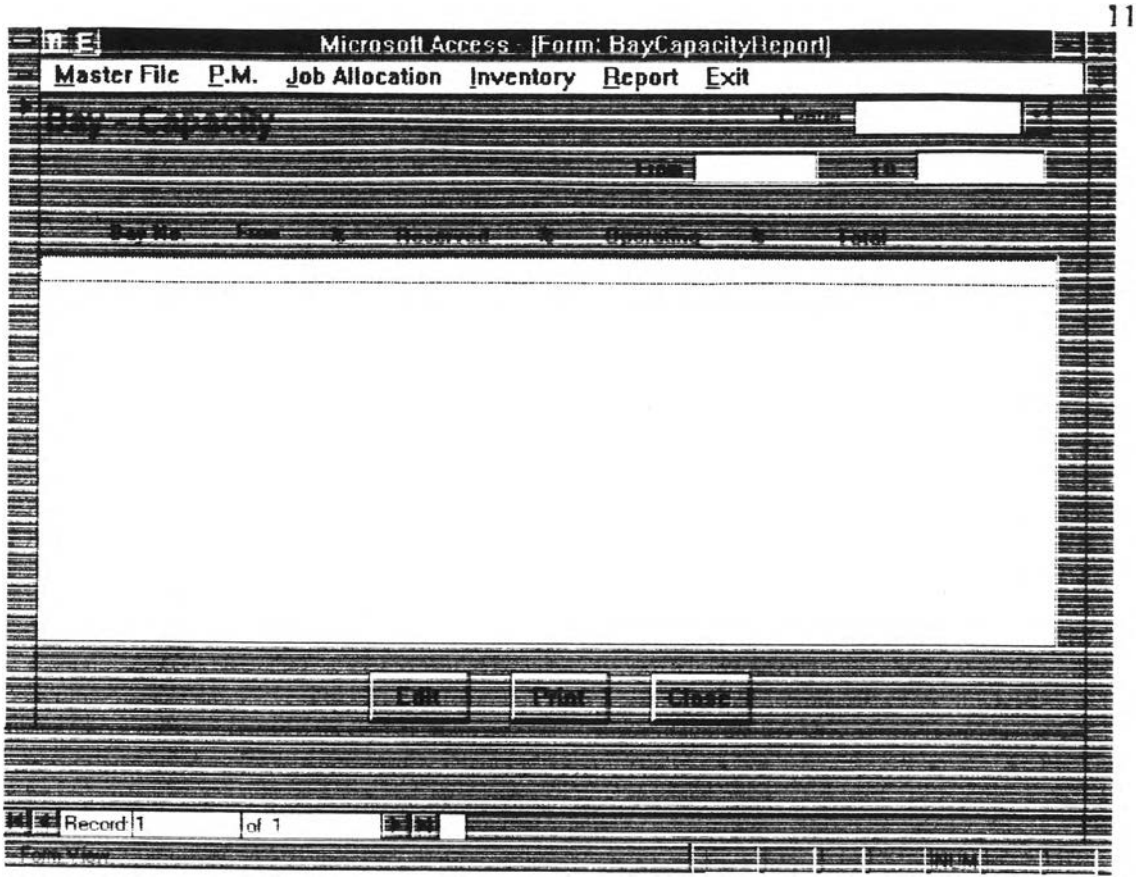


Figure 5-32 : Bay Capacity Report screen

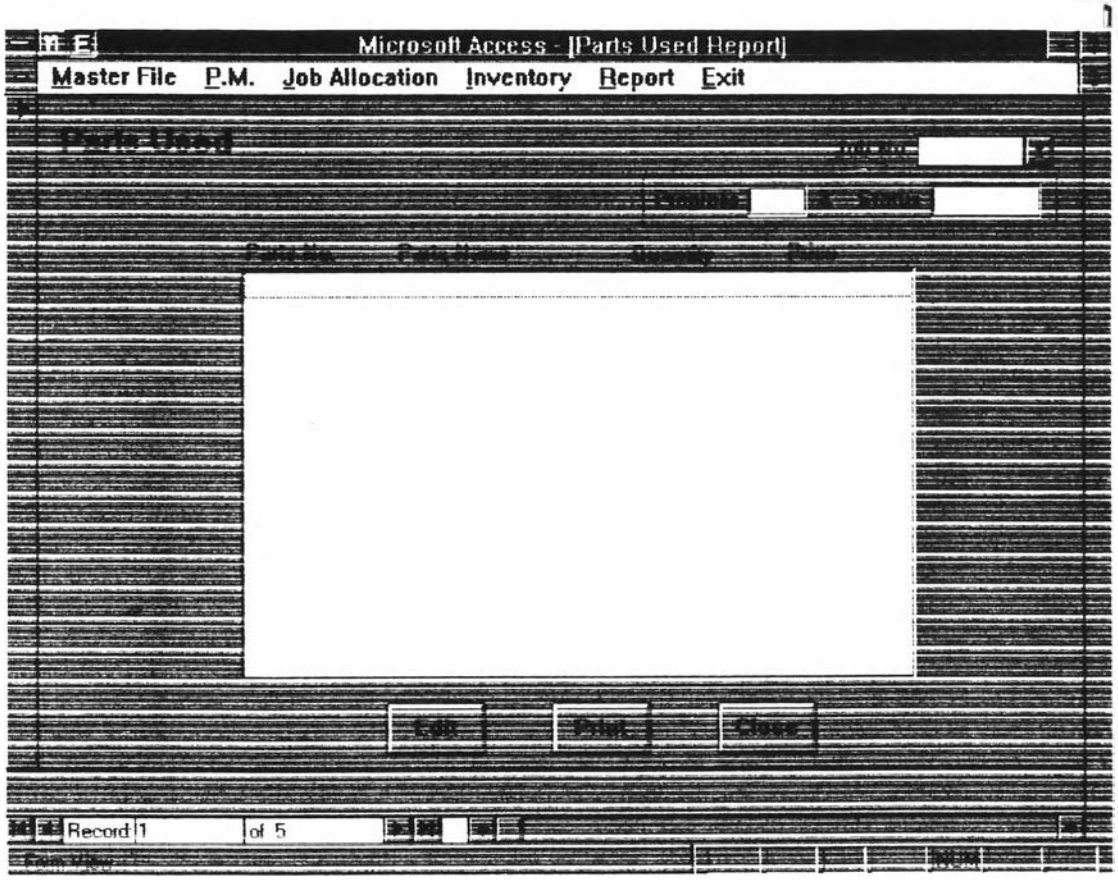


Figure 5-33 : Parts Used Report Screen

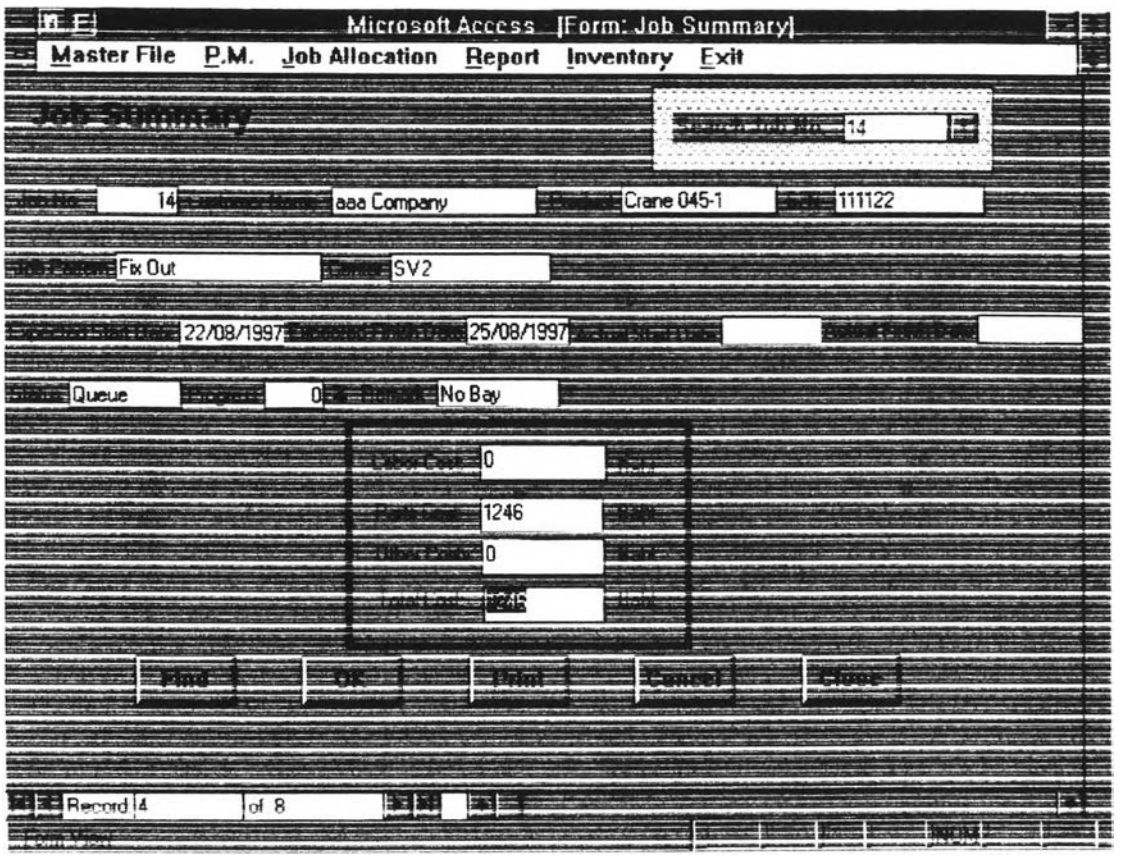


Figure 5-34 : Job Summary Report screen

5.5 Inventory Control

This part is designed based on three main activities. They are issue and sell spare parts from store of each service center. transfer spare parts from head office to each service center. and re-order imported spare parts from supplier.

The first activity can be re-categorized into two activities. They are to issue spare parts from store to use in job operation and to sell spare parts to direct customers. For issue spare parts activity to use in job operation, it is contained in job allocation plan part. The other activity. spare parts sales to direct customers. is mentioned in this part. The program of this part is designed for the operator of all service centers to record every transaction they sell spare part to customer. First. they choose their center name from center combo box and click the spare parts they want to sell from the list. Then. they input sold quantity and click OK. The program will actomically calculate and show total price charged to the customer. (For more details. see user manual in appendix section)

The second activity is further separated into two cases. The first is Fair Share case. This case occured when total requirement of all service center in any week is greater than on hand quantity at head office. The program will automatically calculate the suitable transferred quatity distributed to each service center and show them in the bottom list. When these spare parts have already been transferred. the operator at head office can record the transaction by only clicking Transfer button. The second case is Nomal case. This case occurs when total requirement of all service centers are less than on hand quantity at head office. The operator at head office can record the transaction by clicking a part number from the list and choose the center name from center combo box. Then. he has to input transferred quantity in transferrd quatnity field and click Transfer button. (For more details. see user manual in appendix section)

The last activity is designed based on two steps. The first step is to show the spare parts that has on hand quantity at head office lower than its re-order point in Parts should be re-orderd list When the operator check the list. he will be warned to take action to re-order those spare parts. After these spare have already re-ordered with suggested re-order quantity. the operator can record the transaction by clicking Re-Order button. The re-ordered parts are moved to appear in Parts on Delivery list. The program will record re-ordered quantity and re-orddered date of that spare parts. The second step is to record transaction when the re-ordered spare parts have delivered to the store of head office. The operator can record the transaction by clicking that spare parts from the Parts on Delivery list and clicking Receive button. The program will record received quantity and received date of that spare parts. (For more details. see user manual in appendix section.)

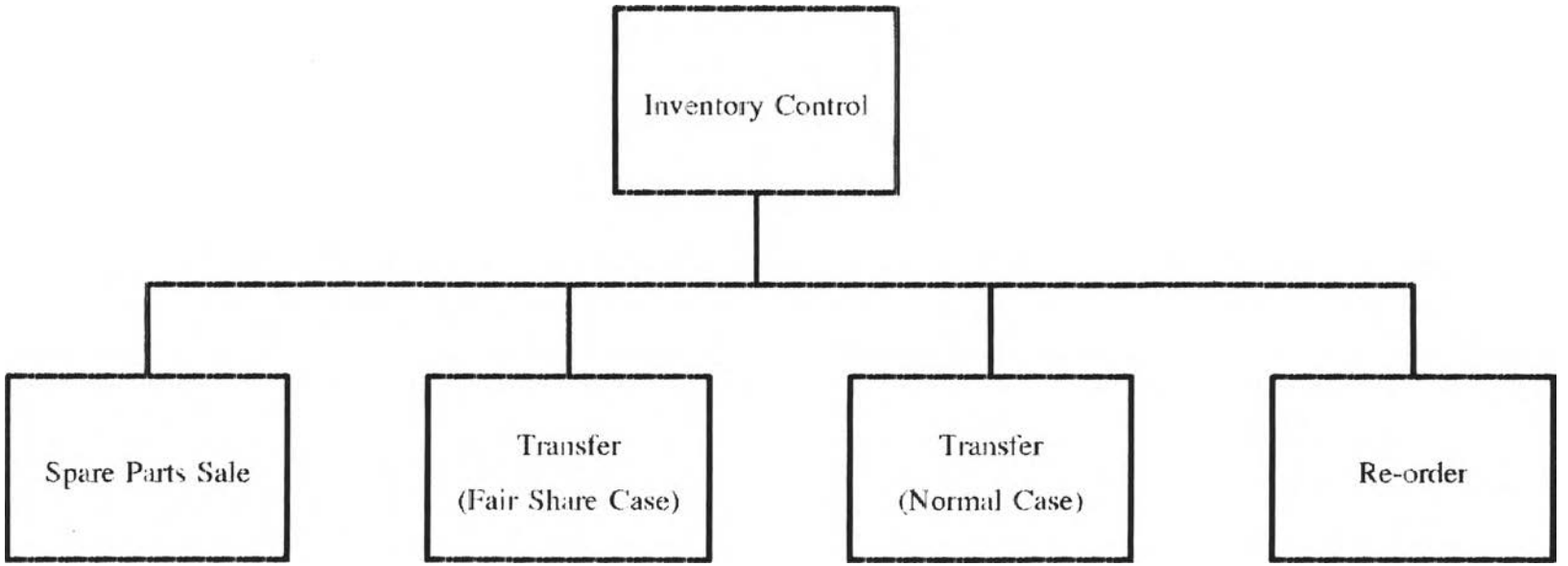


Figure 5-35: Inventory Control Chart

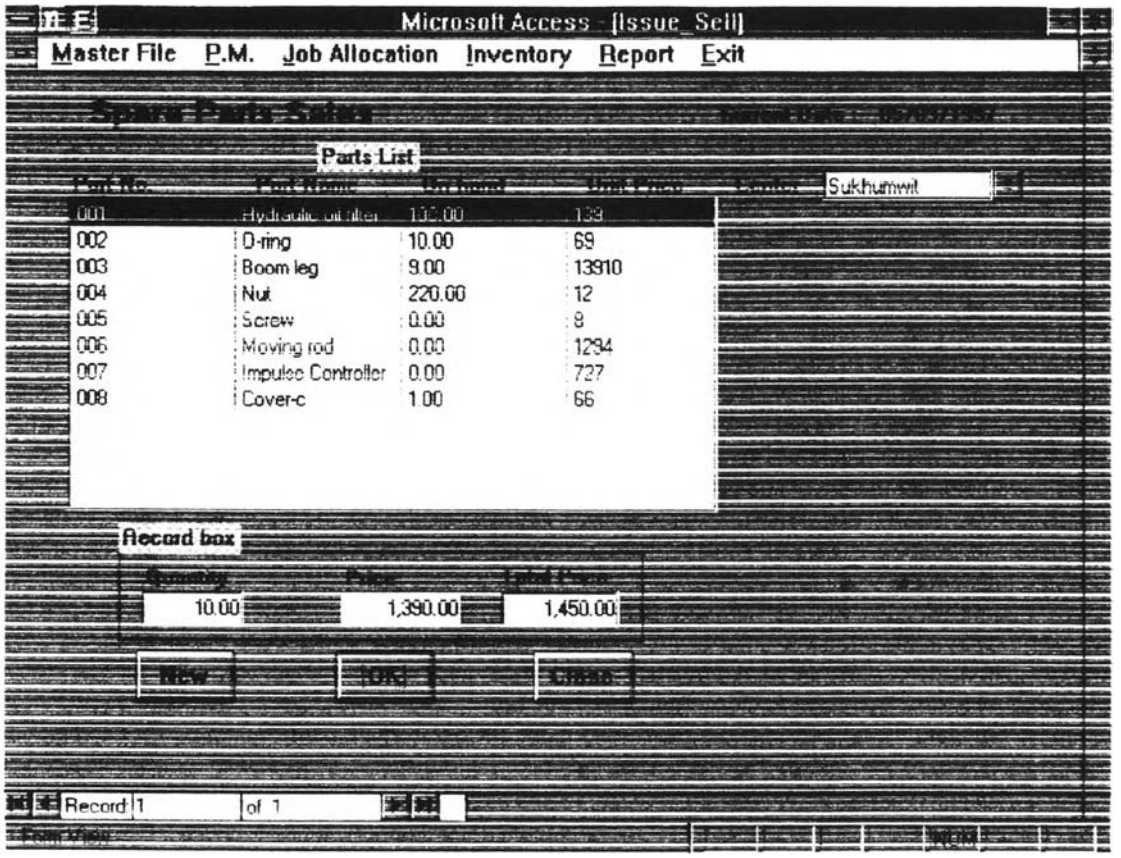


Figure 5-36: Spare Parts Sales screen

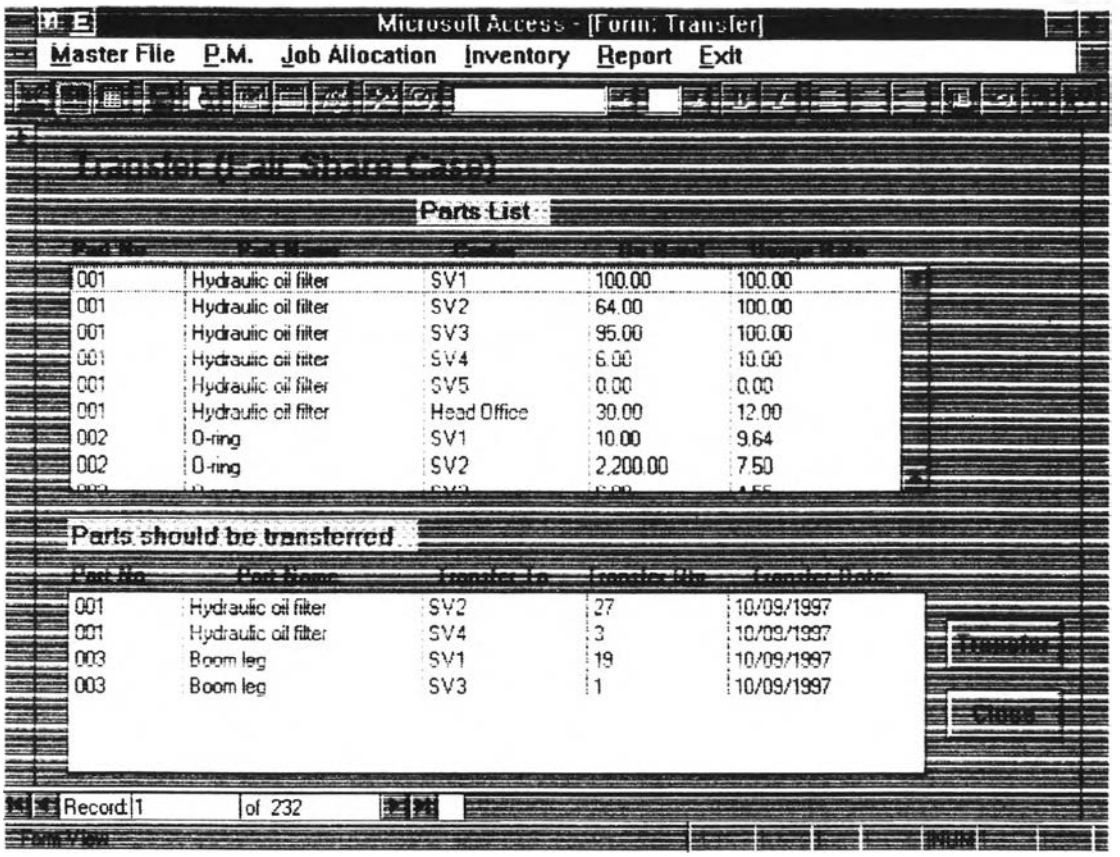


Figure 5-37 : Transfer (Fair Share Case) screen

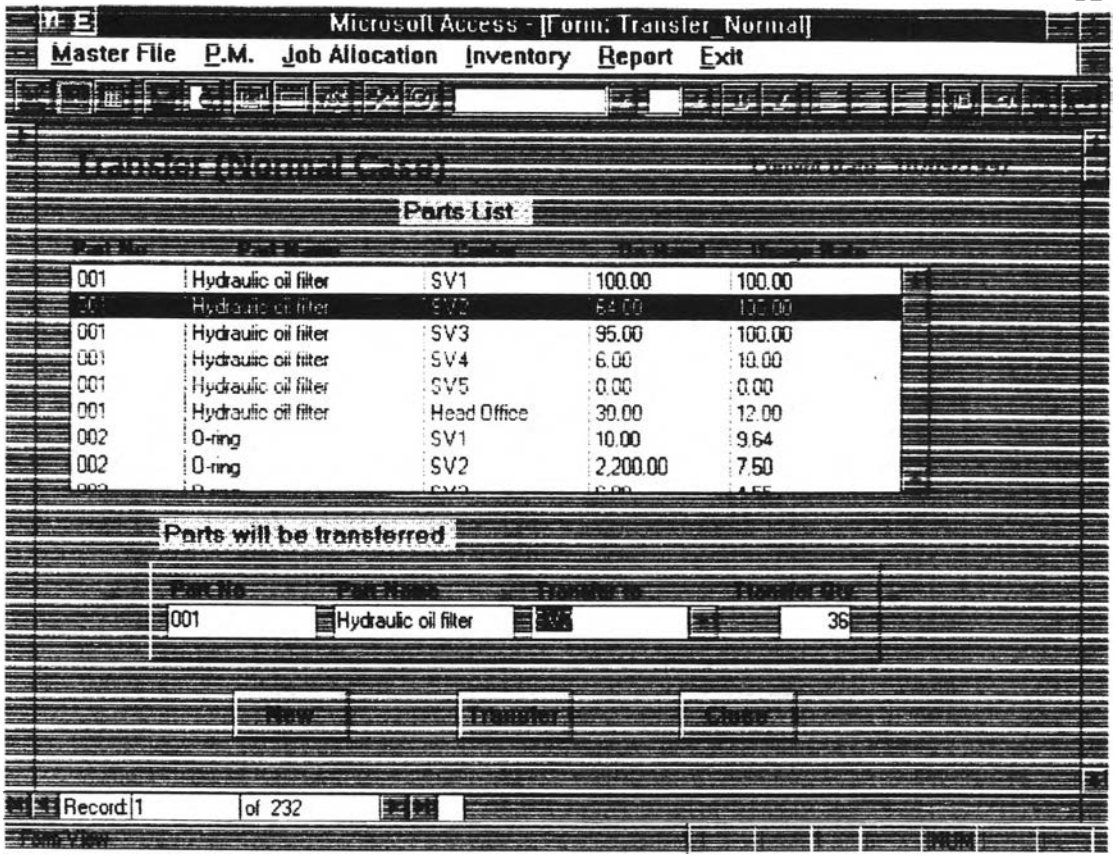


Figure 5-38 : Transfer (Normal Case) screen

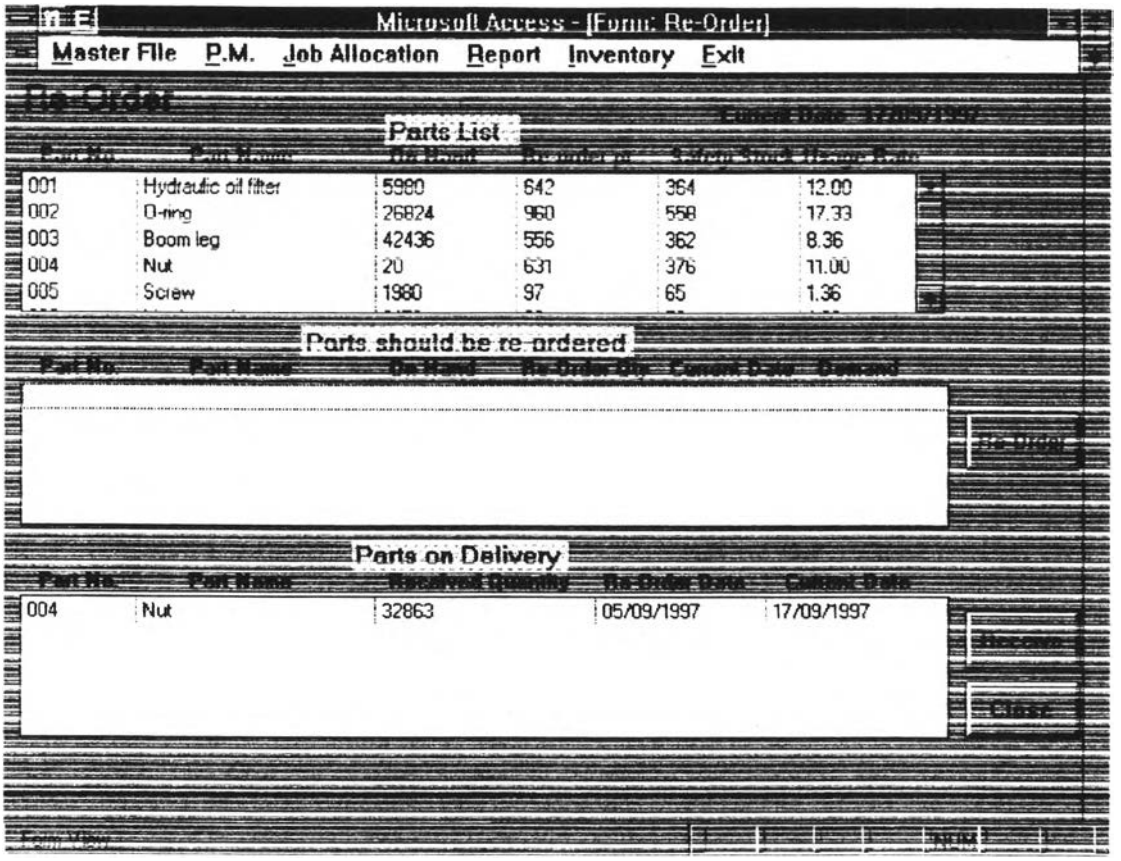


Figure 5-39 : Re-order screen