Design of a material replenishment system for a CRU assembly line

Design of a Material Replenishment System for a CRU Assembly Line

WPA 1305

Study report for the Technical University of Eindhoven, faculty of Mechanical engineering, WPA

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Student : Jeroen C. van der Burg, Study-professor : prof. ir J.M. van Bragt

Coach RANK XEROX : ir A.E.M. Mulder, Coach T.U. Eindhoven : ir A.T.J.M. Smals

RANK XEROX MANUFACTURING (NEDERLAND) B.V., VENRAY

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Abstract

In this report a proposal is made for a material replenishment system for CRU assembly at the Venray plant of Rank Xerox. This system consists of:

- an overhead conveyor from the main stores to the assembly line and back to the main stores (for parts containers and finished products);
- an assembly conveyor with flexible routings (for parts containers and products);
- a maximal use of small batches for the parts transport to the assemblyline.

The method with which this proposal is made, is described in this report. The proposed system makes possible an increase of assembly area, by reducing the floor surface that is being used for material replenishment.

Summary

In this report a proposal is made for a material replenishment system. Due to the fluctuating character of the Strategic Planning Assumptions of the products (the CRUs), a method is determined with which replenish activities can be calcutated from given production rates and products.
Such a system should be able to supply the assembly line with parts. With this calculated data a material replenishment system can be determined.
This system is devided in three main modules:

1. Transport from the main store to the assembly area.
   Chosen is for an **overhead conveyor** (from the main store to the beginning of the assembly line).
2. Distribution in the assembly area to the individual assembly stations.
   Chosen is for transport by the existing **assembly conveyor**.

The choices for module 1 and 2 have been made on basis of a cost analysis (comparison of the alternatives) and on basis of the fact that this combination of transport has a small floor surface occupation compared to its alternatives.

3. The moving of the parts within reach of the assembly operator.
   For this module two proposals have been made:
   A. Manual parts handling,
   B. Automated parts handling.
   The choice between these two can be made on basis of economic arguments: Alternative B is chosen when the arrival frequency of containers at a assembly station is so high that the costs of manual labour outweigh the automation costs.
   The **automated parts handling** is worked out in a design, which is attached to this report. In this design the following modules can be determined:
   - **a Push and Return unit:**
     a unit which pushes the full parts container off the assembly conveyor pallet into the lift unit and returns empty parts containers back on the conveyor pallets.
   - **a lift unit:**
     a unit which lifts the containers to the required shelf level.
   - **a store unit:**
     a unit in which the containers can be stored on shelves at the assembly line as work stock for the assembly operators.

CONCLUSIONS AND RECOMMENDATIONS

The underlying problem, which is caused by increasing production rates and diversity of products (Customer Replaceable Units), is the lack of (assembly) space.

In the present situation wooden pallets (1×1.2m.) with parts are brought by forklift trucks from the main stores to the assembly stations. By introducing the proposed method of parts replenishment a reduction of space occupation can be achieved, compared to the present replenishment situation.

This reduction consists of:

- the reduction of the sizes of the aisles around the assembly lines;
- the reduction of the size of the parts containers at the assembly line.

The last mentioned reduction has the disadvantage that the transport batch size decreases. This decrease increases the transport frequency, which increases the parts handling. Automation of the high frequent parts handling in the main stores and at the exchange point needs still some research between the overhead conveyor and the assembly conveyor.

The design of the automation of the handling and storing at the assembly stations is added to this report

The company, its product and the assignment

RANK XEROX **MANUFACTURING (NEDERLAND) B.V., VENRAY**

Rank Xerox Manufacturing (Nederland) b.v., in Venray was founded in 1965 and was at that time the first Rank Xerox plant in Europe. Over the years it has grown and now it is the second largest production unit in the group.
The holding Company, Xerox corporation, started operations in 1961 as a manufacturer and distributor of photocopiers based on a xerographic processs developed by the American physicist Chester Carlson. This method was unique in that it permitted dry copying on to ordinary paper with the aid of static electricity and semiconductors.
A joint venture with the Rank organisation Ltd. in England was soon establishedfor the purpose of distributing the Xerox machines outside the USA. This is how Rank Xerox was founded. Since 1969 Xerox has been the major shareholder in Rank Xerox.
A total of 100,000 people are employed at the various Xerox compagnies, 30,000 of these with in Rank Xerox. More than 3000 people work for Rank Xerox in the Netherlands.

CRU MRT & MT Team

(Manufacturing Resourses & Manufacturing technology)

The start up of the CRU MRT & MT Team was in 1989. This team is devoted to the manufacturing of the Customer Replaceable Units. The CRU production is characterized by its high production volumes and its small product size, (compared to the usual copier production in Venray).

The production method

The production of the CRU's consists of a assembly process at several assembly lines, which are situated in building B of the Rank Xerox plant in Venray. These assembly lines consist of a conveyor, besides which manual and automatic assembly stations are situated.
The present part replenishment is taken care of by forklift trucks, which bring the parts on pallets from the main store to the assembly grids.

The product

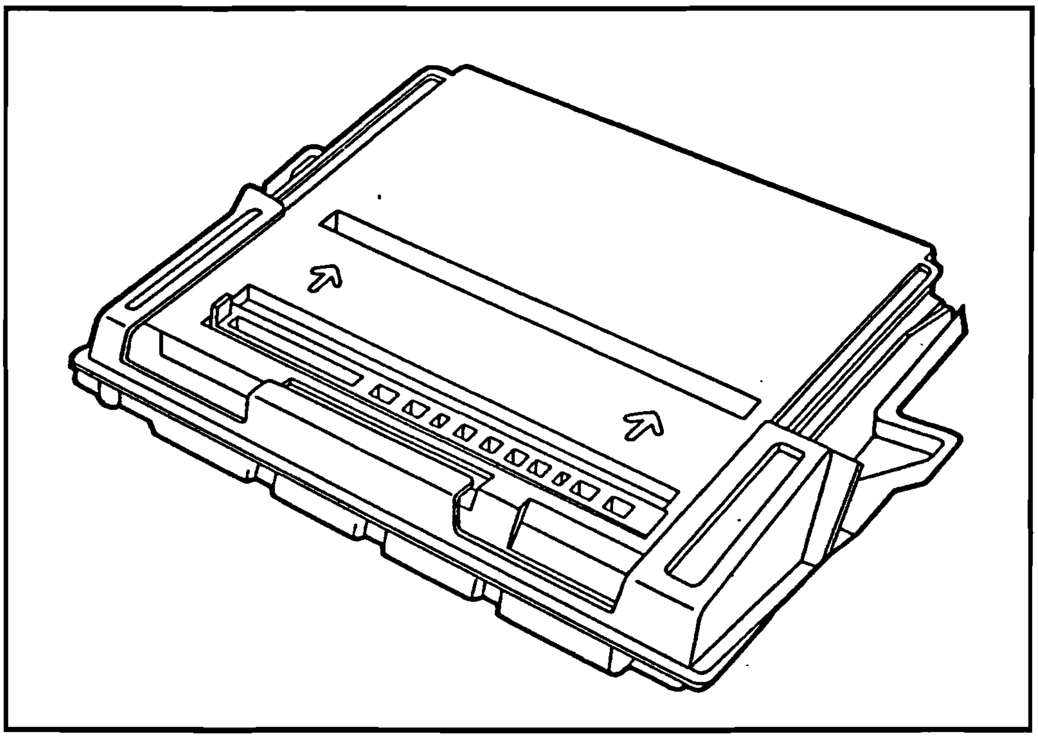
The assembled product is a CRU (Customer Replaceable Unit). A CRU is a part of a copier, which the user can replace by a new one, when the lifetime of the old one has expired.

In a CRU the following major parts can be determined:

- a fotoreceptor: a drum or a belt;
- a corotron: a thin wire which brings the static charge on the fotoreceptor.
- (optional): a toner cartridge (toner=print powder).

Its measurements are ± 500×300×100 mm.

The description of the copy process is given in appendix 2.



The 5028 CRU.

Project assignment description

After considering the projects system area, requirements and other conditions, a assignment description was made after consultation between the Technical University of Eindhoven and Rank Xerox. Briefly worded, this project assignment description is:

One or more proposals must be made for:

- the use of the operational or activateable functionality of the JIT material replenishment system and
- the design of a modular parts supply mechanism,

for the transport of parts, which are needed for assembly of several Customer Replaceable Units on a (future) mix build assembly line. For the comprehensive project assignment description, see appendix 1

Introduction:

Possibilities, design conditions and requirements for a material replenishment system.

There is a need for a material replenishment system. This system must meet the design conditions and requirements.
The problem with designing of a material replenishment system is that these design conditions for a major part are not fixed and one should take into account the large range of possibilities.
Some important data for (the design of) a material replenishment system are:

- SPA dependable data (SPA = Strategic Planning Assumptions):
  - The transport units: Boxes, pallets, etcetera.
- Transport frequency: Transports per time.
  - Transport quantities: number of parts in a box, number of boxes per transport.
- Further data:
  - Transport distances: the beginning and ending point.
  - Floor space division: assembly, working floor store & transport.

These data and design conditions are not yet fixed.
When these and design conditions are not known it is not possible to point out problems which occur with a certain design. That is why one must attend to potential problems; these are problems that may occur in the CRU production process and may block the achieving of the main objectives of the CRU production.
Potential problems in the production process are:

1. Assembly
   Required: assembly must make a sufficient number of products (according to the SPA volumes).
2. Store space at the assembly line
   Required: the available space must be enough to contain the nessecary products or product parts.
3. Means of transportation
   Required: must be able to deliver the products or product parts, that are necessary for assembly, on the right time and place .
4. Beginning point of transport
   Required: it must be able to deliver the products or product parts that are necessary for assembly.

Assembly has priority 1, because of it being a labour intensive process, so standing idle costs a lot of money. So problem 2, 3 and 4 may cause the assembly not to live up to its conditions/requirements (= SPA= dayrates). This makes the problems 2, 3 and 4 potential bottlenecks of the production process.

The process of decision making.

There is a need for a method with which one can decide if choices can be made, whilst carrying out a designing project.
The following working method has been chosen:
The entrance of the process of decision making is devided in a variable part and a input part and it has "problemless alternatives" for a material replenishment system as output of the process.
The process of decision making is represented in the following figure:

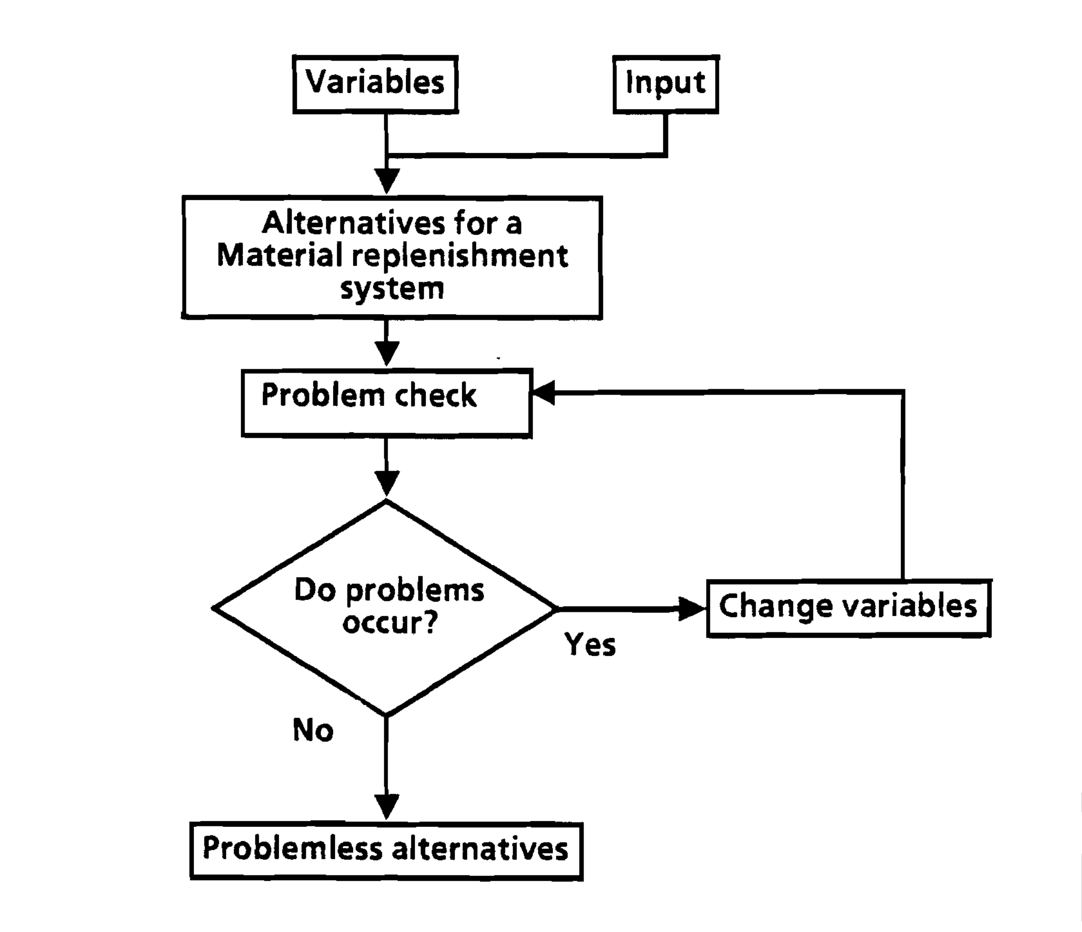


Figure1: The process of decision making.

Explanation of the process parts:

Variables:

Variables are variable data and design conditions for several subproblems. These variable data and design conditions are variable by the designer.

Input:
Input consists of fixed data and design conditions, that is mostly caused by the Strategic Planning Assumptions or SPA volumes.

Alternative for a material replenishment system.
An alternative consists of several sub alternatives, which are chosen from the possibilities for the subproblems, considering a certain input and variable assumption.

Problem check
Compares the chosen alternatives (the taken decisions) with the problem functions for exceeding the acceptation limits (=designconditions / requirements).

Do problems occur?
When the combination of subproblem alternatives does not live up to the requirements, a problem occurs.

Change variables.
To adapt variable (design)data , so a material replenishment design will be accepted (=problemless alternative). This adapting can be done several ways, due to the fact that there are several variables to vary.

Problemless alternatives.
All previous decisions result finally in one or several solutions or designs:
a material replenishment system that lies within the acceptation limits of the sub problems of the system.

The working out of the process of decision making.

To be able to work according to this decision schedule the following must be done:

1. Formulate the sub problem functions.
2. Define and work out the possibilities for the sub problems.
3. Choose from the alternatives for the subproblems.

1. The formulating of the sub problem functions

Introduction:
To get a clear view of the functions of all sub problems, all aspects of these sub problems as well as the connection between the sub problems must be known. That is why the following three actions must be taken:

1. The structuring of the connection of the sub problems of the production process.
2. The specification of the input and sub problems.
3. The formulating of the sub problem functions.

1.1.The structuring of the connexion of the sub problems of the production process.

Main Sub Problems:
MSP 1. Assembly;
MSP 2. Store / handling unit at assembly line (14);
MSP 3. Way(s) of transport (9);
MSP 4. Originating point of transport. (15)

General subproblems.
The main subproblems 1 to 4 are not only dependable on each other, but also on other, general subproblems. These general subproblems can influence more than one main subproblems. That is why the enlargement of the subproblem division by adding of "general subproblems" is needed for getting a full understanding of the total design problem. These general subproblems belong to the group of variables (variable data and design conditions, that is changable by the designer). The general subproblems are:

- Parts control (3);
- Safety stock (4);
- Batch sizes for the parts supply; frequency of the parts supply (5);
- Product containers (6);
- Way of floor geography (10).

Input is:

- The product (parts) classification and volumes (1);
- Way of producing: Blockbuild, mixbuild: batch sizes (2).
- Total available area of the working floor (7);
- The assembly layout (8);
- Ergonomical demands (for the handling of / the supplying of the assembly operator) (11);
- Automation requirements (for the handling of / the supplying of the assembly machines) (12);
- Further design requirements: mudular (13).

The subproblems depend on eachother as follows:
3: depends on (4, 5, 9)
4: depends on 1, 2, 3, (5, 9)
5: depends on 1, 2, 3, 4, (9)
6: depends on 5
9: depends on 5, 6, 7, 8, (3)
10: depends on 7, 8, 9
14: depends on 4, 6, 9, 10, 11, 12
15: depends on 5.

This corresponds with the following sketched diagram:

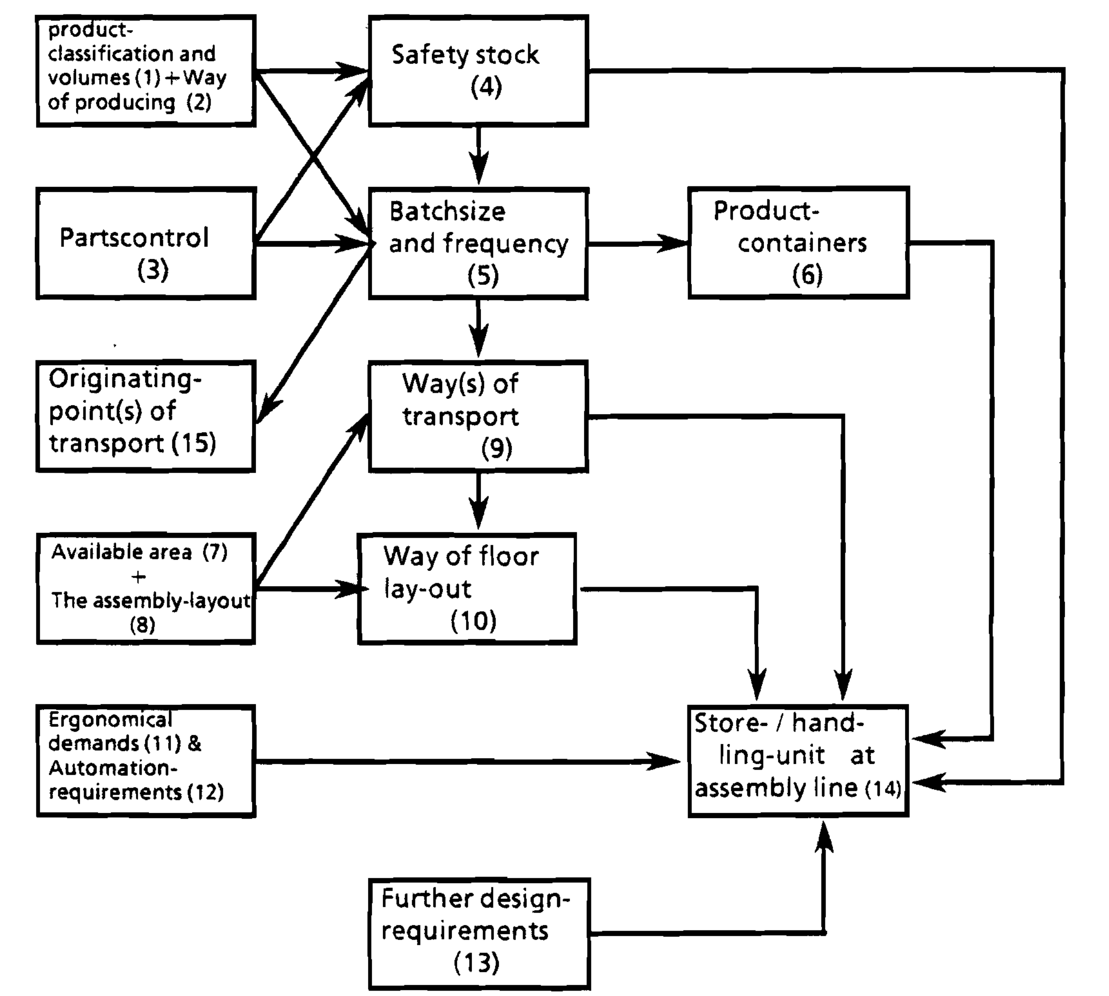


Figure 2: Relation diagram of the subproblems.

The sub problems are numbered in a working order, which is the best order to solve the sub problems, because working this way it is possible to have the data or possibilities which are needed for the solving of the next subproblem(s). This diagram points out the main solving direction; each problem has some degree of feed back to the previous sub problem (See paragraph 1.3.).

1.2. The specification of input and subproblems.

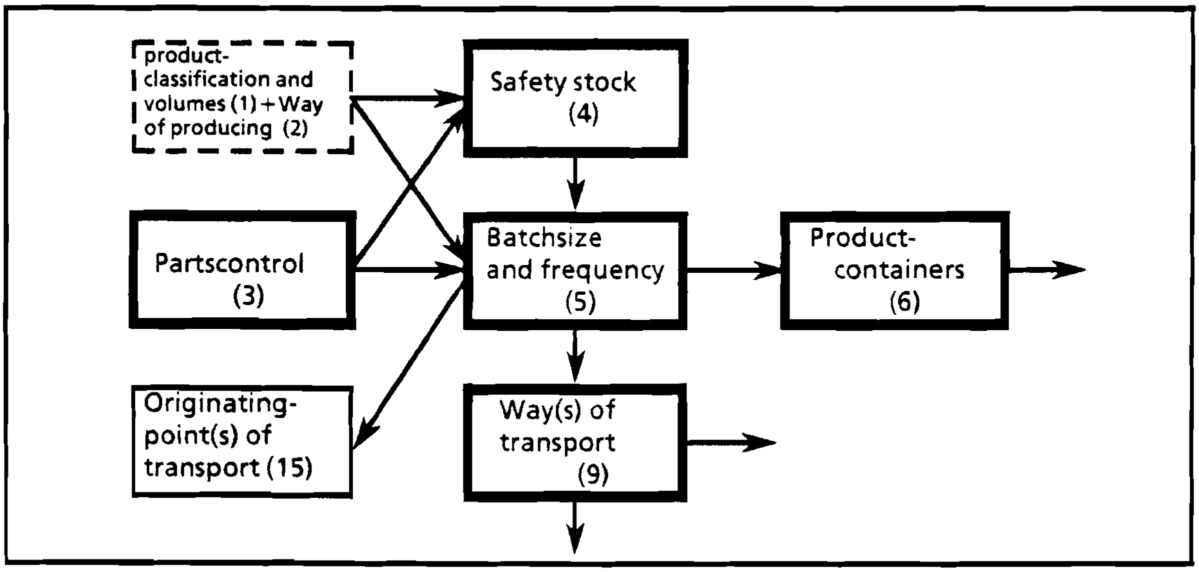
For specification of input and subproblems see appendix 12.

1.3. The formulation of the sub problem functions.

A sub problem can have more than one subproblem function. A subproblem function represents a property of a subproblem or a group of subproblems, which is a function of several data (variable and input or fixed data).
These functions (together with their acceptation limits), must be formulated in such a way, that these functions meet the design conditions and requirements.
When several subproblems are dependable on each other, sub optimalization can be avoided, not by making an individual choice for each subproblem, but by determination of all possibilities of the subproblems, after which the total subproblem group can be optimalized. Such an optimalization is the most favourable combination or combinations of the alternatives of the subproblems, that belong to the subproblem group.

Subproblemgroup 3-4-5-6-9:
The following subproblems, which belong to this sub problem group, are depending on each others:
- Alternatives for the parts control (3);
- The size of the required safety stock on the workingfloor (4).
- The transportvelocity (9);
- The limitations to the transport capacity (9);
- Productcontainers (6);
  - Material, shape, length, height width, volume (determines the minimal/ optimal transport batch size (5) or larger).
  - Handling requirements,
  - Special requirements or adaptions.

Problemfunctions:
- Storing costs (minimalize) (3-4-5-9);
- Transportation costs (minimalize) (3-4-5-9).
- The batchsize of the parts supply (5);
- The frequency of the parts supply (5);



Assembly (Msp 1).
Function: producing CRU's;
Requirements: Number of produced CRU's must be equal to or larger than the volumes prescribed by the S.P.A..

Way of floor lay out (10).
Function:
Total (available) area on the work floor (7) minus the area that is needed for transport (9) minus the area that is required for assembly (8) equals the area that is available for the handling and storing unit at the assembly line.

Store / handling unit at assembly line (14).
The properties of the design have been being determined by the choices that were made in subproblem 4, 6, 9, 10, 11, 12, 13 (see also 1.2.).

Originating point of transport (15).
The (possible) design of a buffer;
Input: (Dynamic) process properties.
Function: Buffer size.
When the required (dynamic) process properties (5) are not sufficiently covered by the process properies of the originating point, there must be searched for a solution of this problem. A possible solution is the design of some sort of a buffer. Design requirements are being determined by the input data and by the previous choices (see 1.2.).

2. Define and work out the possibilities for the sub problems.

Introduction:
When the properties and connections of the subproblems are known, the alternatives for the different sub problems must be examined to make an optimal design or combination of alternatives. This is handled in the next chapter.

Chosen workingorder (see chapter 1):
1. The product(parts) classification and volumes;
2. Way of producing: Blockbuild, mixbuild: batch sizes.
3. Partscontrol;
4. Safety stock;
5. Batchsizes for the parts supply; frequency of the parts supply;
6. Product containers;
7. Total available area of the working floor;
8. The assembly layout;
9. Way(s) of transport;
10. Way of floor lay out .
11. Ergonomical demands (for the handling of / the supplying of the assembly operator);
12. Automation requirements (for the handling of / the supplying of the assembly machines);
13. Further design requirements: modular.
14. Store / handling unit at assembly line ;
15. Originatingpoint of transport.

<u>2.1. The product(parts) classification and volumes;</u>

2.1.0. The product classification.
(classification of the materials that must be transported).

There is a need for a product classification, because of the lack of data of the productparts, that must be assembled. We do know what products must be made and if we know what products resemble eachother, we can make a good estimation of the effect of all parts on a material replenishment system by assuming that the effects within a class or group are identical.

The Systematic Handling Analysis (R. Muther) prescribes the classification of materials by using the following main properties:

<u>PHYSICAL PROPERTIES:</u>
1. Measurements: Length, width, height;
2. Weight per unit or per volume unit (density);
3. Shape: Flat, bent, compact, nestable, irregular, etc.
4. Damaging risk: Breakable, explosive, perishable, poisonous, corrosion forming, etc.
5. Condition: Sticky, hot, wet, dirty, to eachother belonging pairs, the containers in which it's being transported.

<u>OTHER PROPERTIES:</u>
6. Quantity: Volumes, both in total as in batchsize.
7. Time: regularity, urgency, season conditions.
8. Special requirements: Legal regulations, company regulations, business politics.
9. Origin and destiny: As a consequence of the way of producing, storing and assembling, the origin and destination are both product specific properties.

The physical properties are often the most important aspects, which influence the choice of the material classification.
Quantity however, is also a very important aspect; goods in great quantities normally are transported in another way than smaller quantities.

PROCEDURE FOR CLASSIFICATION:
When classifying materials, one should work by the following procedure:
1. Identify all goods or groups and put them on a list.
2. Analyse the properties of each material or material class and determine the dominant or extra important distinguishing marks.
3. Registrate and combine the properties.

One should remark, that goods and their packaging are often of primary importance. That is why the classification is supposed to be done in the smallest practical unit (bottle, tin, box, etc.) or the most probable transport unit in which is being transported (a cardboard box with bottles, bundles of clothes, pallets, tote tins, etc.).
It speaks for itself that the classification is built up out of classes, which are built up out of sub classes (classes within classes).

2.1.1. Identify all goods or groups and put them on a list.
The groups in which the products, (and their parts), are divided are called families.
The family division for the different CRU models on basis of commonality in assembly, are as follows:

Familyname	Familymembers
5014	1012, 5012, 5014, 5012B, 5014B.
5017	5017, 5317.
XBOW	CROSSBOW (=CROSSBOW40, CROSSBOW50, SCIMITAR40, SCIMITAR50), LV4 AD, LV4 95, LV4.
5028	5028, YANKTON.
SUMIDA	SUMIDA, SUMIDA DEC.
SUPERSTAR	SUPERSTAR
LV3	LV3, LV3 94.

2.1.2. Analyse the properties of each material or material class and determine the dominant or extra important distinguishing marks.

The part properties of the CRU's can be arranged on highest importance, considering the material classification.
Beginning with the most important:

I. Measurements (1), weight (2), shape (3),
II. Quantities (6), the number of parts (per product).
III. Condition, the way it is transported.
IV. Destiny & Origin (9).

I. Measurements (1), weight (2), shape (3).

Measurements, weight and shape determain the transport volume. The maximum size of the volume and/or the weight of the transport unit of a transport system depends on the sort of transportation and the sort of transport container/ unit. So measurements, weight and shape determine indirectly the capacity of transport that is required is therefore of a major importance.

II. Quantities (6).

Quantities or the number of parts per product are of next importance, due to the fact that they determine the intensity of the transport flow, which is of importance when choosing a transport system.
Quantities are expressed in boxpallet equivalents (BPeq.), which stands for the number of boxpallets (=storing unit), that is needed required for the storing of an amount of parts.

III. Condition, the way in which it its being transported.

The condition, or the packing / container in which the parts are delivered into the store determines the transportbatchsize, provided that one should decide to repack.
When present, the transport batch size data is collected and when absent, ther an assumption will be made for the missing transportcontainer information.
In the present situation the 88P311 packing standard for the transportation and storing of parts is used as much as possible. This standard consists of the following:

Containertypes / sizes:
Transport / storage units:
Codes:

- A: In use for RX Venray: High wooden boxpallet;
- C: In use for RX Venray: Half high wooden boxpallet;
- H: Block style pallet / ground pallet.

From these codes the following codes for pallets can be formed:

- AA : High wooden boxpallet, with destination high wooden boxpallet store;
- CC : Half high wooden boxpallet, with destination store;
- CC X: Half high wooden boxpallet, with destination half high wooden boxpalletstore, loaded with a special containertype;
- HH : Ground pallet, with destination ground pallet store;
- HHK: Ground pallet, with destination ground pallet store, loaded with MN 5 boxes;
- HHQ: Ground pallet, with destination ground pallet store, loaded with MN7 boxes.

The codes for pallets with tote tins (=MN2 size) are:

- HD D: Ground pallet, with destination tote tin store, loaded with MN2 boxes.
- AD : High wooden boxpallet, with destination tote tin store, loaded with MN2 boxes.

CONT	MEASUREMENTS [mm]	CODE
MN 1	264 * 115 * 110	B
MN 2	476 * 282 * 122	D
MN 3	480 * 282 * 238	E
MN 4	575 * 383 * 122	J
MN 5	587 * 381 * 238	K
MN 6	955 * 575 * 400	P
MN 7	1160 * 968 * 396	Q
MN 8	1160 * 968 * 946	R
others:		
Exeptional	Special container type.	X

Tabel1: *Containertypes/formaten.*

IV. Destiny & Origin (9).
The origin and the destiny of the parts are of importance when determining the transport distance, that is needed for the determination of the transport labour. (The transport labour is directly proportional to intensity×distance). The origin possibilities are:

The store (code 2P);
The PMS (code 1SB);
Special materials (code 1JB).

By determining which quantities are required in which form at each (AGV)station on the working floor, it is possible to determine the required capacity per destiny place.
The code in the LOTUS worksheets are: AGV + #. (AGV station does not mean that a AGV must be used; you may read: work or assembly station).

2.1.3. Registrate and combine the properties.

Registrate the properties ("physical" and "others") and determine the material class by combining those materials, which have dominant or extra important properties of the same kind.

In a LOTUS 1 2 3 spreadsheet parts are combined in two ways, so the materialclasses or, if you like sub materialclasses, consist of a group of parts with:

The same destiny and the same packing / (transport) container,

or,

The same origin and the same packing / (transport) container
(See 2.1.2., III and IV).

This spreadsheet is presented in appendix 4.

This spreadsheet needs (an assumption for) the production planning.
This is subproblem 2.: Way of producing.

2.2.: Way of producing.
To make an asssumption for the different scenario's for the production planning, the following data must be filled in:
a. SPA volumes: product families & dayrates;
b. Guidelines:
   A constant labour occupation for the complete line,
   a minimal and / or maximum period length which is allowed or demanded between the product changes, (when a mixbuild production is chosen).
c. needed labour per product (or product part).

This data can be combined in a LOTUS 1 2 3 spreadsheet, after which it can be optimalized, so that it meets the guidelines (see b.).
This spreadsheet is presented in appendix 3.

Mixbuild or blockbuild.
Mixbuild producing is a production method with which the assembly line is divided into stations, at which only one product(family) is built.
Blockbuild is the production method with which the assembly line is divided into stations, at which the production of different products is being interchanged at certain time intervals (see figure 2.2.1).

Mix-build (time →)

STATION 1	product 1	product 1	product 1	product 1
STATION 2	product 2	product 2	product 2	product 2

Block-build (time →)

STATION 1	product 1	product 1	product 2	product 2
STATION 2	product 1	product 1	product 2	product 2

figure 2.2.1: Mixbuild or blockbuild.

To make a well considered choice between mix and block build, one must look at all advantages and disadvantages, which are represented in the following table:

Way of producing	Advantages	Disadvantages
Mixbuild	Dedicated production at each station: no learning-losses. Lesser days of supply (DOS). No "batch-rest"problem.	A small productionsrate may lead to few workstations per product which can result in a unfavourable line-balance (large number of parts at one assembly station).
Blockbuild	A more optimal line balance. It is possible to make several products with small productionrates on a normal balanced assembly line.	Periodical change of product: relatively high learning-losses. Little more days of supply (DOS). Measures must be taken to solve the "batch-rest"problem (storing place or batch adoption).

2.3. Problemcluster 3 4 5 9:

- Parts control,
- transport batchsize,
- safety stock at the assembly line,
- the transport batch size and the way of transport.

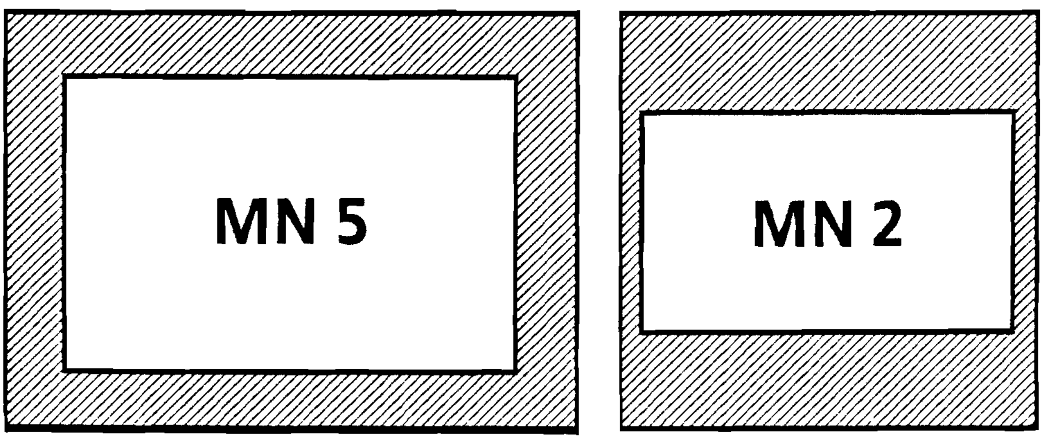
In this paragraph the relation between the above mentioned items will be explained.

Transportfrequency and the transport batchsize.
The assembly line has a production speed which is related to the dayrate that is planned and is represented by the SPA volumes. This production speed determines the need for parts to be transported to the assembly line.
There are several ways to transport the parts, but the total quantity within a certain timerange is fixed, so:

Total transported quantity = frequency × quantity,

in which frequency stands for the number of transports per time and the quantity stands for the transport batch size (the batch size with which the parts are transported).

The way of transport and transport container (subproblem 9 & 6).
The way of transport determines which transport containers can be transported, by for example its size, or its carrying capacity.
For example: a transport conveyor can not transport containers that are largerthan the size of the conveyor or *conveyor pallet*. When a pallet with the size of 550× 550 mm. is used a container must be chosen which *makes optimal use of this pallet*; for example the MN 2 box (see figure 2.3.1). Therefore the MN5 & MN2 containers are chosen for transport from the store to the assembly line, because of the following advantages:
little space occupation at the assembly line.
these containers are transportable on a (assembly) conveyor.



MN 5 size: 590×390×240	MN 2 size: 490×290×120
pallet size: 750×550	pallet size: 550×550

Figure 2.3.1 transport container on conveyor pallet.

Ways of transportation.

There are three different groups of ways of transport selected to be examined:

1. Transport on the floor.
   There are three possibilities for transport on the floor:
   - Manpowered;
   - Automatic Guided Vehicles;
   - Forklifttrucks.
2. Transport overhead.
3. Combinations of different ways of transport.
   - Assembly conveyor + overhead conveyor
   - Sub assembly conveyor + overhead conveyor

Their characteristics are:

- transport velocity;
- the (maximum) size of a carryable transport container;
- the used/needed space;
- pick & placing time;
- transportation costs.

This leads to this table:

Way of transport	Transport-velocity	Maximum size of a carryable transport container	Space: aisle width	pick & placing time
On the floor: - Manpowered - AGV - Forklifttrucks	 0.82 m/sec. 0.71 m/sec. 1.70 m/sec.	 PALLET PALLET PALLET	 2.0 m. 2.5 m. 3.0 m.	 40 sec.* 110 sec. 60 sec.
Overhead conveyor	0.45 m/sec.	MN5	N.A.	10 sec.*
Sub- conveyor	0.45 m/sec.	MN5	N.A.	10 sec.*
Assembly conveyor	0.40 m/sec.	MN5	N.A.	10 sec.*

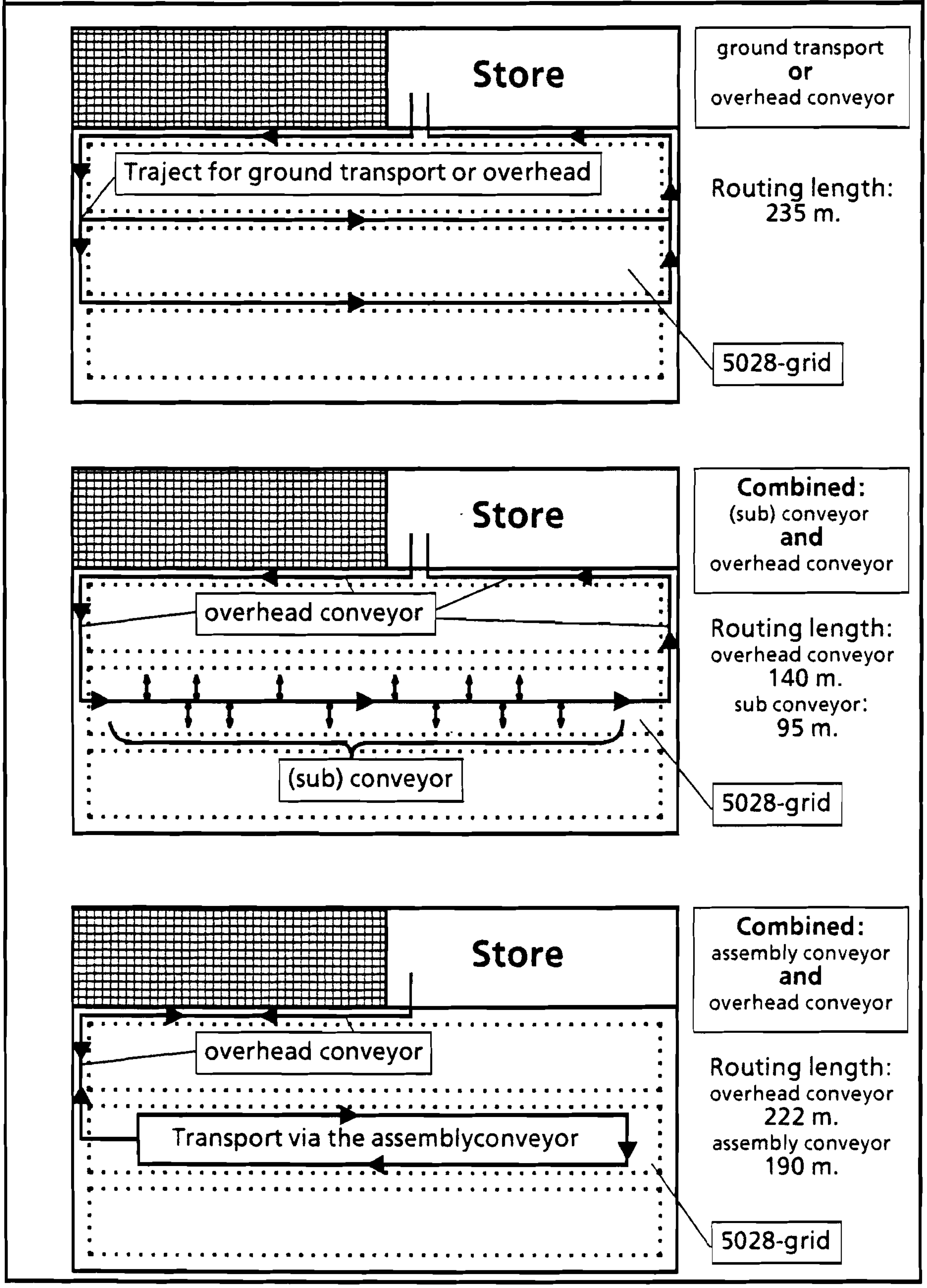
*: estimates.

Area / floor geography & assembly line mapping (Subproblem10 + 7/8).

From the spreadsheets, earlier mentioned in paragraph 2.1.2 sub problem 1&2, the floor occupation can be derived by placing the correct number of pallets or boxes in the drawing of the assembly line.
The need for space (the needed pathwidth) for different ways of transportation is represented in the characteristics table of "Ways of transportation".
So when we choose for forklifttrucks we must use the grid as it is currently available in building B (3 AGV grids).
When there is a need for more grids (= more space), and the aislewidths must be smaller for the gaining of space, one is forced to use an overhead conveyor for transportation of parts to the assembly line.

The floor lay out also decides the distances that must be transported from origin to destination.
These distances are represented in the following figure.

3 Transport-routings for Building B



Costs.

The total costs can be divided into two parts:

1. Costs of the transport system.
2. Costs of the stock on the work floor (WIP).

1. Costs of the transportsystem.

The costs of transportation are passed on the product, so:

$$\textbf{Costs per productpart} = \frac{C_{transport}\ [Dfl/day^*]}{\text{Transports per day}^* \times \text{deliver-batchsize}}$$

*: pick up [empty] & delivery [full]

Transportation costs.

Way of transport	Investment I=[Dfl]	Deprecia-tion (i=0.08) p= [Dfl / day]	Manhour (Dfl 50.54) + operating costs c=[Dfl/2shfts]	Total costs $C_t = p + c$ C_t =[Dfl/day**]
On the floor:				
- Manpowered	1200	0.96	808.64	809.60
- AGV	50000 (vast)*			
	+125000	138.91	0.00	138.91
- Forklifttrucks	N.A.	345.60	808.64	1154.24
Overhead conv.	500000	400.00	0.00	400.00
Combined:				
Assy. conv.*** +overhead conv.	95000 +150000	76.34 + 120.50	0.00 + 0.00	196.84
Sub assy conv. +overhead conv.	500000	400.00	0.00	400.00

*: 6 AGV's in building B **: 1 day = 2 shifts = 16 Hrs. ***: adjustment costs.

The calculation of p goes as follows:

$$\mathbf{I \times (1 + i)^n = \Sigma_i\,(p \times (224\ days) \times (1 + i)^i)}\text{, for i = 1to n and n = 7years.}$$

that gives: $\mathbf{p = 0.0007938 \times I}$

The total costs (C_t) of the conveyors are included the transport pallet costs, so

System costs = Transportcosts /day (=C_t).

For the transport on the floor applies the following:

System costs = Needed number of vehicles × Transportcosts /day (C_t

Number of vehicles.

The transport velocity of transportation determines the time that is needed for transporting the parts from origin to destination. Together with the transport frequency it determines the total needed transport time from which we can derive the required number of transport vehicles, because:

$$\frac{\Sigma_i(\text{distance} \times \text{frequency} / \text{transport velocity})_i}{\text{available transport time per shift}} = \text{Needed number of vehicles}$$

for i = 1 to n, when n = number of assembly stations.

This makes the following system costs for the different ways of transport:

Way of transport	Costs C_t = [Dfl/day**]	Needed number of vehicles	System costs [Dfl/day**]
On the floor:			
- Manpowered	809.60	2	1619.20
- AGV	138.91	2	277.81
- Forklifttrucks	1154.24	1	2308.48
Overhead conv.	400.00	N.A.	400.00
Combined:			
Assy. conv.* + overhead conv.	196.84	N.A.	196.84
Sub assy conv. + overhead conv.	400.00	N.A.	400.00

2. Costs of the stock on the workfloor (WIP).

The value of the products is represented as follows:

$C_{VALUEWIP}$ = **Value product × interest % × deliver batchsize***

*: assumed is that every part is delivered in aproximately the same batchsize.

Together that gives:

$$C_{total} = C_{transport} + C_{VALUEWIP} = n_{batch}^{1} \times \alpha + n_{batch} \times \beta$$

These costs are represented in the graphics in appendix 8 of this report. The graphic shows that there is a minimum of the costs of the stock on the workfloor for a certain batchsize.
The way of transport can not be chosen when only considering the financial side of the matter. In the following table all advantages and disadvantages are summed up to make a more complete comparison, that is needed for a well considered choice.

Advantages and disadvantages of different ways of transport.

Way of transport	Advantages	Disadvantages
Manpowered handpallet-truck	Very low investment. Flexible routing	Not automatic: manpower needed. Floor area occupation.
AGV	Automatic (no manpower).	Floor area occupation. High investment. Fixed routing
Forklifttruck	Low investment. Flexible routing	Not automatic: manpower needed. Floor area occupation.
Overhead conveyor	Free floor area. Layout simplicity (vertical and horizontal bends). Simple design . Low costs. Automatic (no manpower).	Limited headroom. Roof must meet certain load-bearing requirements. Fixed routing Everything must be transported in MN5, which means a higher transport frequency Not everything can be transported in MN5 boxes
Assembly conveyor	Production layout/routing = material replenishment layout/routing. Free floor area. Automatic (no manpower). Very low costs.	line capacity requirements are raised (see apendix ..). Complex controling system required. Everything must be transported in MN5, which means a higher transport frequency Not everything can be transported in MN5 boxes
Sub conveyor	Production layout/routing = material replenishment-layout/routing. Free floor area. Automatic (no manpower). Low costs.	Complicated design (little space available). Complex controling system required Everything must be transported in MN5, which means a higher transport frequency Not everything can be transported in MN5 boxes.

Safety stock or minimum batchsize.

The speed of the stock control system, together with transportation time, determines the minimum batchsize or safety stock at the assembly line.

Assumptions for the determination of the minimum batch size are:

- a JIT pull system controls the parts flow output of the store (parts control).
- a transport consists of one batch each transport.
- one batch is held at the assembly line as workingstock (=WIP).
- the shortest interval time between pulls is achieved by pulling at arrival of the last pulled batch (parts control).
- the assembly line should be able to continue production (enough parts should be available).

This makes the following equation:

$$\left(\begin{array}{c}\text{Reaction time}_{\text{parts control system}} \\ + \\ \text{transportation time}\end{array}\right) \times \begin{array}{l}\text{Production speed} \\ \text{[products/time]}\end{array} = \text{minimum batch size}$$

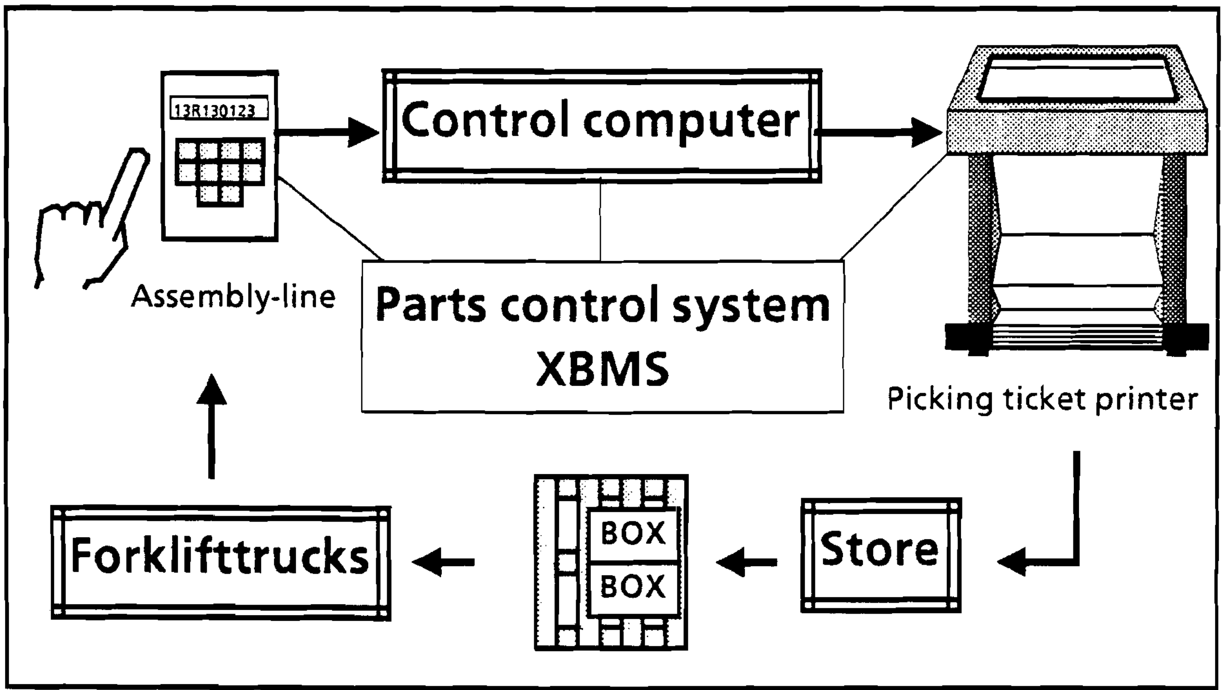
Due to the fact, that the reaction time of the control system is much larger than the transportation time, the reaction time is the leading time factor in the allowed (minimum) batch size at the assembly line.

These minimum batch sizes are represented in the graphics in appendix 10 of this report.

Parts control.

The presently installed parts control system is the XBMS pulling system.

XBMS works as follows:



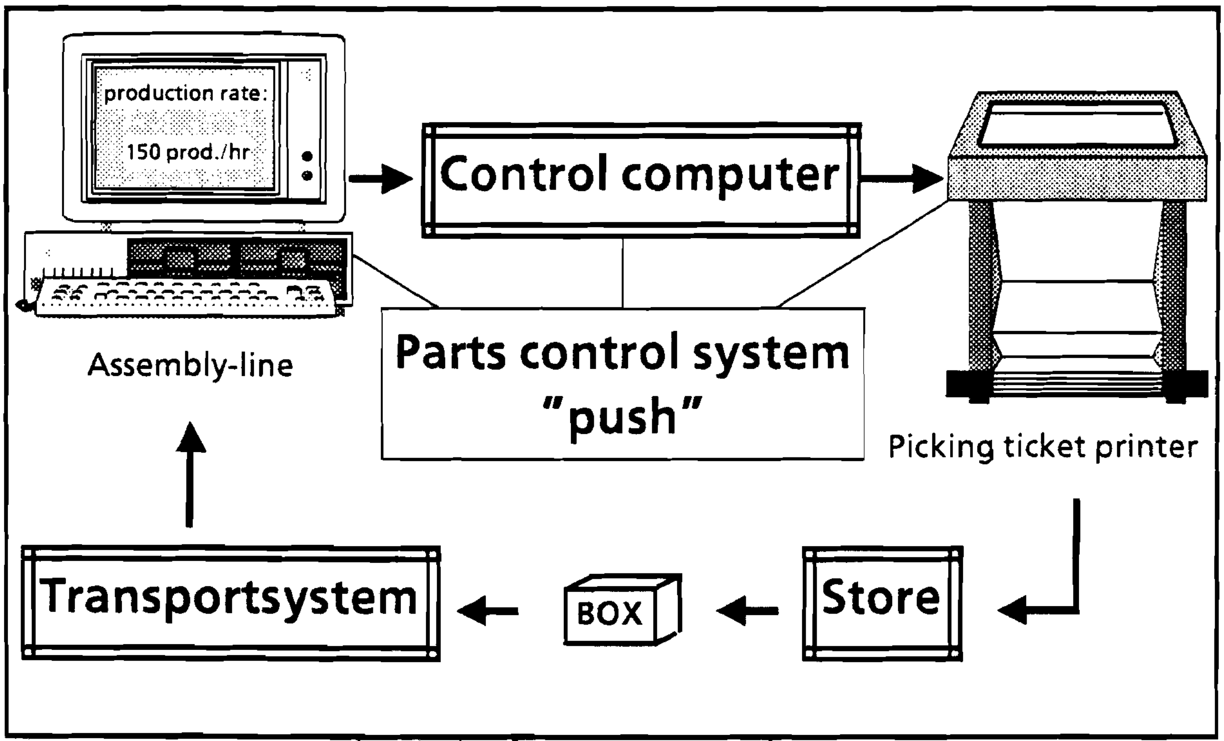
The XBMS parts control system.

This system is sufficient for a JIT pulling system, the operators at the assembly line are responsible for the requests for parts.

When there is a lack of space on the assembly floor it is possible to choose for smaller parts containers which occupy lesser space or are easier to store at the assembly line. When the size of a part in combination with the size of the chosen container in which the part is moved, determines that the number of parts in a container should be lower than the **calculated minimum batchsize**, then a JIT pull system no longer can be used for the control of the parts flow output of the store.

Instead of a JIT pull system one shoulduse a push system, which plans ahead and makes part requests in advance.

To make this possible, a computer (for instance: a personal computer) should be used to make the required requests, which the computer can calculate out of the number of products that should be produced within a certain time range.
This number of products can entered by the responsible engineer at the assembly line.
This parts control system is being represented in the following figure.



Alternative for a parts control system.

3. The choices for the sub-problems.

In the previous part of this report several sub-problems have been examined for alternatives. The alternatives all have their advantages and disadvantages. A decision must be made which choices must be made to go further with the next step in the designing of a material replenishment system. These decision points are:

1. Way(s) of transport;
2. Way of producing;
3. Transport containers;
4. Way of partscontrol.

The choices and the reasons for choosing an alternative are:

1. Way(s) of transport (2.3.)
choice(s): Combined transport: overhead conveyor assembly conveyor

reason(s): Low costs
Smaller space occupation*

2. Way of producing (2.2.)
choice: Block build producing, with the possibility to interchange 3 products at one assembly station.

reason: The increasing number of different products, that should be assembled in the future.

3. Transportcontainers (2.3.)
choice(s): MN2 and MN5

reason: The choice of transportation by an overhead and assembly conveyor.
Smaller space occupation* (by parts) at assembly line.

4. Way of partscontrol (2.3.)
choice(s): Combined parts control: pull and push system.

reason(s): When neccesary, use of a push-partscontrol-system will be made, otherwise use of the already present pull-system will be made.

*: Smaller space-occupation.
Lack of space is a major problem in building B, due to the increasing volumes of production. By reducing the width of the between the assembly lines and reducing the size of the parts containers, that have to be present at the workstations of the assembly lines a smaller space occupation can be achieved. Smaller aisle widths then is required than are needed for the pallet transports with forklifttrucks, can only be achieved by choosing an alternative way of transport. Smaller partscontainers can be chosen in such a way that they can be transported on a conveyor. So the combination of conveyor transport and smaller parts containers can be a solution for the lack of space in building B.

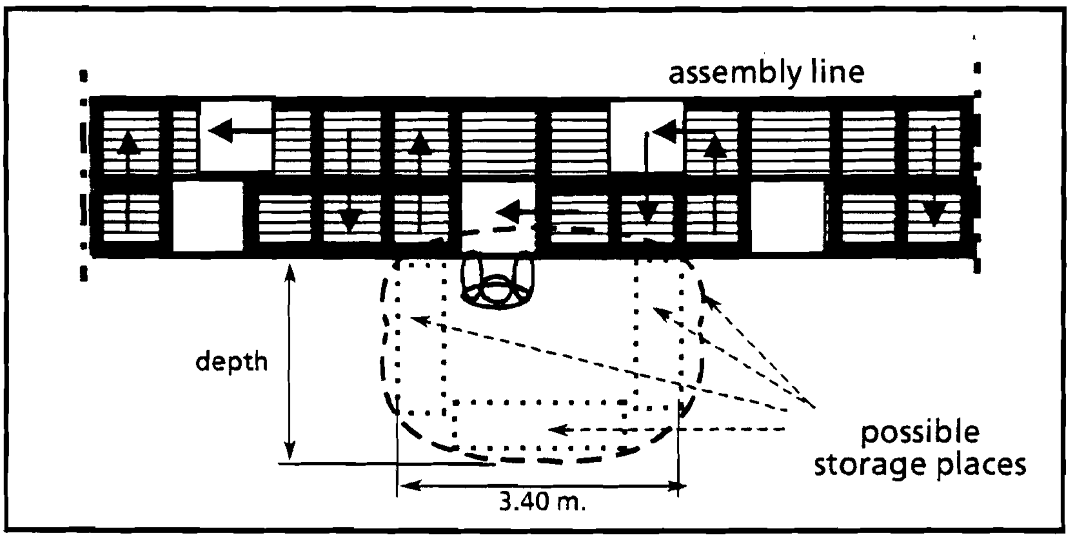
4. The store and handling unit at the assembly line.

Introduction:
After deciding on the transportcontainers, the way(s) of transport, producing and partscontrol the only remaining sub problem for which alternatives must be determined, are the store and handling unit at the assembly line.
To make a design and a functional specification for such a unit, the following requirements must be known:

1. General design requirements.
2. Container sort(s);
3. Container quantity;
4. Ergonomical demands;
5. Automation;

4.1. General design requirements.

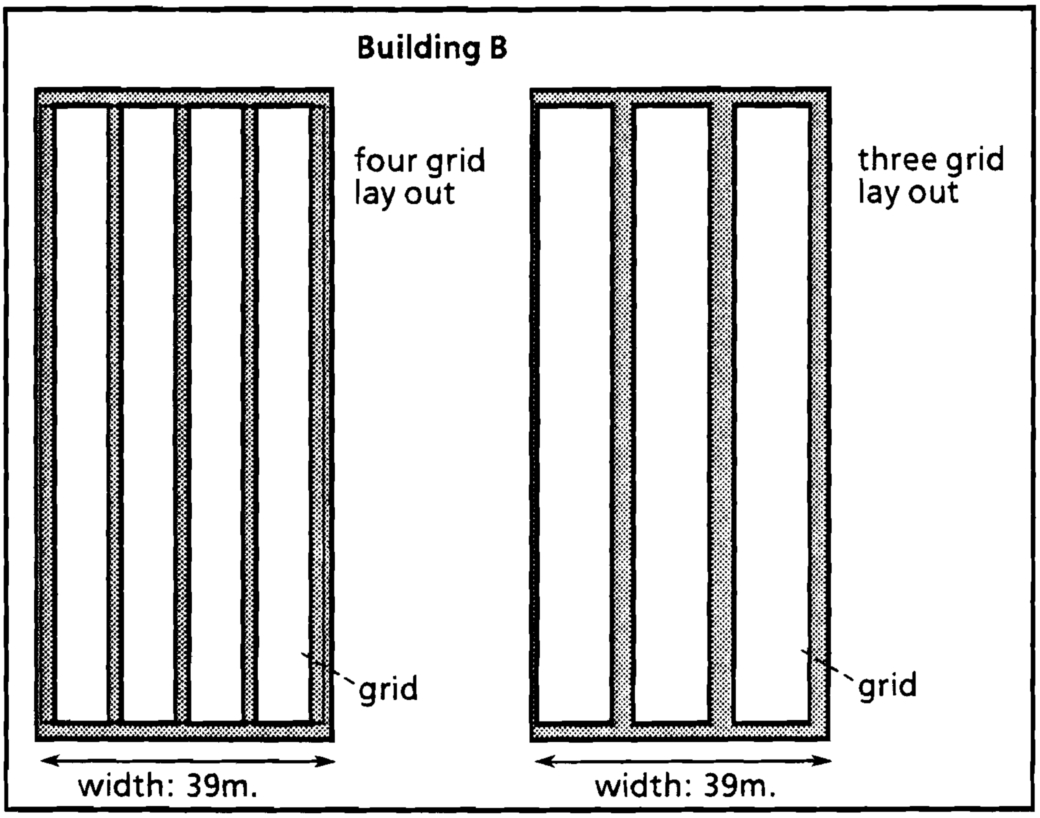
- modular built : "multi purpose" or universal design.
- Individual stores at assembly stations,
- Low floor occupation.
- The storing system must be *failsafe* in reference to the assembling of different products after the changing of products.
- The costs of each storage system (at a assemblystation) should be approximately *f*5000,-.
- Time materialhandling operator < 5% of the cycletime.
- Changing time (from one product to another) approximately 5 minutes.
- System area: from the assembly line within reach of the assembly operator.



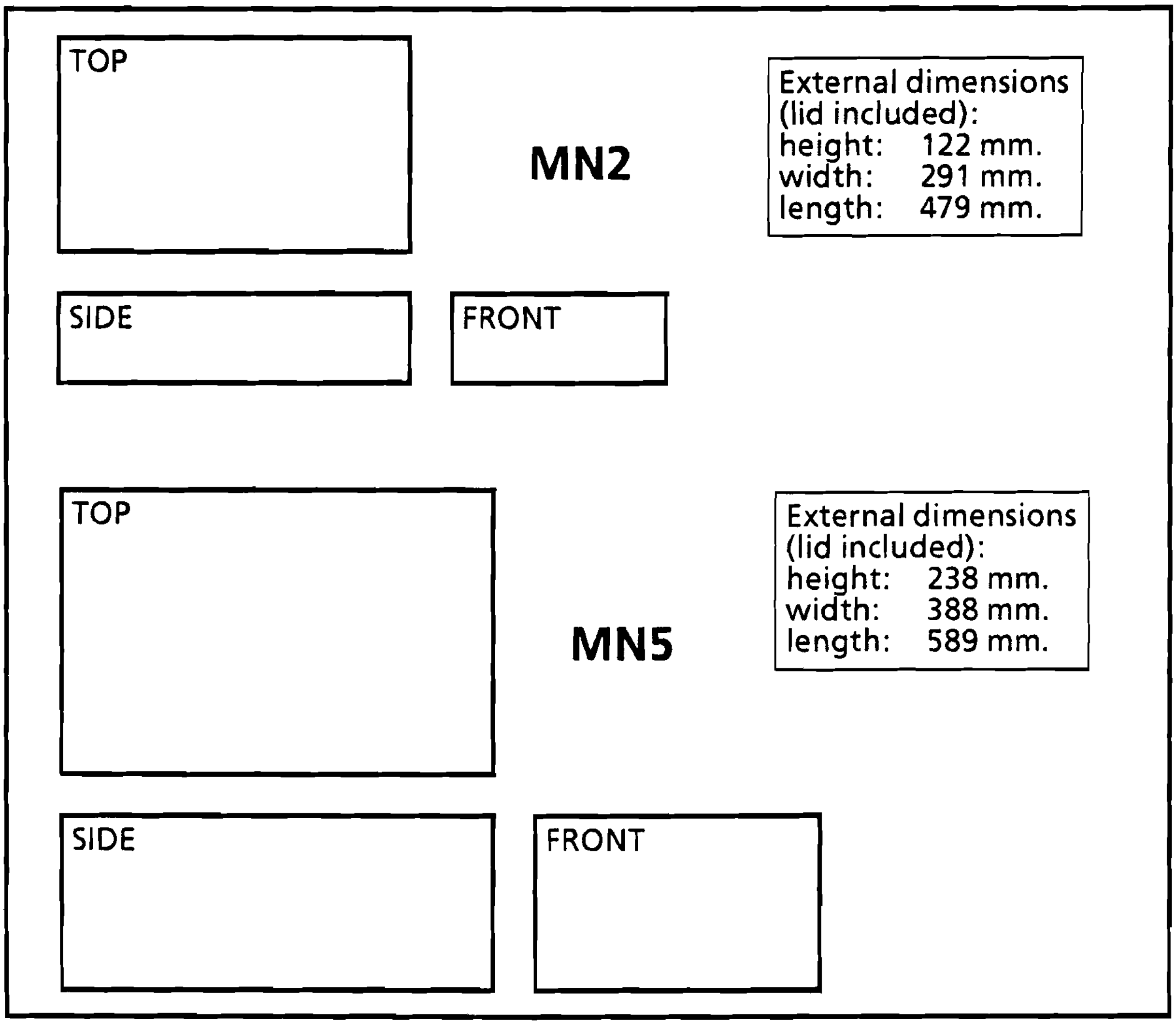
The depth of the workingplace of the operator (see preceding figure) depends on the chosen layout of the building.
There are two possible layouts of buildig B (see figure on page 31):

- three grid layout: (present situation)	depth:	3.70m.
	gridwidth:	10m.
	aislewidth:	3m.
- four grid layout:	depth:	2.30m.
	gridwidth:	7.25m.
	aislewidth:	2m.*

*: Legal minimum: a man must be able to pass a forklift truck with a pallet (width 1.1m.) → minimal aisle width: 2m. (JH).

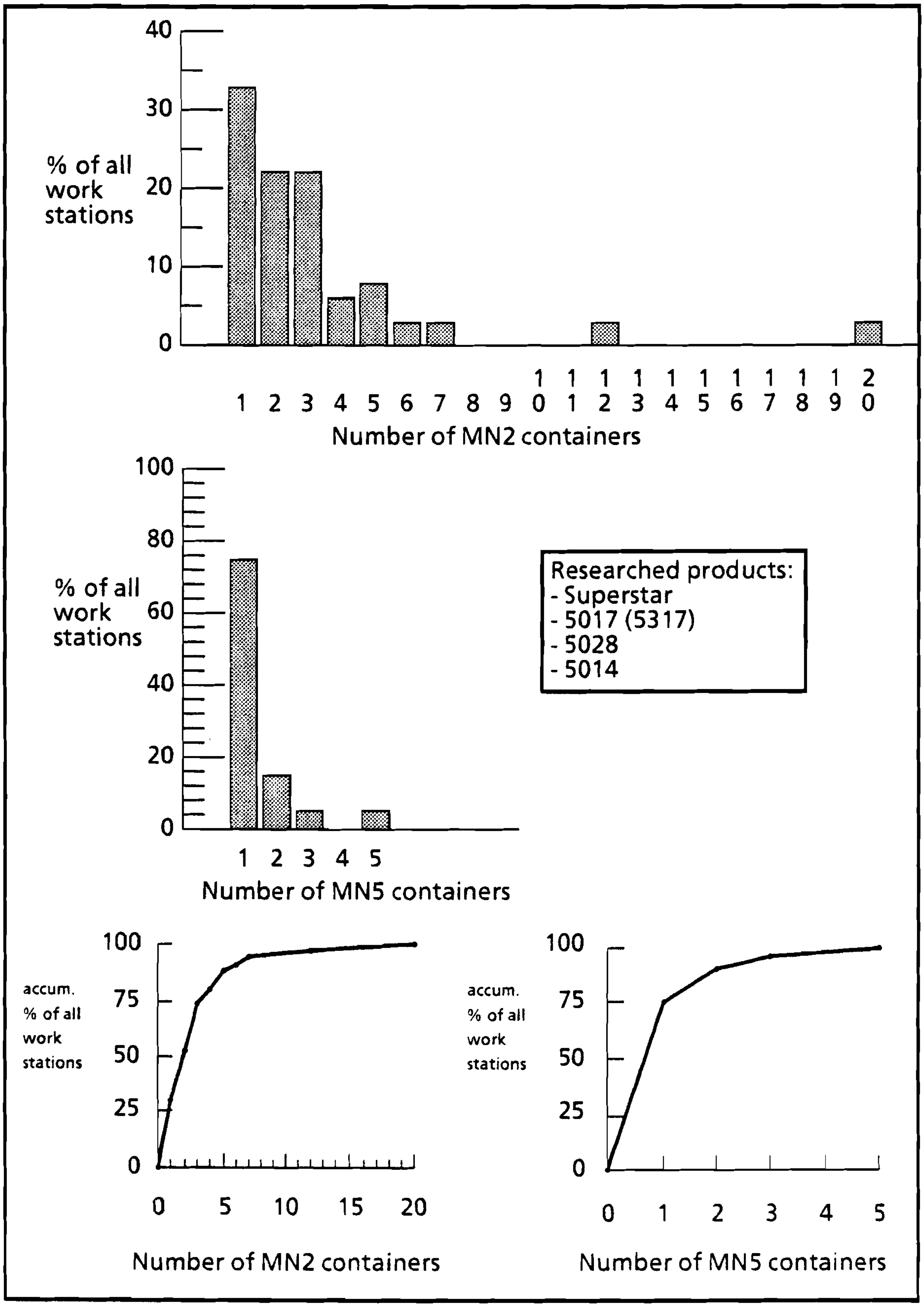

Building B
four grid
lay out
grid
width: 39m.
three grid
lay out
grid
width: 39m.

4.2. Container sort(s);
In the previous part of this report the following part containers are selected:

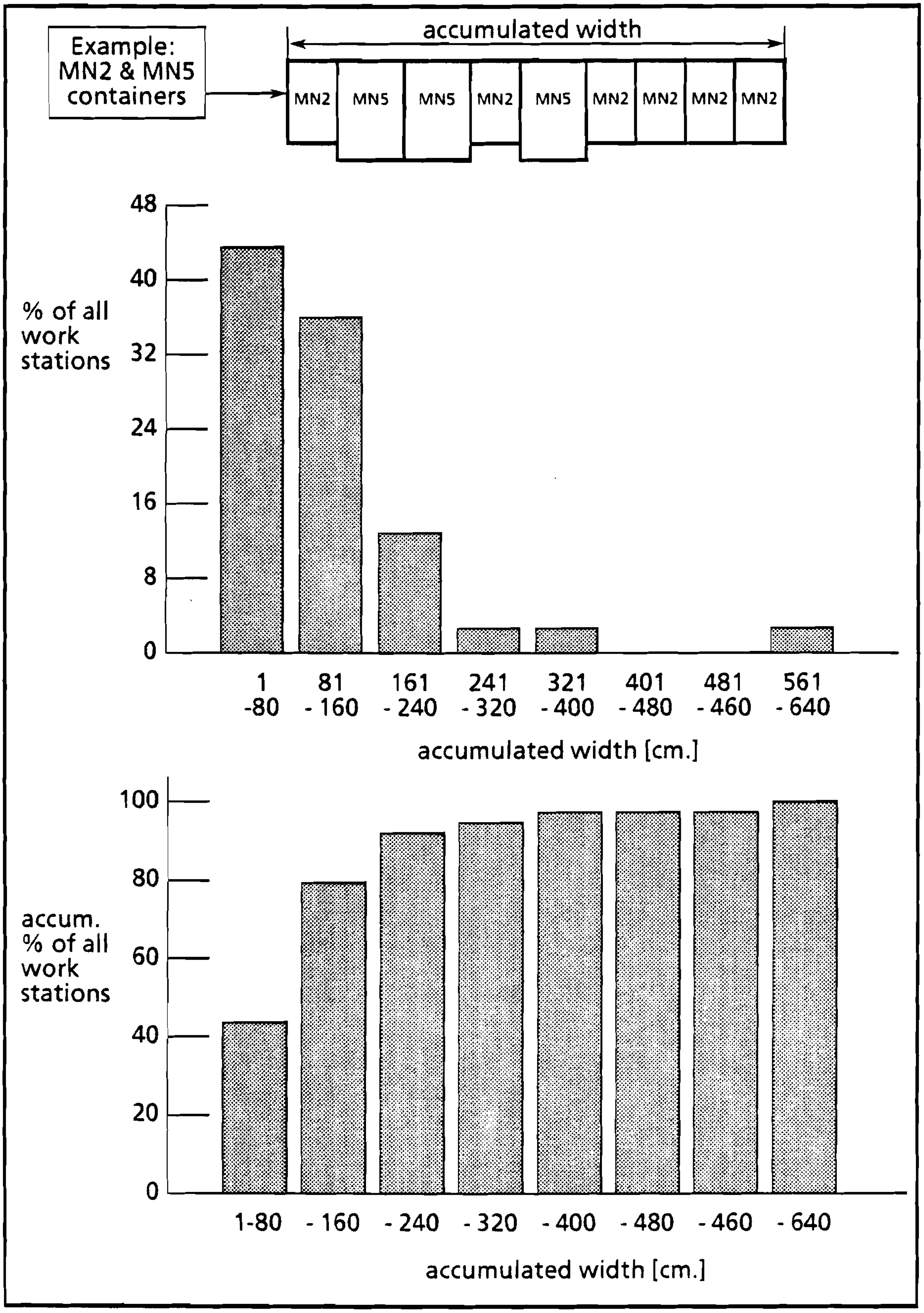


The maximum weight of the container plus contents is 15 kg. The container itselve weighs 1 - 2 kgs.

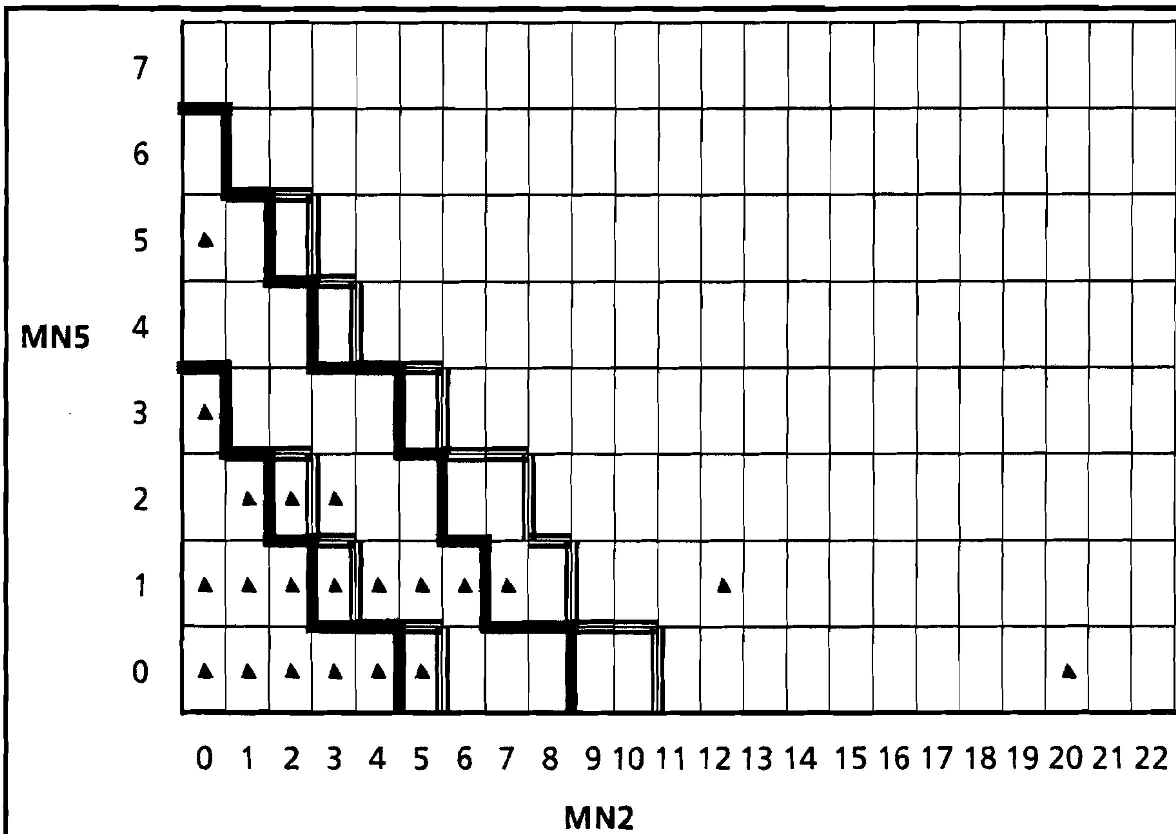
4.3. Container quantity; (per station)
The analyses of the parts flow of the product parts that are known gives a certain container occupation division at the assembly stations.
This division is represented in the following figures:



When we decide to store the container side to side, the total (accumulated) length of the containers is represented in the following figures/graphics.



The storage of these containers should be done in such a way that the containers occupy as little space as possible. This means that the containers must be stored above each other: on shelves. The following figure gives an analysis:



▬ : containercapacity of 1 & 2 shelves of 120 cm.

═ : containercapacity of 1 & 2 shelves of 150 cm.

▲ : found containercombination at one station, for *one* product

Shelf length: 150cm.

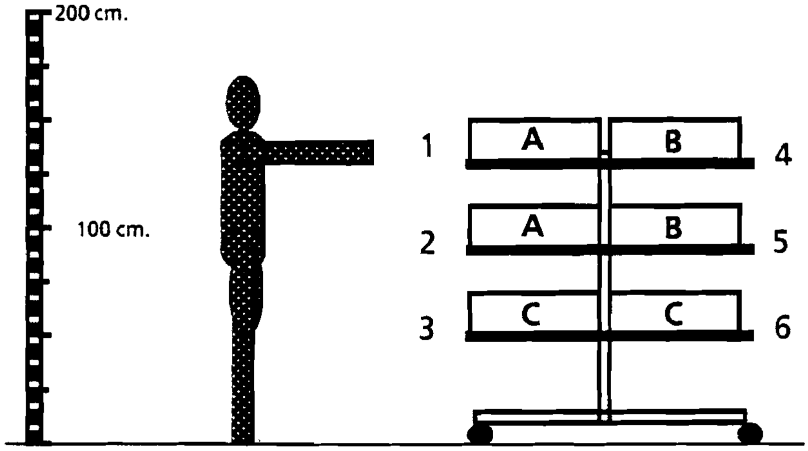
1 shelf:	77 %	2 shelves is a 95 % solution*
2 shelves:	18 %	
more:	5 %	

Shelf length: 120 cm.

1 shelf:	64 %	2 shelves is a 92 % solution*
2 shelves:	28 %	
more:	8 %	

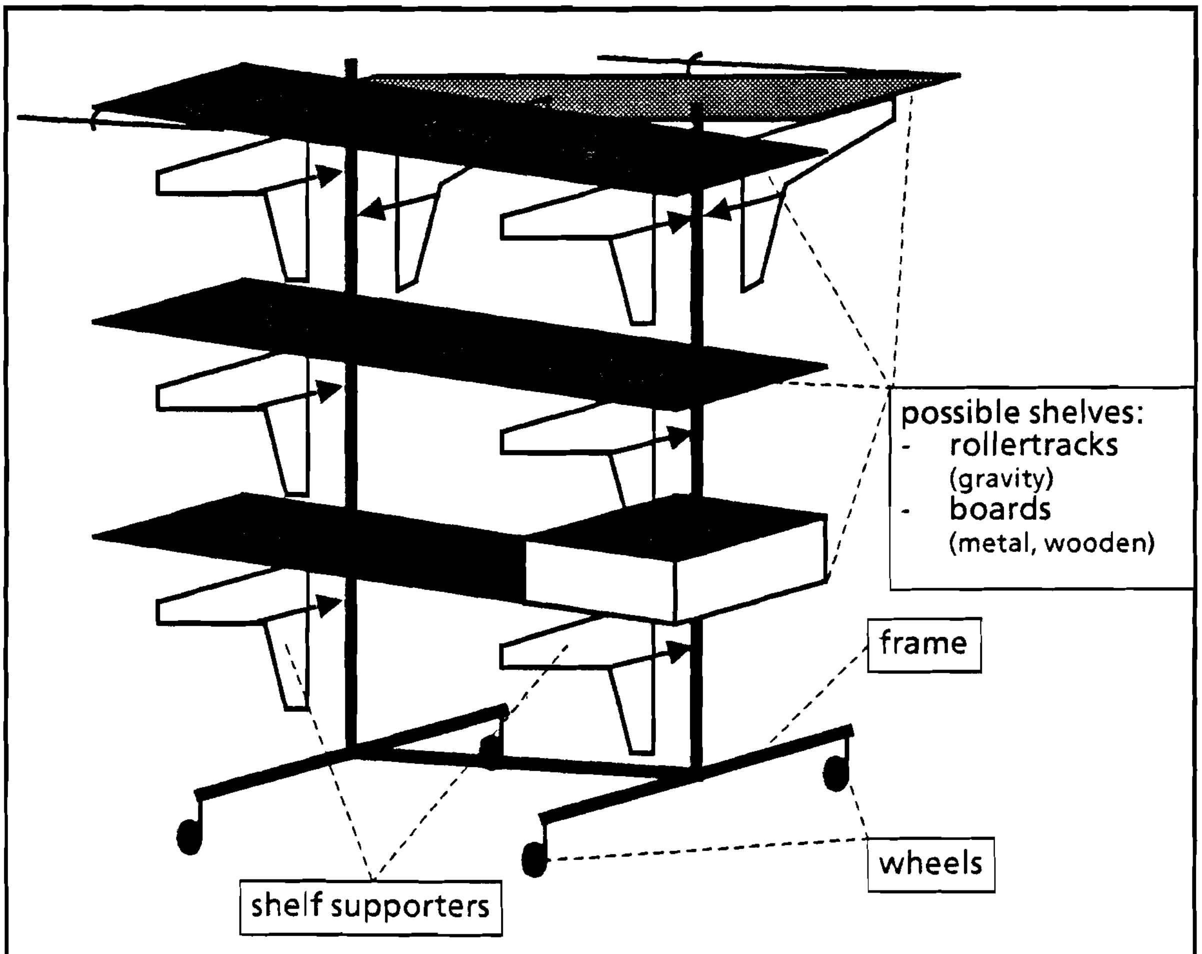
*: see apendix ... for calculations

Furthermore is demanded that the store at a assembly station must have enough capacity for the parts of 3 different products. This means that when one product needs two shelves, one store should consist of six shelves. (See in the following figure on page 35).

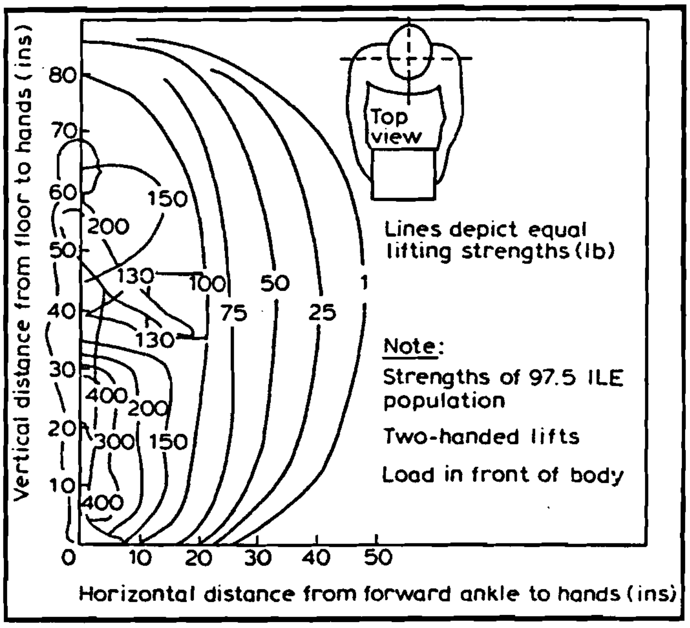


SHELF	1	2	3	4	5	6
PRODUCT	A	A	C	B	B	C

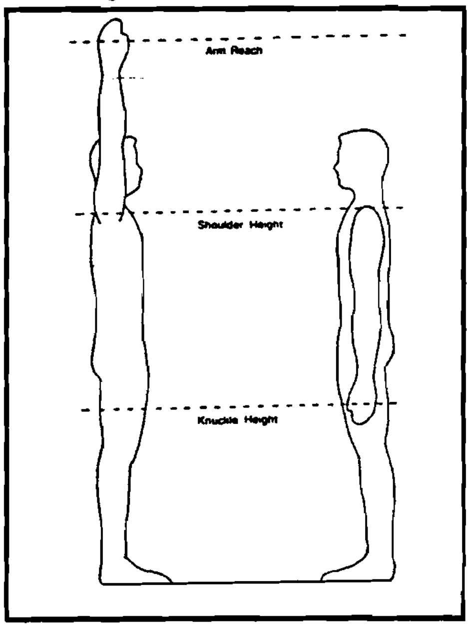
Here is a rough sketch of the modular build store



4.4. Ergonomic demands.



When a store is designed, that should be loaded and/or emptied by an operator, the physical aspects of the operator should be payed attention to. For loading, the operator must take containers off the assembly line with a certain frequency and store it at a certain level. The maximum weight of the containers is 15 kg. An operator needs a certain strength to lift a container. When we speak of lifting-strength we speak of a force output that can be produced with a given body posture. That is why an operator has a predicted (lifting) strength profile for lifting objects (see the upper figure on this page).



This strength profile however, is variable when an object is lifted more than once (in a certain frequency). This effect is researched and the results are printed in the book "Manual materials handlingt". In this book a distingtion has been made between three "sorts" of lifting, namely:
- lifting from floor to knockle height;
- lifting from knockle to shoulder height, and
- lifting from shoulder to reach height (see the lower figure on this page).

For the assembly operator the usual working height is from knockle to shoulder height with a lifting distance of approximately 50 cm. For these three sorts of lifting research has been the maximum acceptable weight of lift for different boxsizes, frequencies, vertical distances and sexes is.

See the following tables for the results of lifting from knockle to shoulder height. After examining the data in tables (see appendix 13, tables 4.4.a and 4.4b), one can conclude that a container with a maximum weight of 15 kg gives no problem, when the time period between lifts is approximately 1 min or higher (see table females).

In "Ergonomie op de werkplek*" tables are printed in relation to safe weights of lift (see appendix 13, tables 4.4.c and 4.4.d). According to the tables 15 kg is allowable, when the lifting commences at 75 cm above the ground.

4.5. Automation.

Automatic assembly stations
Preceding research showed that automatic assembly stations, that need product parts (such as a wire stringer and a automatic screwdriver) have a low parts delevery frequency. At the moment, the assembly machines are not fully automated, in this sense that the loading of the needed material (product parts) is being done by a machine operator (which attends several machines). Because it is not possible at the moment to load automatically it isn't logical to make a automatic container exchanging device.
A good alternative is to deliver the parts for the automatic assembly stations to the nearest manual assembly station. (This of course is only allowable when the deliver frequency is low and will not burden the operator of the manual station too much).

Manual labour vs. automation.

Discussed In this paragraph is the need for automation. As usual the final decision is taken after concidering the profits, which automation might have, when automation replaces manual labour.
Possible reasons for replacing manual labour by machines are:
- the moving of heavy objects;
- faster way of producing;
- more accurate way of producing;
- cheaper way of producing;

The objects (containers) that shouldbe moved have a maximum weight of 15 kg., which is allowed to be lifted by an operator (see 4.4. Ergonomical demands). It is not very likely that the automated handling will be faster than the manual handling, but the automated handling however will be more accurate, due to of the fact that an operator can make mistakes more easily than a machine.
So the comparing of costs of manual and automated labour determines the final choice, altough one should keep in consideration that the effective assembly time of an operator will decrease when manual handling is chosen.

Costs comparison.

The two methods to compare are:
1. Automatic handling: Investment (7 years, $i=0.08$),
2. Manual handling: labour costs.

4.5.1. Automatic handling costs.

Automation possibilities:

The automation of the handling of the storing process can be devided in 4 actions:

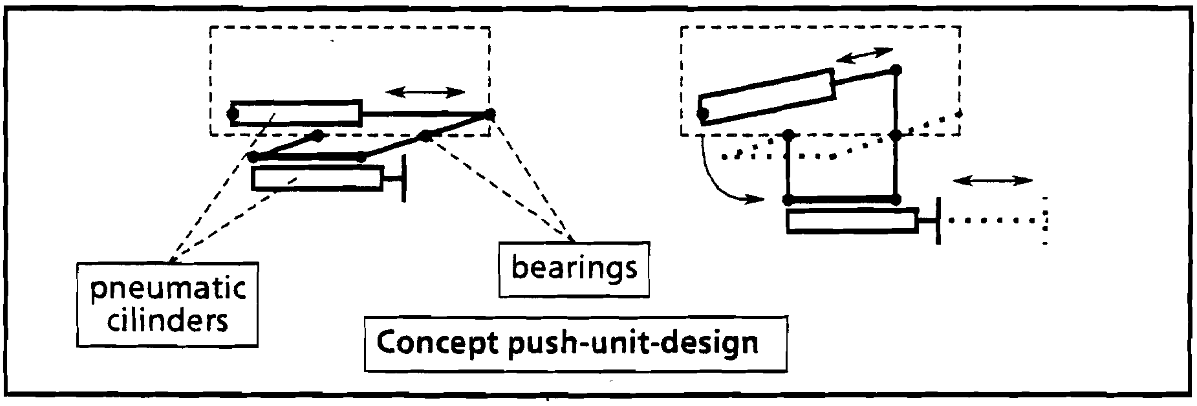
a. Moving a container from the assembly line;
b. Moving a container in store;
c. Moving an empty container on assembly line.
d. Controlling: the sensor & controlling system.

To make a cost estimate of a automatic storing device, a **concept design** must be made for all for actions (a, b, c and d). For the choises that lead to the concept design, see appendix 11.

Conceptdesigns.

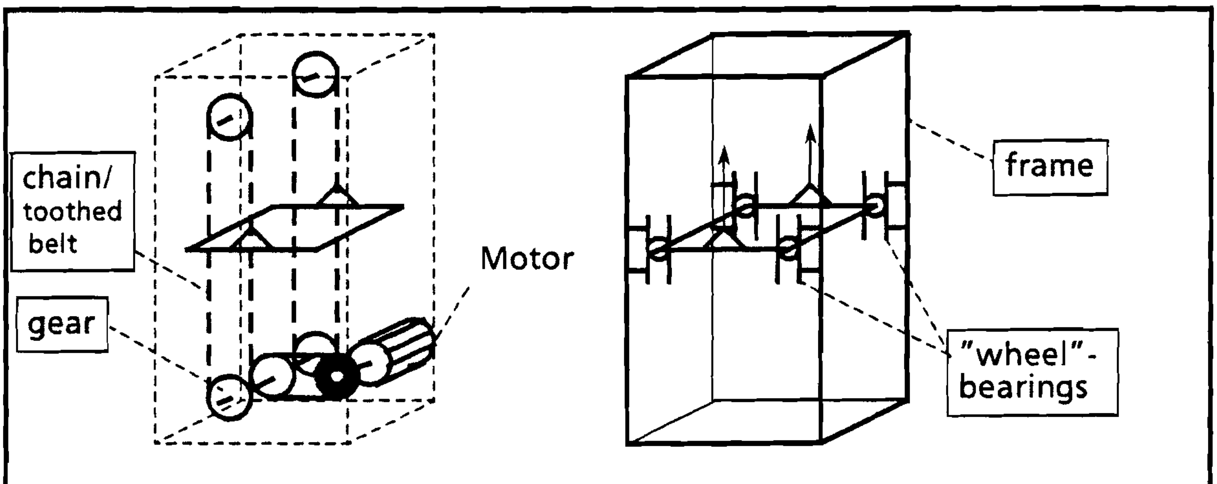
a. Moving a container from the assembly line;

When a parts container has arrived at the load and unload position, the container must be pushed of the container pallet into the lift unit.



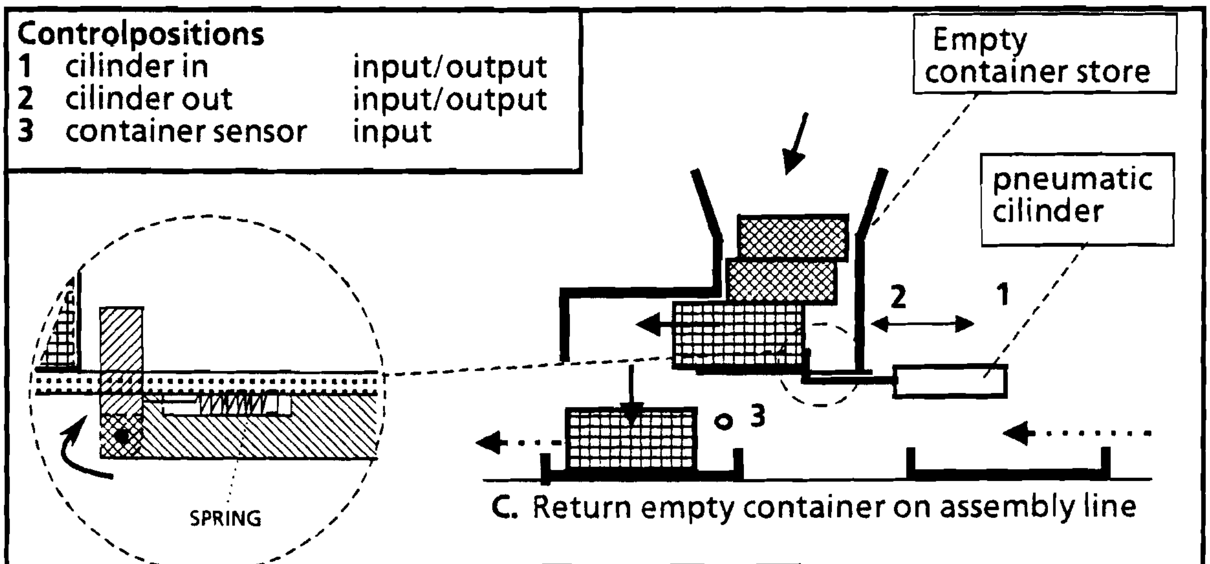
Concept push-unit-design

b. Moving a container in store;
The container must be lifted to the right level, where it should be released, so that the container can roll down the rollertrack into the store.



Concept lift unit design

c. Moving an empty container on assembly line.
The assembly operator empties the containers and puts the empty containers into a store, from which they are being removed automatically and dropped on the container pallets on the assembly conveyor



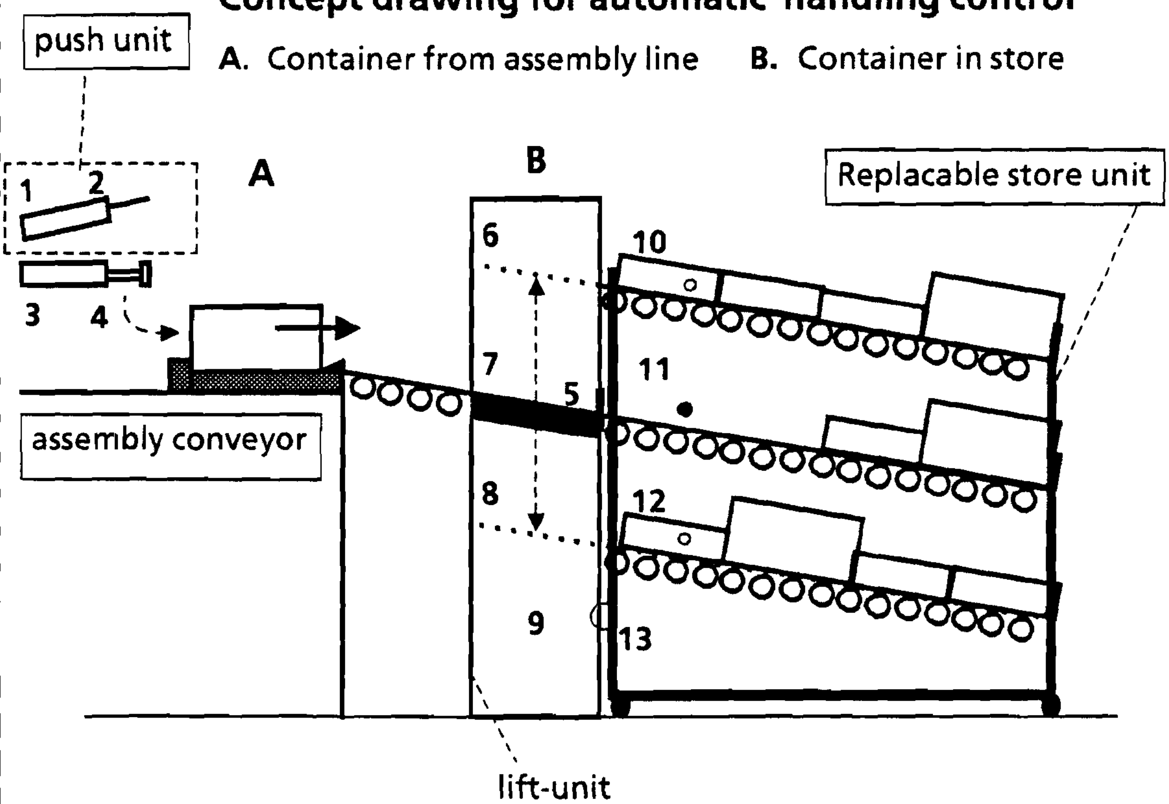
Concept return unit design

d. Controling: the sensor & controling system.

The required inputs and outputs in the design for the automatic handling are represented in the following figure:

Concept drawing for automatic handling control

A. Container from assembly line **B.** Container in store



Controlpositions	
1 cilinder in	input/output
2 cilinder out	input/output
3 cilinder in	input/output
4 cilinder out	input/output
5 position stop	output
6 position sensor	input

7 position sensor	input
8 position sensor	input
9 motor control	output
10 container sensor	input
11 container sensor	input
12 container sensor	input
13 store sensor	input

The lift unit positions on the middle level by means of controlling the lift motor (9) and checking the position sensors (6, 7 and 8).
The push unit removes the containers from the conveyor, when the conveyorsystem gives the "container present" sign (this action is controlled by pneumatics).

The container rolls down the rollertrack into the lift against the position stop (5).

The control system of the assembly conveyor knows the identity and consequently the "destination shelf" of the container. The control system checks if the store is connected with the lift with the store sensor (13) and checks if the shelf (to which the container must go) is free with the container sensors (10, 11 and 12). If not, the system must warn the operator.

The lift unit positions on the required level by means of controlling the lift motor (9) and checking the position sensors (6, 7 and 8).

When level and the container check are OK, the position stop (5) on the lift platform goes down and lets the container roll on the shelf, from which the operator takes the parts/parts containers when required.

When the conveyor pallet is emptied, it is possible to return an empty container on this pallet (see the lower figure on page 40). To check if the pallet is empty, a sensor or a feedback from the control system can make a container check. When the "pallet empty" sign is given the cilinder(s) can be activated and return a container on the pallet.

All concept designs together determine what the total investment is:

Investment for automatic handling.

Depreciation period: 7 years,
interest rate: $i=0.08$.

		Estimated Investment
- Handling units:	a. Container from assembly line† - pneumatic cilinders - "overhead" frame	*fl.* 10 k.
	b. Container in store† lift unit - electromotor gears and chains incl. - lift cage/frame contruction, - liftplatform, bearings incl.	*fl.* 20 k.
	c. Empty container on assyline† - pneumatic cilinder - empty container store	*fl.* 10 k.
- Control unit:	d. - sensor & controlling system††	*fl.* 20 k.

The costs per day are: $p=0.0007938 \times I$ *

so: $p_a=$ *fl.* 7,95
$p_b=$ *fl.* 15,90
$p_c=$ *fl.* 7,95
$p_d=$ *fl.* 15,90

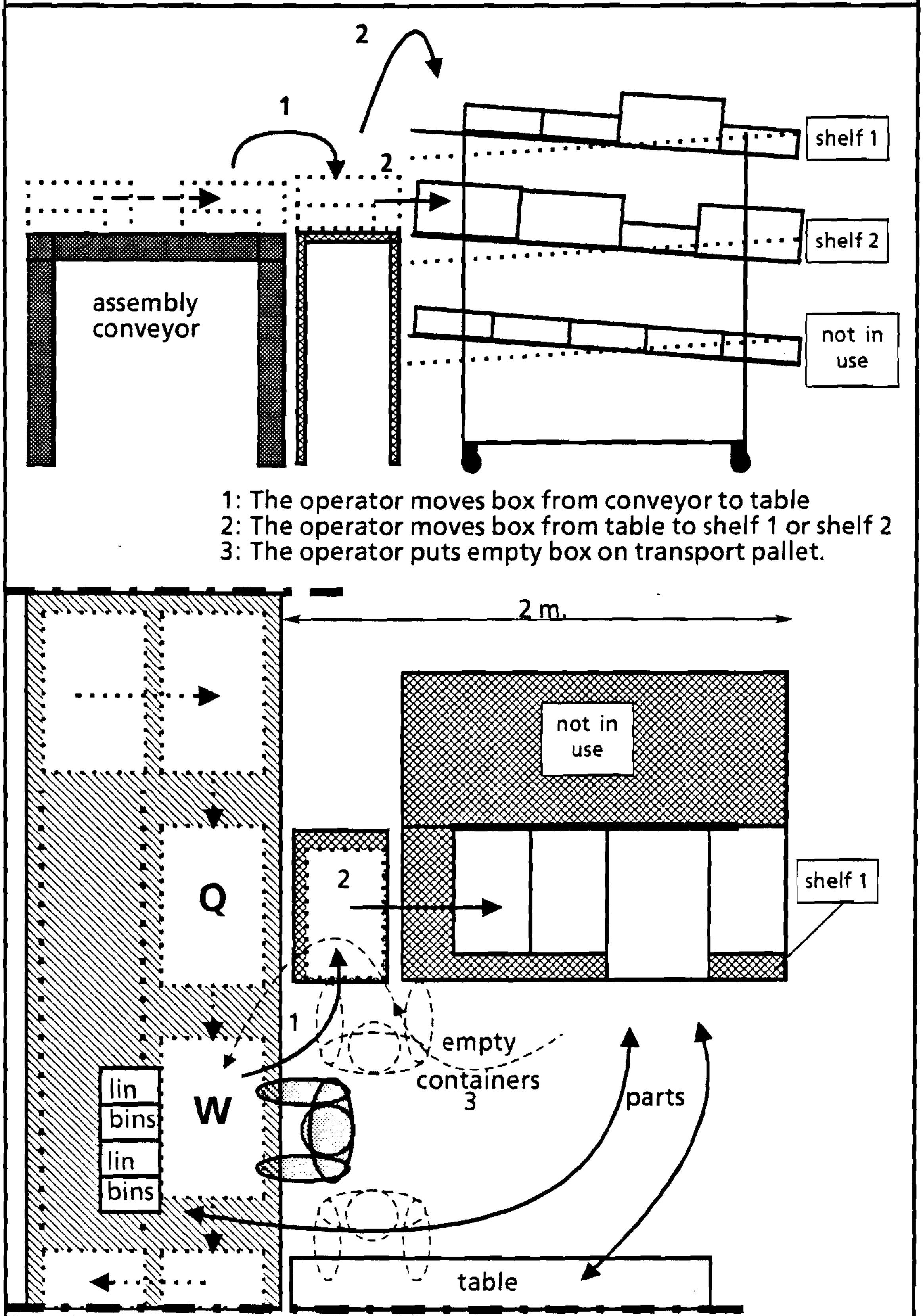
$p_{total}=$ *fl.* 47.70

*: see page 24.
†: cost estimates by L.Elbers.
††: cost estimates by N. Tissink.

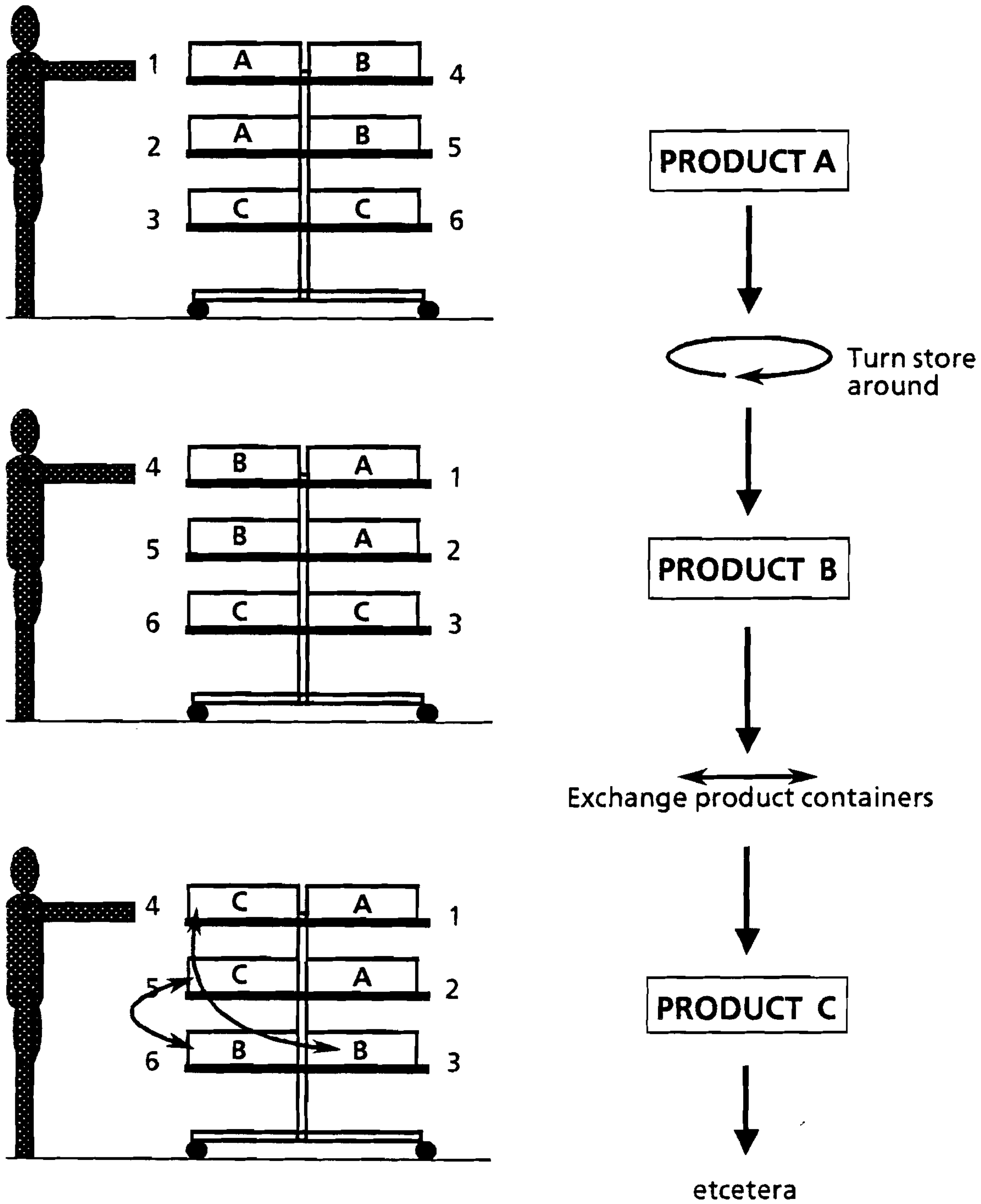
4.5.2. Manual handling costs.

The design of the work situation and work method for manual handling are being represented in the following figures:

Container movements & work situation at a assembly station



THE CHANGING OF PRODUCTS in the store-rack



The handling time per container:

Action	Estimated time
1. Take the transport container from a pallet and put is on the little table.	5 sec.
2. choose shelf (nr.1 or 2) and put container on shelf.	10 sec.
3. put empty box on transport pallet.	5 sec.
Total	20 sec.

The average total handling labour time per day per station, can be calculated by multipying the number of container deliveries per day per station, with the estimated handling labour time:

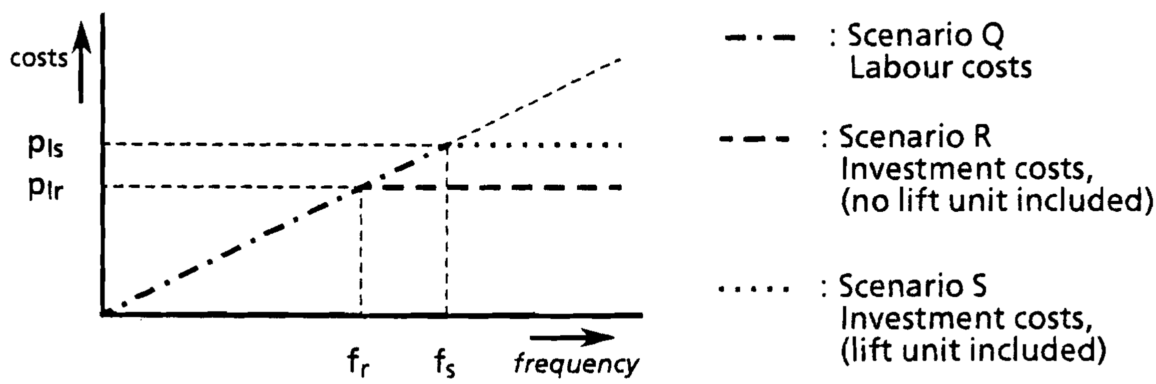
{# of container deliveries*} × labourtime = 46 × 20 = 0.2562 hr.

labourcosts = ± *fl.* 50,- / hr. → **Total labourcosts for handling**: *fl.* 12,81 [per day]

*: see apendix ... for calculations.

4.5.3. Comparing and deciding.

In the preceding proposal the daily automation costs are higher than the manual labour costs. This makes manual labour preferable to an investment for automation in the average present situation.
This will be named **scenario Q** and its daily costs are equal to the total labour costs for handling (see 4.5.2.).
There are two possible ways to automate which depend on deliver frequency and number of different products. When the product part containers at one station fit on one shelf, there is *no need for a lift unit* (only a push unit and a return unit). This will be named **scenario R** and has dayly costs of C_{lr}.
When the productparts at one station don't fit on one shelf, there is need for a lift unit (and a push unit and a return unit). This will be named **scenario S** and has daily costs of C_{ls}. This is represented in the following figure:

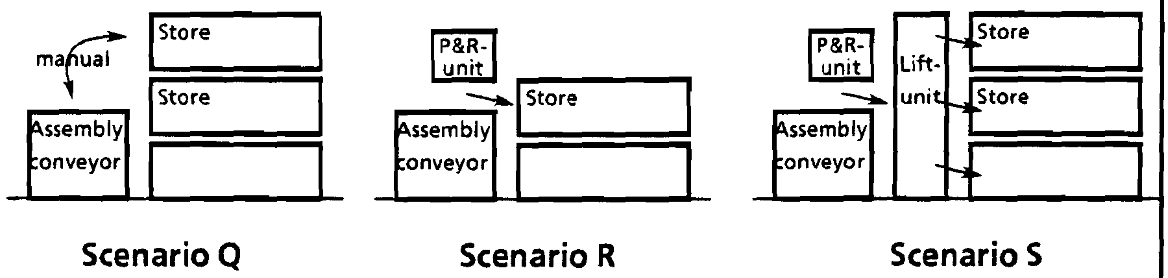


p_{ls} = *fl.* 47,70 (see 4.4.1.) p_{lr} = *fl.* 47,70 - *f*15,90 = *f*31,80 (see 4.4.1.)

The automation costs of scenario **R** correspond with the costs which are made by **0.954** hrs of labour. So when each container needs **20** seconds of handling time

this means that f_r = **170** containers a day*. When a frequency is higher than f_r *and* all containers at one station fit on one shelf, it will be preferable to design an automated storing device (as in scenario R).
The automation costs of scenario S corresponds with the costs that are made by **0.636** hrs of labour. So when each container needs **20** seconds of handling time this means that f_s = **115** containers a day*. When a frequency is higher than f_s *and* not all containers at one station fit on one shelf, it will be preferable to design an automated storing device (as in scenario S).

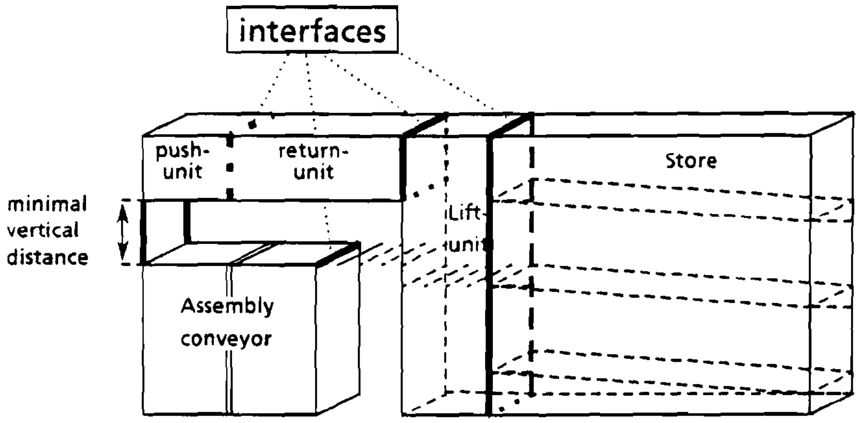
Equipment arangements for the different scenarios



*: This calculation is only valid when the operator is able to use the time, (which is created by automating the handling process), for assembly.

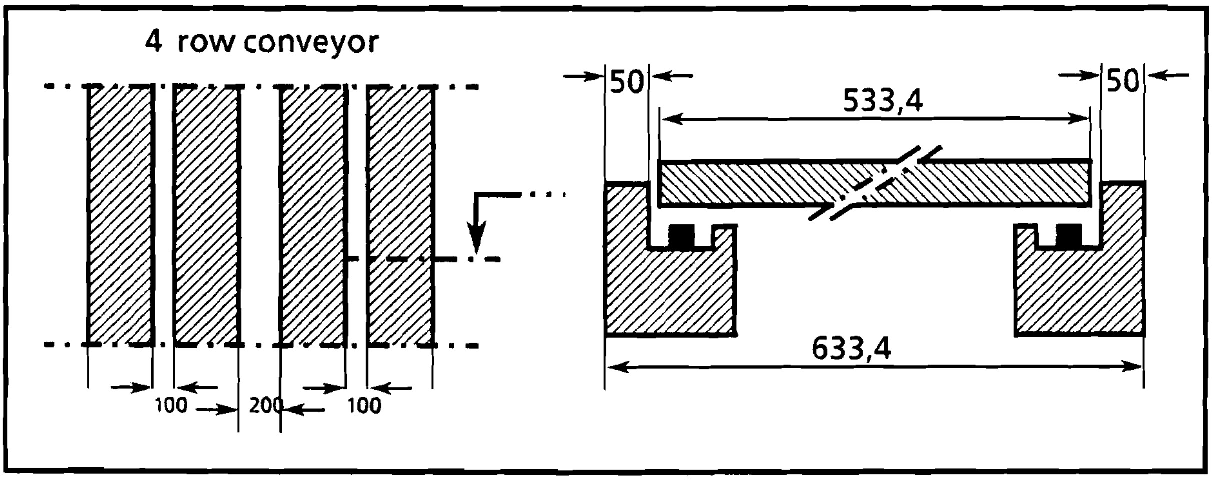
4.5.4. System area determination of the units.

A system area of a unit is the area which is predestined for this unit. This area is separated from its surroundings by the system borders. When a border makes the connection with a system area of another unit, this border is called an interface. To develop these units independably, some agreements should be made to be sure that the different units will fit on each other.



System area's:

The assy line unit: The height of the assembly conveyor is approximately 925 mm. (adjustable between 900 and 950 mm.).



The dimensions of a conventional conveyor pallet are: 533,4×560 mm.

The push & return unit: The under surface should be positioned central above the side track of the assembly conveyor, and has a minimal vertical distance of .... to the assembly conveyor.

Width:	maximal: the width of two conveyors + width of MN5 box = 2×733 +450 = 1916 mm.
Depth:	minimal: depth of MN5 box = ±60 cm. maximum: width of a conveyor side track.
Height:	relatively unlimited (preferable the same height as the lift unit: 160 cm.).

The lift unit: The under surface shouldbe positioned on the floor, in the line of the side track of the assembly conveyor, in such a way that the return unit can be connected with the lift unit.

Width:	minimal: the width MN5 box = ±40 cm.
Depth:	minimal: depth of MN5 box = ±60 cm.
Height:	relatively unlimited (as small as possible): 160 cm.

Store unit:

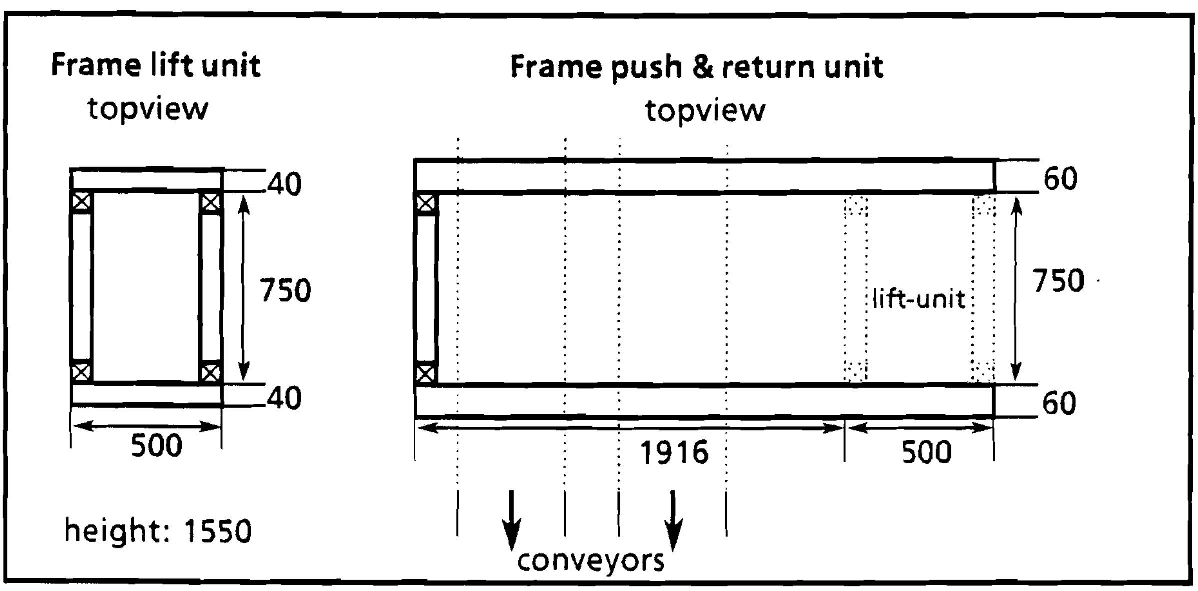
Width:	150 cm.
Depth:	minimal: depth of MN5 box (1or2×) =60 cm or 120 cm.
Height:	the same height as the lift unit or smaller (160 cm.)

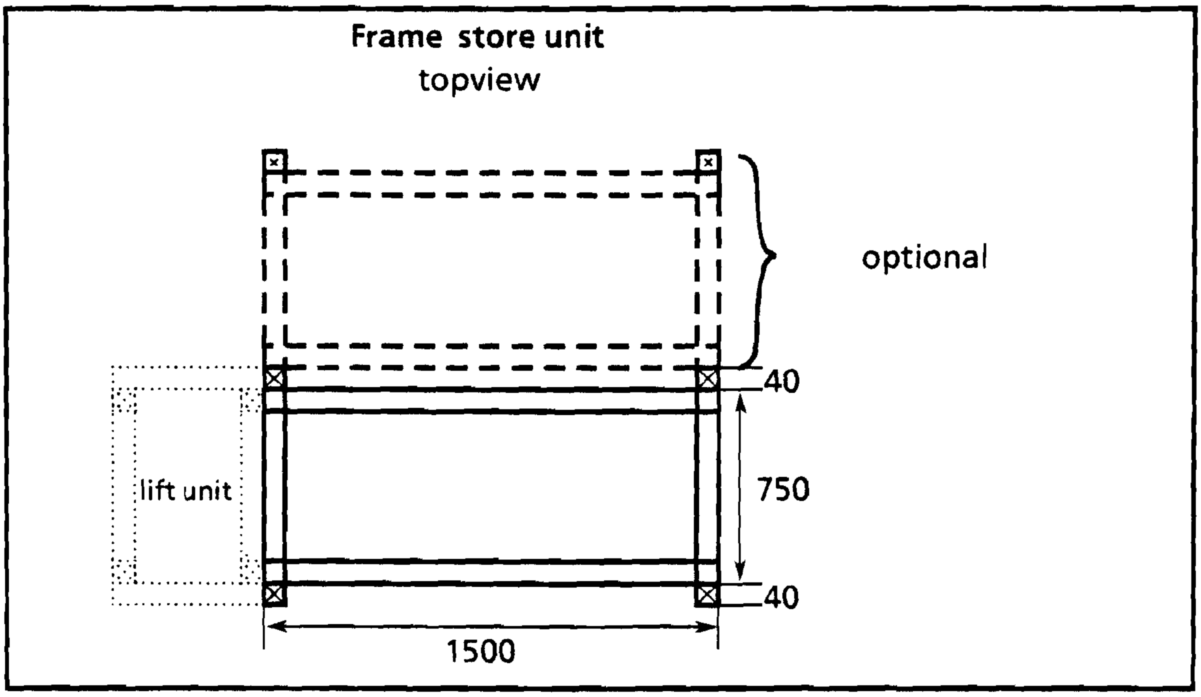
The interface agreements:

Push & return unit /assemblyline:	The transport pallet should be designed for pushing full containers off and returning the empty ones on the conveyor pallet.
Push unit/return unit:	The push unit should be attachable to the return unit;
Return unit/liftunit:	The push unit should be attachable to the return unit;
Liftunit/assemblyline:	entrance/exit width: >65 cm. entrance/exit height: 92.5 cm.
Lift unit/store unit:	exit/entrance width: >60 cm. exit/entrance heights: 85 cm. 125 cm. 45 cm. (optional third / lower level).
Unit connection:	The frames of the individual units should be connectable easily . Therefore is chosen for a frame construction that consists of easy connectable profiles. The profile system that is frequently used at RANK XEROX (Venray) is the BLOCAN® profile assembly system. The advantages of this system are: - variable use; - assembly friendly; - (easy) disconnectable joints; - many sided accessories. These properties come in extra handy because only few automated handling stations have to be built, because a automated handling station is only preferable at relatively high container arrival frequencies (see 4.5.3.).

In the preceeding part of this paragraph it becomes clear, that before designing the individual units, the interfaces should be designed or determined first. This can be done by designing the frame(s), in which the individual units can be placed.

Frame design.
The measurements of the chosen profiles of which the frame is constructed are: 40×40 mm. and 60×60 mm. (see appendix 14).





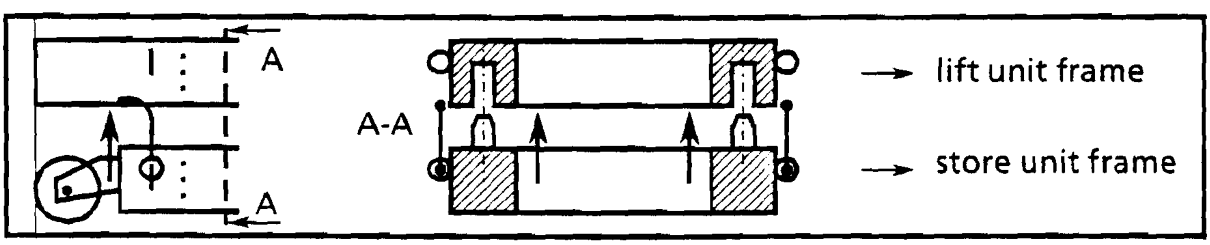
Other interfaces.
There are also interfaces which are not determined by the frames, namely:
- The connecting rollertrack between the assembly line and the lift unit,
- The coupling device between the lift unit and the store unit,
- The container pallet.

The connecting rollertrack assemblyline / lift unit.
This rollertrack should 'steer' the containers into the lift unit, after they are pushed off the conveyor pallet. This means that the entrance width is larger than a MN5 container and it's exit width must be 67 cm.
So the same width as the store rollertracks will do (75 cm.).
The rollertrack should be height adjustable for 100 mm. and + 100 mm.

The coupling device lift unit / store unit.
Because the store unit should be replacable, the lift and store unit should not be permanently fixed to each other. So there should be a coupling device, which fixes the position of the two mentioned units relatively to each other.

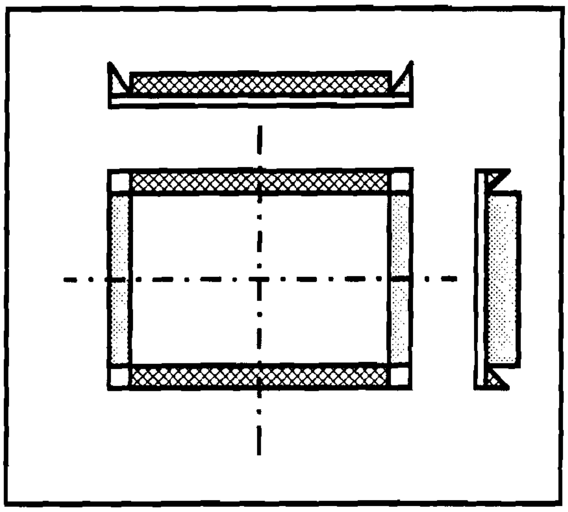
This can be done by:	- positioning:	pens (cilindrical, form fitted),
		blocks/planes (force fitted).
	- fixing:	clamps,
		hooks,
		magnets

An easy solution is the combination of hooks and positioning pens. The store frame (with holes in it) is first manoeuvred againts the lift unit frame to which the pens are fixed. Then the hooks should be fixed, so that the store can not move from its place anymore. (See the following figure).



The container pallet.
To make it possible for the push and return unit to push off and return the containers on the conveyor pallets, there are some design requirements for such container pallets, namely:
- MN2 and MN5 containers both should be transported by this pallet;
- The push unit should be able to push the containers off a pallet;
- The return unit should be able to return the container on a pallet;
- The containers may not move off the pallet during the transport.

The flat ground surface, that is as large as a MN5 box, is surrounded by sloped edges. These sloped edges help the positioning of the containers and make it possible to push off the containers when the push force is large enough.

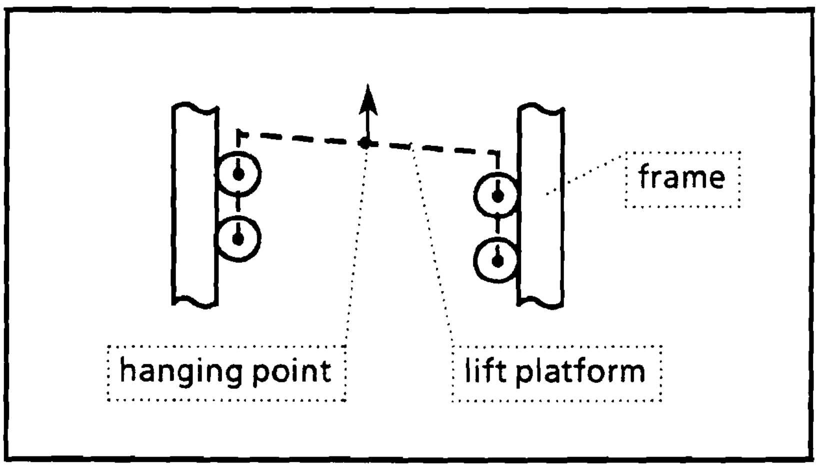


After determining the system area's, the interfaces and the sort of "building blocks"that will be used, it is possible to design the individual units.

4.5.5. The remaining problems of the unit design.

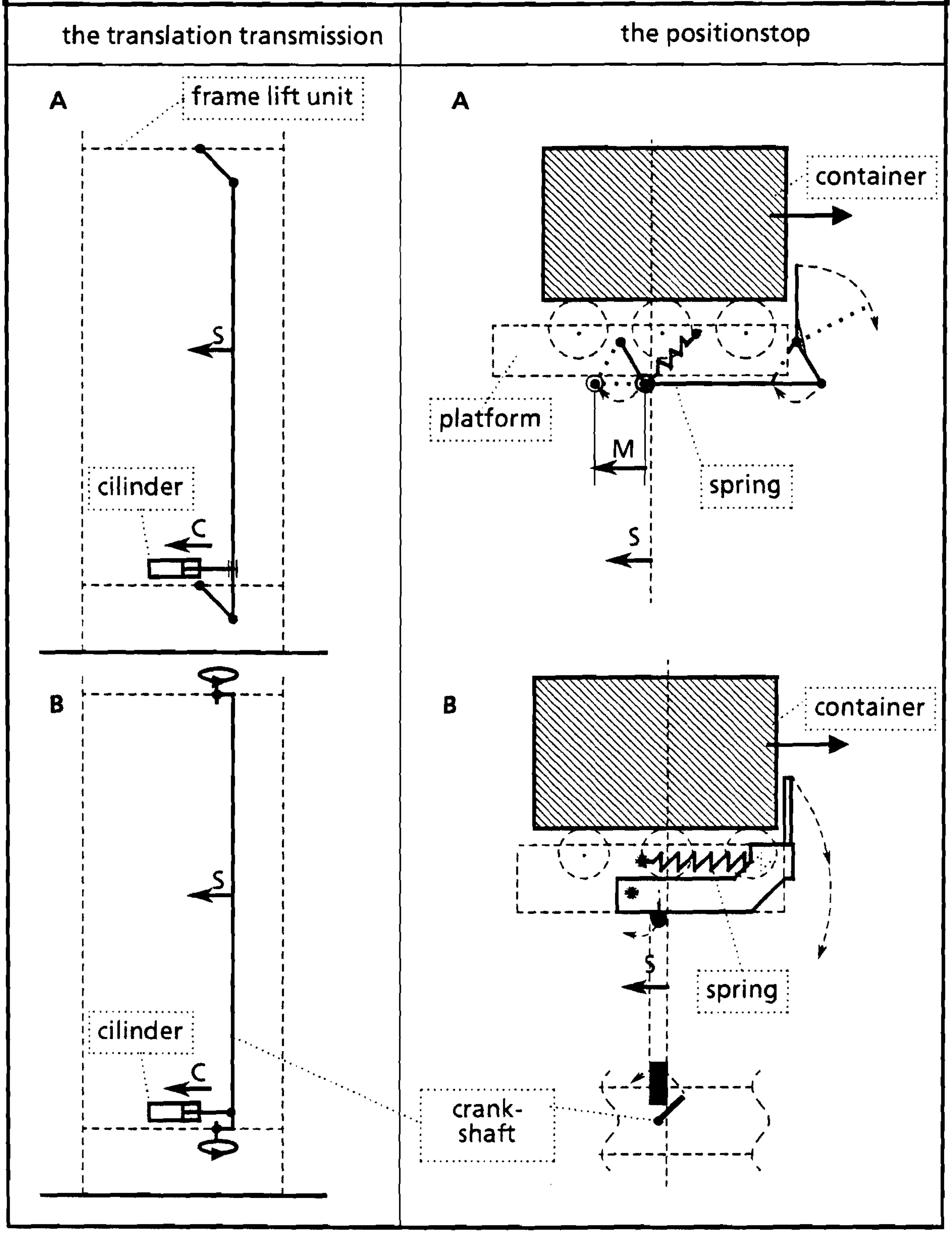
The lift unit.

Problem 1: The leading of the lift platform:
To prevent the rotation round the hanging point, each of the four leading points is provided by two leading wheels.



Problem 2: The position stop at the end of the platform.
It is not advisable to attach electric and pneumatic devices to the (moving) lift platfrom, because of possible cable breakage or leaking pressure tubes. The construction should also use as little space as possible. The following construction satisfies these demands (see the figure on page 51).

Schematic representation of the positionstop mechanisms



The translation transmission A has two disadvantages:
- its translation is highly dependable of the play an precision of the joints of the mechanism.
- It is relatively complex and voluminous.

The translation transmission B:
- is relatively compact, and
- has a little translation deviation, because of torsion of the axis.

The translation leading B is chosen.
The positionstop A is more complex than positionstop B, so positionstop B is chosen.

Problem 3: The transmission and the generator.
The needed motorpower (generator) and the strength of the toothed belts is determined as follows:

$m_{cont.} = \pm 15$ kg.;

$m_{platf.} = \pm 10$ kg.; $v = 0.25$ m/s ;

$g = 10$ m/s^2.

a = factor for the dynamic (acceleration) force and the friction force = 2

$F_g = (m_{cont.} + m_{platf.}) \times g = 250N$

$F_a = F_g \times a = 500N$

The estimated minimal needed motor power: $P = F_a \times v = 125W$.
When the width of a toothed belt is 10 mm., the power that can be carried over is 0.3 kW/10 mm., which is amply sufficient for this application.
Gear diameter = $\pm$100 mm. $\rightarrow$ n = $\pm$48 rpm. $\equiv \omega = 5\ s^{-1}$
$\rightarrow T = P/\omega = 25$ Nm
See appendix 14 for the design of the lift unit.

The return unit.
Problem : The cilinders need a stroke length of 500 mm. (which is a total cilinder length of 620 mm.) and a compact construction is required.
See appendix 14 for the design of the return unit.

The push unit.
Problem : The cilinders need a stroke length of 450 mm. (which is a total cilinderlength of 570 mm.) and a compact construction is required.
The position specifications:
passive position: higher than 300 mm. above the conveyor.
active position: higher than the container pallet (height 50 mm.) and low enough to be able to push a MN2 container (height 122 mm.) $\rightarrow$ between 75 and 100 mm. above the conveyor.
See appendix 14 for the design of the push unit.

Drawings
The drawings of the provisional design of the concepts, discussed in the previous paragraphs, are put in appendix 14.

Conclusions and recommendations.

Conclusions

The main problem for the increasing CRU production is a lack of space. This problem can be partly solved by decreasing the space that is requiredfor parts transport to the assembly line and storage at the assembly line.

Such a decrement can be achieved by the following proposals:

- an overhead conveyor from the main stores to the assembly line and back to the main stores (for parts containers and finished products);
- an assembly conveyor with flexible routings (for parts containers and products);
- make maximal use of small batches for the parts transport to the assembly line.

The execution of these proposals need an integrated approach to the complete material flow. Not only in the assembly area, but also in the main stores several changes must take place (for example: the change from pallet deliveries to box or container deliveries).

The advantages of the proposed system are:

- It is a flexible solution and when installed properly it can be at least as flexible as a AGV system.
- Its relative low space occupation.
- A tidy work floor.
- The system is able to transport the finished products back to the main stores as well.

The system has also some negative properties:

- Large product parts can only be transported in small batches what usually means high arrival frequencies and a high burdening of the assembly conveyor.
- When smaller aisles between the assembly grids are accomplished, it is more difficult to move heavy objects at the assembly line (for example heavy tooling / equipment).

Recommendations

Replenishment like the proposed system, deserves recommendation, because it works for ±90% of the product parts, *and* because of its "space creation", which makes it possible to increase the production in the same work area of building B (the main problem for the CRU production).

For the large product parts (±10% of all products) a dedicated solution should be developed, for example:

- a dedicated lift unit from and to the overhead conveyor at the station where these large parts are needed, or
- parts replenishment of these large parts in pallets at stations which are situated at the ends of the assembly conveyor.

A condition for this replenishment system is that the introduction of such a change of parts replenishment should happen in good consultation with the main stores department.

Automation of the exchange of containers between the assemblyconveyor and the stores at the assembly line should only be done for high container arrival frequencies.

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Manual materials handling,
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Taylor & Francis 1989

Ergonomie op de werkplek,
K.Poll, NIA, GAK,/NIA 1991

Systematic Handling Analysis, R. Mutter.

APPENDICES

Appendix 1 Project assignment description

On the next page the (dutch) project assignment description is shown.

OPDRACHTOMSCHRIJVING 10-10-1991

Student: J.C. van der Burg
Afstudeerhoogleraar: Prof. Ir. J.M. van Bragt
Begeleiders: Namens de TUE: Ir. A.T.J.M. Smals
Namens Rank Xerox: Ir. E. Mulder

KADER VAN DE OPDRACHT

Uitgaande van het door Rank Xerox Venray geimplementeerde voorraadbesturings- en transportsysteem (JIT-material-replenishment-systeem) en gebaseerd op concepten die ontwikkeld zijn ten behoeve van F.A.S., is de opdracht als volgt:

OPDRACHT

Er moeten een of meerdere voorstellen worden aangedragen voor:

- het benutten van de operationele en te activeren functionaliteit van dit JIT-material-replenishment-systeem en
- het ontwerpen van een modulair onderdelen-toevoermechanisme,

ten behoeve van het transport van onderdelen voor de assemblage van verschillende Customer-Replaceable-Unit-modellen op een (toekomstige) mix-build assemblyline.

TOELICHTING

Het betreft het transport van deze onderdelen, vanaf een intern voorraad- of produktiepunt tot binnen handbereik van een operator of assembleer- of hanteermachine.
Het kunnen toeleveren van de juiste hoeveelheden CRU-onderdelen op het juiste tijdstip op de juiste plaats bij een operator of machine is een hoofdeis voor het te ontwerpen systeem.
Uitgangspunten zijn:

- Het voorraadbesturingssysteem zoals dat nu aanwezig is (ATNS= Assembly Terminal Network System en XBMS= Xerox Bussiness Managing System);
- De produktievloer van de CRU-plant;
- De mogelijkheden van transport binnen Rank Xerox Venray.
- De geplande CRU-produktie wordt bepaald door de door Rank Xerox verwachte aantallen, die worden weergegeven in de Strategic Planning Assumptions (SPA).
- De afstudeeropdracht behoort te worden afgehandeld volgens de projektstrategie, zoals geformuleerd door prof. v. Bragt.
- De afstudeeropdracht behoort een constructief gedeelte te hebben.

VERSLAG, ETC.

Bij de secretaresse is verkrijgbaar:

1. Het memorandum "Afstuderen in de Produktietechnologie en -Automatisering".
2. Richtlijnen afstuderen bij onderwijsgroep "Specifieke produktiemiddelen".
3. "Wat moet waar en hoe in het verslag" door drs. P. Westendorp.

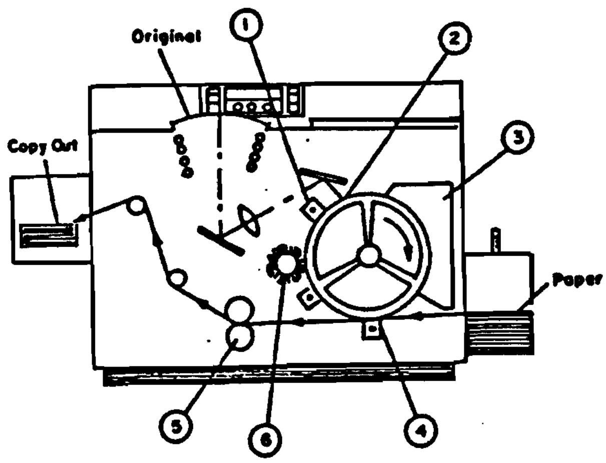
Voor akkoord: Prof. J.M. van Bragt,

Ir. A.T.J.M. Smals, Ir. E. Mulder,

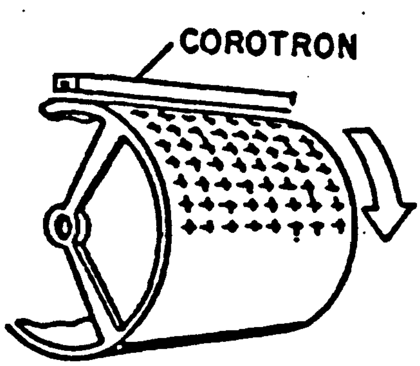
J.C. van der Burg,

Appendix 2 **The copy process**

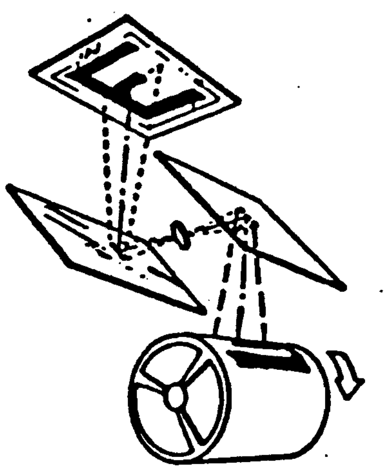
On the following pages is given the description of the copy process.



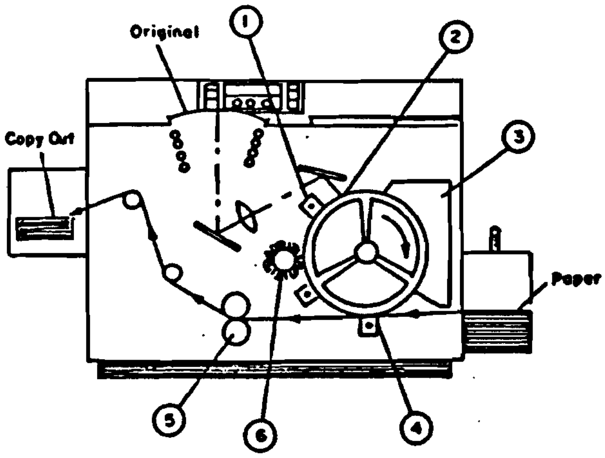
The steps of the Xerographic process.



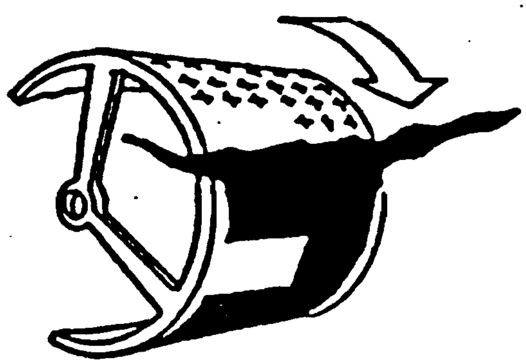
1. By rotating the drum (cilinder) along a high voltage wire (the corotron) the (with photoconductor coated) drum gets electro-staticly charged.
   These parts, the corotron and the drum are the mainparts of the CRU.



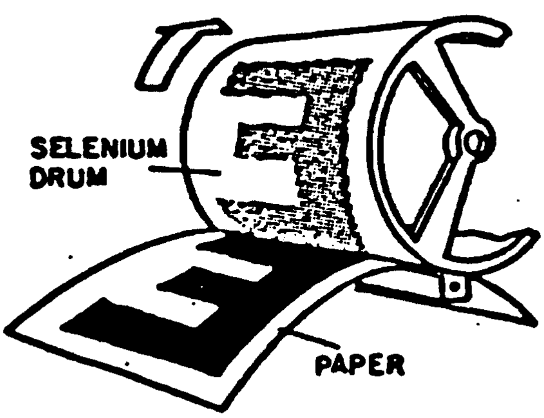
2. By projecting light on this drum the static charge disappears where the light reaches the drum and there arises a (latent) image of the original on the drum.



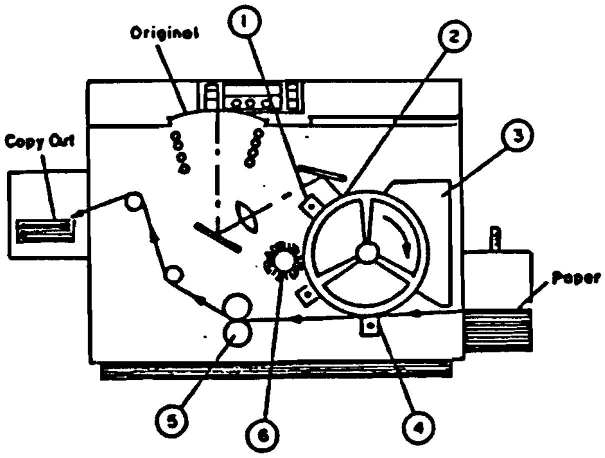
The steps of the Xerographic process.



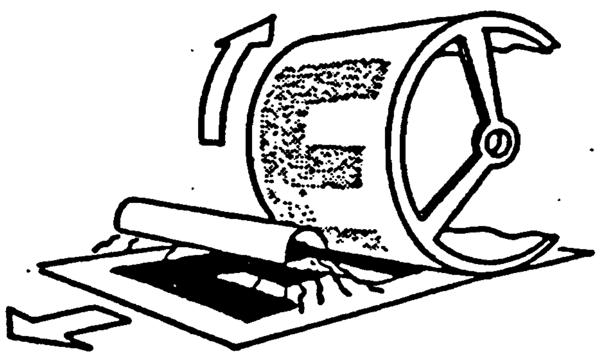
3. By bringing the toner dust (with an opposite charge) on the latent image, the toner will attach there where a static charge is present, so there appears a visible image on the drum.



4. The sheet of paper will be loaded on such a way, that when the sheet moves along the drum, the toner-image will be transfered from the drum on to the paper.

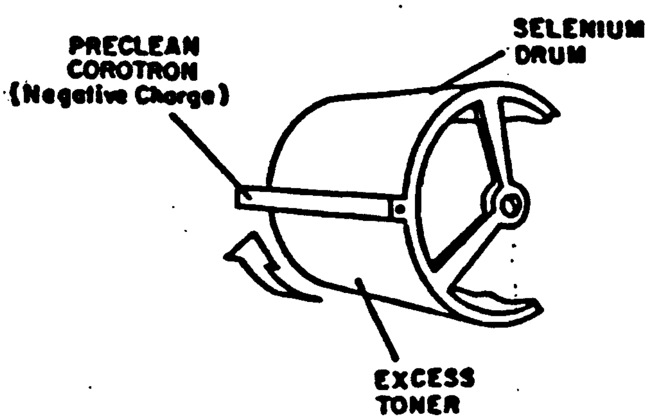


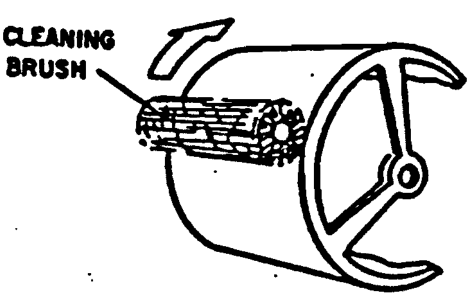
The steps of the Xerographic process.



. The toner that is still loose on the paper is melted on the paper by a heat source.

6. Finally the drum rotates along a discharging corotron, which loosens toner that's still on the drum, so that the toner easily can be removed from the drum by a scraper or a brush.
Now the Xerografic process can start all over again.





Appendix 3 The way of producing

In this appendix the LOTUS spreadsheet (+ listing) is printed with which a mix build schedule can be composed.

Productionschedule of the 5028 line, in 1993

Minimum length of a productionperiod: 3 days.

						# REPETITIONS <period 1,period 4> =			2	# REPETITIONS <period 5,period 8> =			3
						period 1	period 2	period 3	period 4	period 5	period 6	period 7	period 8
Product	Average dayrate	Labour st.	Average # hrs/day	cycle-time prod.sched. [days]	production periods /cyclet.	# of days 7 (hrs/day)	# of days 5 (hrs/day)	# of days 3 (hrs/day)	# of days 7 (hrs/day)	# of days 7 (hrs/day)	# of days 5 (hrs/day)	# of days 3 (hrs/day)	# of days 7 (hrs/day)
5014	376	0.13	49	22	1	154				154			
5017	146	0.25	37	22	1		161				161		
CBOW	160	0.13	21	22	1			153				153	
LV4	345	0.13	45	22	1				141				141
	Sum hrs/day:		151										
YANKTON*	66	0.15	10	110	2			182					
5028*	1080	0.15	162	110	18	171	171		171	171	171	171	171
	Sum [hrs/day]:		172		Used cap.:	325	332	334	312	325	332	324	312
	Tot. sum [hrs/day]:		323		Overcap.:	110	103	101	123	110	103	111	123
	Installed man. assytim DR		2900		Cap.variation [%]:	1	3	3	−3	1	3	0	−3
	Maximum capacity:		435	100%	323								

* 5028-family

Product	(products /day)	(products /day)	(products /day)	(products /day)	(products /day)	(products /day)	(products /day)	(products /day)
5014	1182	0	0	0	1182	0	0	0
5017	0	642	0	0	0	642	0	0
CBOW	0	0	1173	0	0	0	1173	0
LV4	0	0	0	1084	0	0	0	1084
YANKTON*	0	0	1210	0	0	0	0	0
5028*	1142	1142	0	1142	1142	1142	1142	1142

Product	(products /period)	(products /period)	(products /period)	(products /period)	(products /period)	(products /period)	(products /period)	(products /period)
5014	8272	0	0	0	8272	0	0	0
5017	0	3212	0	0	0	3212	0	0
CBOW	0	0	3520	0	0	0	3520	0
LV4	0	0	0	7590	0	0	0	7590
YANKTON*	0	0	3630	0	0	0	0	0
5028*	7996	5712	0	7996	7996	5712	3427	7996

```
A:A1: {Page 1/1 SWISS24} 'Productionschedule of the 5028 line, in 1993
A:E4: {Bold} 'Minimum length of a productionperiod: 3 days.
A:G7: {LTB} '# REPETITIONS <period 1,period 4> =
A:J7: {RTB} +F17
A:K7: {LTB} '# REPETITIONS <period 5,period 8> =
A:N7: {RTB} +E17/E12-F17
A:G8: {LTB} 'period 1
A:H8: {LTB} 'period 2
A:I8: {LTB} 'period 3
A:J8: {LTB} 'period 4
A:K8: {LTB} 'period 5
A:L8: {LTB} 'period 6
A:M8: {LTB} 'period 7
A:N8: {LRTB} 'period 8
A:A9: {Page LRT} 'Product
A:B9: {LRT} 'Average
A:C9: {LRT} [W10] 'Labour
A:D9: {LRT} 'Average
A:E9: {LT} 'cycle-time
A:F9: {LT} 'production
A:G9: {L} '# of days
A:H9: {L} '# of days
A:I9: {L} '# of days
A:J9: {L} '# of days
A:K9: {L} '# of days
A:L9: {L} '# of days
A:M9: {L} '# of days
A:N9: {LR} '# of days
A:B10: {LR} 'dayrate
A:C10: {LR} [W10] 'st.
A:D10: {LR} '# hrs/day
A:E10: {L} 'prod.sched.
A:F10: {L} 'periods
A:G10: {L} 7
A:H10: {L} 5
A:I10: {L} 3
A:J10: {L} 7
A:K10: {L} +$G$10
A:L10: {L} +$H$10
A:M10: {L} +$I$10
A:N10: {LR} +$J$10
A:E11: {LB} '[days]
A:F11: {L} ' /cyclet.
A:G11: {LTB} '(hrs/day)
A:H11: {LTB} '(hrs/day)
A:I11: {LTB} '(hrs/day)
A:J11: {LTB} '(hrs/day)
A:K11: {LTB} '(hrs/day)
A:L11: {LTB} '(hrs/day)
A:M11: {LTB} '(hrs/day)
A:N11: {LRTB} '(hrs/day)
A:A12: {Page LRTB} '5014
A:B12: {LRTB} 376
A:C12: {LRTB} [W10] 0.13
A:D12: {LRTB} (F0) +C12*B12
A:E12: {LRTB} @SUM(G10..J10)
```

```
A:F12: {LRTB} (F0) 1
A:G12: {LRTB} (F0) +$E12*$D12/(G$10*$F12)
A:K12: {LRTB} (F0) +$E12*$D12/K$10
A:A13: {Page LRTB} '5017
A:B13: {LRTB} 146
A:C13: {LRTB} [W10] 0.25
A:D13: {LRTB} (F0) +C13*B13
A:E13: {LRTB} +E$12
A:F13: {LRTB} (F0) 1
A:H13: {LRTB} (F0) +$E13*$D13/(H$10*$F13)
A:L13: {LRTB} (F0) +$E13*$D13/L$10
A:A14: {Page LRTB} 'CBOW
A:B14: {LRTB} 160
A:C14: {LRTB} [W10] 0.13
A:D14: {LRTB} (F0) +C14*B14
A:E14: {LRTB} +E$12
A:F14: {LRTB} (F0) 1
A:I14: {LRTB} (F0) +$E14*$D14/(I$10*$F14)
A:M14: {LRTB} (F0) +$E14*$D14/M$10
A:A15: {Page LRTB} 'LV4
A:B15: {LRTB} 345
A:C15: {LRTB} [W10] 0.13
A:D15: {LRTB} (F0) +C15*B15
A:E15: {LRTB} +E$12
A:F15: {LRTB} (F0) 1
A:J15: {LRTB} (F0) +$E15*$D15/(J$10*$F15)
A:N15: {LRTB} (F0) +$E15*$D15/N$10
A:B16: {LTB} '       Sum hrs/day:
A:D16: {LRTB} (F0) @SUM(D12..D15)
A:A17: {Page LRTB} 'YANKTON*
A:B17: {LRTB} 66
A:C17: {LRTB} [W10] 0.15
A:D17: {LRTB} (F0) +C17*B17
A:E17: {LRTB} 5*E$12
A:F17: {LRTB} (F0) 2
A:I17: {LRTB} (F0) +$E$17*$D$17/($I$10*$F$17)
A:A18: {Page LRTB} '5028*
A:B18: {LRTB} 1080
A:C18: {LRTB} [W10] 0.15
A:D18: {LRTB} (F0) +C18*B18
A:E18: {LRTB} +E$17
A:F18: {LRTB} (F0) +E18/E12*4-$F$17
A:G18: {LRTB} (F0) +$E$18*$D$18/($E$18-$F$17*$I$10)
A:H18: {LRTB} (F0) +$E$18*$D$18/($E$18-$F$17*$I$10)
A:J18: {LRTB} (F0) +$E$18*$D$18/($E$18-$F$17*$I$10)
A:K18: {LRTB} (F0) +$E$18*$D$18/($E$18-$F$17*$I$10)
A:L18: {LRTB} (F0) +$E$18*$D$18/($E$18-$F$17*$I$10)
A:M18: {LRTB} (F0) +$E$18*$D$18/($E$18-$F$17*$I$10)
A:N18: {LRTB} (F0) +$E$18*$D$18/($E$18-$F$17*$I$10)
A:B19: {LTB} '     Sum [hrs/day]:
A:D19: {LRTB} (F0) @SUM(D17..D18)
A:F19: {LRTB} (F0) 'Used cap.:
A:G19: {LRTB} (F0) @SUM(G12..G18)
A:H19: {LRTB} (F0) @SUM(H12..H18)
A:I19: {LRTB} (F0) @SUM(I12..I18)
A:J19: {LRTB} (F0) @SUM(J12..J18)
```

```
A:K19: {LRTB} (F0) @SUM(K12..K18)
A:L19: {LRTB} (F0) @SUM(L12..L18)
A:M19: {LRTB} (F0) @SUM(M12..M18)
A:N19: {LRTB} (F0) @SUM(N12..N18)
A:B20: {LB} 'Tot. sum [hrs/day]:
A:D20: {B} (F0) +D16+D19
A:F20: {RTB} '   Overcap.:
A:G20: {LRTB} (F0) +$D$22-G19
A:H20: {LRTB} (F0) +$D$22-H19
A:I20: {LRTB} (F0) +$D$22-I19
A:J20: {LRTB} (F0) +$D$22-J19
A:K20: {LRTB} (F0) +$D$22-K19
A:L20: {LRTB} (F0) +$D$22-L19
A:M20: {LRTB} (F0) +$D$22-M19
A:N20: {LRTB} (F0) +$D$22-N19
A:B21: {LB} 'Installed man. assytim DR:
A:D21: {B} 2900
A:E21: {LT} '           Cap.variation [%]:
A:G21: {LRTB} (F0) -100+G$19/$D$20*100
A:H21: {LRTB} (F0) -100+H$19/$D$20*100
A:I21: {LRTB} (F0) -100+I$19/$D$20*100
A:J21: {LRTB} (F0) -100+J$19/$D$20*100
A:K21: {LRTB} (F0) -100+K$19/$D$20*100
A:L21: {LRTB} (F0) -100+L$19/$D$20*100
A:M21: {LRTB} (F0) -100+M$19/$D$20*100
A:N21: {LRTB} (F0) -100+N$19/$D$20*100
A:B22: {LB} 'Maximum capacity:
A:D22: {B} 0.15*D21
A:E22: {LB} '           100%=
A:F22: {RB} (F0) +D20
A:A23: {Page} '* 5028-family
A:F24: {LT} 'Product
A:G24: {LT} '(products
A:H24: {LT} '(products
A:I24: {LT} '(products
A:J24: {LRT} '(products
A:K24: {LT} '(products
A:L24: {LT} '(products
A:M24: {LT} '(products
A:N24: {LRT} '(products
A:G25: {L} '          /day)
A:H25: {L} '          /day)
A:I25: {L} '          /day)
A:J25: {LR} '          /day)
A:K25: {L} '          /day)
A:L25: {L} '          /day)
A:M25: {L} '          /day)
A:N25: {LR} '          /day)
A:F26: {LRTB} '5014
A:G26: {LRTB} (F0) +G12/$C12
A:H26: {LRTB} (F0) +H12/$C12
A:I26: {LRTB} (F0) +I12/$C12
A:J26: {LRTB} (F0) +J12/$C12
A:K26: {LRTB} (F0) +K12/$C12
A:L26: {LRTB} (F0) +L12/$C12
```

```
A:M26: {LRTB} (F0) +M12/$C12
```

```
A:N26: {LRTB} (F0) +N12/$C12
A:F27: {LRTB} '5017
A:G27: {LRTB} (F0) +G13/$C13
A:H27: {LRTB} (F0) +H13/$C13
A:I27: {LRTB} (F0) +I13/$C13
A:J27: {LRTB} (F0) +J13/$C13
A:K27: {LRTB} (F0) +K13/$C13
A:L27: {LRTB} (F0) +L13/$C13
A:M27: {LRTB} (F0) +M13/$C13
A:N27: {LRTB} (F0) +N13/$C13
A:F28: {LRTB} 'CBOW
A:G28: {LRTB} (F0) +G14/$C14
A:H28: {LRTB} (F0) +H14/$C14
A:I28: {LRTB} (F0) +I14/$C14
A:J28: {LRTB} (F0) +J14/$C14
A:K28: {LRTB} (F0) +K14/$C14
A:L28: {LRTB} (F0) +L14/$C14
A:M28: {LRTB} (F0) +M14/$C14
A:N28: {LRTB} (F0) +N14/$C14
A:F29: {LRTB} 'LV4
A:G29: {LRTB} (F0) +G15/$C15
A:H29: {LRTB} (F0) +H15/$C15
A:I29: {LRTB} (F0) +I15/$C15
A:J29: {LRTB} (F0) +J15/$C15
A:K29: {LRTB} (F0) +K15/$C15
A:L29: {LRTB} (F0) +L15/$C15
A:M29: {LRTB} (F0) +M15/$C15
A:N29: {LRTB} (F0) +N15/$C15
A:F31: {LRTB} 'YANKTON*
A:G31: {LRTB} (F0) +G17/$C17
A:H31: {LRTB} (F0) +H17/$C17
A:I31: {LRTB} (F0) +I17/$C17
A:J31: {LRTB} (F0) +J17/$C17
A:K31: {LRTB} (F0) +K17/$C17
A:L31: {LRTB} (F0) +L17/$C17
A:M31: {LRTB} (F0) +M17/$C17
A:N31: {LRTB} (F0) +N17/$C17
A:F32: {LRTB} '5028*
A:G32: {LRTB} (F0) +G18/$C18
A:H32: {LRTB} (F0) +H18/$C18
A:I32: {LRTB} (F0) +I18/$C18
A:J32: {LRTB} (F0) +J18/$C18
A:K32: {LRTB} (F0) +K18/$C18
A:L32: {LRTB} (F0) +L18/$C18
A:M32: {LRTB} (F0) +M18/$C18
A:N32: {LRTB} (F0) +N18/$C18
A:F34: {LT} 'Product
A:G34: {LT} '(products
A:H34: {LT} '(products
A:I34: {LT} '(products
A:J34: {LRT} '(products
A:K34: {LT} '(products
A:L34: {LT} '(products
```

```
A:M34: {LT} '(products
A:N34: {LRT} '(products
A:G35: {L} '      /period)
```

```
A:H35: {L} '      /period)
A:I35: {L} '      /period)
A:J35: {LR} '      /period)
A:K35: {L} '      /period)
A:L35: {L} '      /period)
A:M35: {L} '      /period)
A:N35: {LR} '      /period)
A:F36: {LRTB} '5014
A:G36: {LRTB} (F0) +G26*G$10
A:H36: {LRTB} (F0) +H26*H$10
A:I36: {LRTB} (F0) +I26*I$10
A:J36: {LRTB} (F0) +J26*J$10
A:K36: {LRTB} (F0) +K26*K$10
A:L36: {LRTB} (F0) +L26*L$10
A:M36: {LRTB} (F0) +M26*M$10
A:N36: {LRTB} (F0) +N26*N$10
A:F37: {LRTB} '5017
A:G37: {LRTB} (F0) +G27*G$10
A:H37: {LRTB} (F0) +H27*H$10
A:I37: {LRTB} (F0) +I27*I$10
A:J37: {LRTB} (F0) +J27*J$10
A:K37: {LRTB} (F0) +K27*K$10
A:L37: {LRTB} (F0) +L27*L$10
A:M37: {LRTB} (F0) +M27*M$10
A:N37: {LRTB} (F0) +N27*N$10
A:F38: {LRTB} 'CBOW
A:G38: {LRTB} (F0) +G28*G$10
A:H38: {LRTB} (F0) +H28*H$10
A:I38: {LRTB} (F0) +I28*I$10
A:J38: {LRTB} (F0) +J28*J$10
A:K38: {LRTB} (F0) +K28*K$10
A:L38: {LRTB} (F0) +L28*L$10
A:M38: {LRTB} (F0) +M28*M$10
A:N38: {LRTB} (F0) +N28*N$10
A:F39: {LRTB} 'LV4
A:G39: {LRTB} (F0) +G29*G$10
A:H39: {LRTB} (F0) +H29*H$10
A:I39: {LRTB} (F0) +I29*I$10
A:J39: {LRTB} (F0) +J29*J$10
A:K39: {LRTB} (F0) +K29*K$10
A:L39: {LRTB} (F0) +L29*L$10
A:M39: {LRTB} (F0) +M29*M$10
A:N39: {LRTB} (F0) +N29*N$10
A:F41: {LRTB} 'YANKTON*
A:G41: {LRTB} (F0) +G31*G$10
A:H41: {LRTB} (F0) +H31*H$10
A:I41: {LRTB} (F0) +I31*I$10
A:J41: {LRTB} (F0) +J31*J$10
A:K41: {LRTB} (F0) +K31*K$10
A:L41: {LRTB} (F0) +L31*L$10
A:M41: {LRTB} (F0) +M31*M$10
```

```
A:N41: {LRTB} (F0) +N31*N$10
A:F42: {LRTB} '5028*
A:G42: {LRTB} (F0) +G32*G$10
A:H42: {LRTB} (F0) +H32*H$10
A:I42: {LRTB} (F0) +I32*I$10
```

```
A:J42: {LRTB} (F0) +J32*J$10
A:K42: {LRTB} (F0) +K32*K$10
A:L42: {LRTB} (F0) +L32*L$10
A:M42: {LRTB} (F0) +M32*M$10
A:N42: {LRTB} (F0) +N32*N$10
```

Appendix 4

In this appendix the LOTUS spreadsheet (+listing) is printed in which the properties of the parts are registrated and combined as described in paragraph 2.1.3. .

Read instruction for the LOTUS spreadsheets.

1. In the upper tableframe are given the productname and its production number.
2. Under the line 'AGV adresses' are given the assembly station numbers of the product. Under each assembly station number is given the (calculated) quantity of container sorts for that are destined for that station.
3. Under the headlines '1JB=Special materials; 1SB=PMS; 2P=STORE' are given the (calculated) quantities of containersorts (calculated for all parts).
4. In the biggest (and also lowest) tableframe on the worksheet are given the partnumbers, description quantity per product and the pack codes, from which the needed data (see2. and 3.) is calculated.

PAGE	PRODUCT	
A4.2	5028	
A4.3	5014	
A4.4	5017	
A4.5	Superstar	
A4.6 - A4.13	5014	(combined with a production schedule), listing included.

5029	100

5028	CUMMULATIVE	AGV-ADRESSES AGV 3000	AGV 3010	AGV 3020	AGV 3030	AGV 3040	AGV 3050	AGV 3070	AGV 3080	AGV 3090	AGV 3115	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x
AA [#/DAY]	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CC* [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH* [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** D [#/DAY]	54.06	0.17	0.22	0.26	0.08	0.63	0.20	0.24	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
**K [#/DAY]	62.17	33.33	12.50	2.65	0.00	1.67	0.91	0.00	0.00	0.00	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
# AA places	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
# CC* places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# HH* places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# ** D places	30	6	3	3	1	4	1	4	0	1	0	0	0	0	0	0	0	0
# ** K places	7	1	1	2	0	1	1	0	0	0	1	0	0	0	0	0	0	0

5028	AGV-ADRESSES AGV x	AGV x	AGV x	AGV x	AGV xx	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV xx	AGV x	AGV x	AGV x	AGV x
AA [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CC* [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH* [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** D [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
**K [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
# AA places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# CC* places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# HH* places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# ** D places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# ** K places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

5028	1JB = Special Materials	1SB = PMS	2P = STORE
AA [#/DAY]	0.00	0.00	0.31
CC* [#/DAY]	0.00	0.00	0.01
HH* [#/DAY]	0.00	0.00	0.42
** D [#/DAY]	0.00	0.00	2.88
**K [#/DAY]	0	67.65385	32.5734
# AA places	0	0	4
# CC* places	1	0	1
# HH* places	0	0	4
# ** D places	0	0	38
# ** K places	0	6	8

CODE	TRANSPORT-UNIT TO ASSEMBLYLINE
AA*	BOX-PALLET (FULL HIGHT, WOODEN, FOR INTERNAL USE)
CC*	BOX-PALLET (HALF HIGHT, WOODEN, FOR INTERNAL USE)
HH*	GROUNDPALLET
** D	MN 2 / TOTE TN

Partnumber	Description	PMGP	QTY	XRPK	XMV	XCON	XIPQ	AGV	# of AA-places	Qty AA	# of CC-places	Qty CC*	# of HH-places	Qty HH*	# of D-places	Qty ** D	# of K-places	Qty ** K
002E016423	COVER	1SB	1.00000	HK	88	K	3	3000	0	0	0	0	0	0	0	0	1	0.333333
016E006040	PRECHARGE INSERT	2P	1.00000	HD	14000	D	700	3000	0	0	0	0	0	0	1	0.001429	0	0
071E000350	HOTSTAMPFOIL 120MMX	2P	0.00010	HD	42700	D	2135	3000	0	0	0	0	0	0	1	4.7E-08	0	0
071E000360	HOTSTAMPFOIL 60MMX3	2P	0.00010	HD	73200	D	3660	3000	0	0	0	0	0	0	1	2.7E-08	0	0
091E045300	TOP COPY CART.	2P	1.00000	HD	200000	D	10000	3000	0	0	0	0	0	0	1	0.0001	0	0
091E046310	COPY CART. ARROW	2P	2.00000	HD	300000	D	15000	3000	0	0	0	0	0	0	1	0.000133	0	0
091E051200	LABEL FX	2P	0.00000	HD	60000	D	3000	3000	0	0	0	0	0	0	0	0	0	0
091E051220	P/R J2	2P	0.00000	HD	60000	D	3000	3000	0	0	0	0	0	0	0	0	0	0
091E061880	LABEL BAR CODE	2P	2.00000	HD	2304000	D	36000	3000	0	0	0	0	0	0	1	0.000056	0	0
001E011332	PHOTO REC. FRAME	1SB	1.00000	HK	200	K	10	14	0	0	0	0	0	0	0	0	1	0.1
001E011342	DRIVE ROLL FRAME	1SB	1.00000	HK	200	K	10	15	0	0	0	0	0	0	0	0	1	0.1
001E017690	MID-FRAME	1SB	1.00000	HK	100	K	8	3010	0	0	0	0	0	0	0	0	1	0.125
003E003550	HANDLE	2P	1.00000	HD	10000	D	500	3020	0	0	0	0	0	0	1	0.002	0	0
003E008682	BUTTON	2P	1.00000	HD	60000	D	4000	3020	0	0	0	0	0	0	1	0.00025	0	0
003R090102	COPY PAPER A3/80GRMS	2P	0.01200	HK	100	K	5	10	0	0	0	0	0	0	0	0	1	0.0024
006R090127	CHEYENNE TONER	2P	0.00200	HH	192	X	96	10	0	0	0	0	1	0.00001	0	0	0	0
006R090147	TONER 1065	1JB	0.00200	CC	198	--	0	13	0	0	1	0.00001	0	0	0	0	0	0
007E007230	PULLEY 28THTO	2P	1.00000	HD	15000	D	750	12	0	0	0	0	0	0	1	0.001333	0	0
009E017360	WIRE SPRING	2P	1.00000	HD	120000	D	6000	3010	0	0	0	0	0	0	1	0.000167	0	0
010E000371	EDGE ERASE SLIDE	1SB	1.00000	HK	650	K	650	3020	0	0	0	0	0	0	0	0	1	0.001538
010E001470	GRID PLUNGER	2P	1.00000	HD	30000	D	1500	15	0	0	0	0	0	0	1	0.000667	0	0
016E000641	DRIVE BUSHING	2P	1.00000	HD	20000	D	1000	12	0	0	0	0	0	0	1	0.001	0	0
016E001441	DRIVE BUSHING FRONT	2P	1.00000	HD	20000	D	1000	12	0	0	0	0	0	0	1	0.001	0	0
016K000254	DRIVE ROLL LLF	2P	1.00000	HH	1050	X	50	12	0	0	0	0	1	0.000952	0	0	0	0
016K000261	TENSION ROLL LLF	2P	1.00000	HH	1050	X	50	14	0	0	0	0	1	0.000952	0	0	0	0
018K000403	INDICATOR ASSY HT	2P	1.00000	HD	4800	D	240	3040	0	0	0	0	0	0	1	0.004167	0	0
026E007980	SCREW-PLAST. CROSS	2P	8.00000	HD	180000	D	9000	3080	0	0	0	0	0	0	1	0.000889	0	0
033E000141	CLEANER BLADE	2P	1.00000	HD	10000	D	500	3040	0	0	0	0	0	0	1	0.002	0	0
033E000730	CLEANER BLADE-WING	2P	1.00000	HD	320000	D	16000	3040	0	0	0	0	0	0	1	0.000063	0	0
033E000840	27MM WING BLADE	2P	1.00000	HD	240000	D	12000	3040	0	0	0	0	0	0	1	0.000083	0	0
035E006581	FLAP SEAL	2P	1.00000	HD	120000	D	6000	3070	0	0	0	0	0	0	1	0.000167	0	0
035E010931	HINGE PLUG	2P	1.00000	HD	30000	D	1500	13	0	0	0	0	0	0	1	0.000667	0	0
035E011091	SEAL-HV CONTACT	2P	1.00000	HD	60000	D	3000	3020	0	0	0	0	0	0	1	0.000333	0	0
035K002041	SEAL-CLEANER	2P	1.00000	HK	2200	K	110	3050	0	0	0	0	0	0	0	0	1	0.009091
035K002051	SEAL FIBER TRAP	2P	1.00000	HKK	15000	K	750	3050	0	0	0	0	0	0	0	0	0	0
035K003211	HINGE SEAL	2P	1.00000	HD	24000	D	1200	15	0	0	0	0	0	0	1	0.000833	0	0
035K003221	MIDFRAME SEAL	2P	1.00000	HD	36000	D	1800	3070	0	0	0	0	0	0	1	0.000556	0	0
035K003230	GRID PLUG SEAL	2P	1.00000	HD	200000	D	10000	15	0	0	0	0	0	0	1	0.0001	0	0
035K003930	GRID CONTACT SEAL	2P	1.00000	HK	6000	K	60	15	0	0	0	0	0	0	0	0	1	0.0126
042E000310	END SEAL	2P	2.00000	HD	20000	D	1000	3050	0	0	0	0	0	0	1	0.002	0	0
042E000323	CLEANER HOLDER	1SB	1.00000	HK	840	K	60	3040	0	0	0	0	0	0	0	0	1	0.016667
055E011071	GRID, SCOROTRON, DAG	2P	1.00000	HD	40000	D	2000	13	0	0	0	0	0	0	1	0.0005	0	0
055E011851	AIR FILTER	2P	1.00000	HK	1500	K	40	3020	0	0	0	0	0	0	0	0	1	0.025
055E012430	SHELD TOP	2P	1.00000	HK	450	K	90	3115	0	0	0	0	0	0	0	0	1	0.011111
055K006752	SHELDBOTTOM ASSY	2P	1.00000	AA	400	--	0	3115	1	0.0025	0	0	0	0	0	0	0	0
062E000890	REFLECTOR	2P	1.00000	HD	60000	D	3000	15	0	0	0	0	0	0	1	0.000333	0	0
063P020161	TAPE	2P	0.00000	HK	200	K	36	0	0	0	0	0	0	0	0	0	0	0
064E000820	BELT-PHTRCP	2P	1.00000	AA*	0	--	0	13	0	0	0	0	0	0	0	0	0	0
090K000832	PLATEN ASSYLLF	2P	1.00000	HK	1024	K	64	14	0	0	0	0	0	0	0	0	1	0.015625
116E000291	GRID CONTACT	2P	1.00000	HD	30000	D	1500	0	0	0	0	0	0	0	1	0.000667	0	0
116E002600	BELT GROUND CONN	2P	1.00000	HD	64000	D	1000	3010	0	0	0	0	0	0	1	0.001	0	0
116E003221	WIRE CONTACT	2P	1.00000	HD	20000	D	1000	3010	0	0	0	0	0	0	1	0.001	0	0
117E003232	WIRE INSUL	2P	1.00000	HD	24000	D	1200	3070	0	0	0	0	0	0	1	0.000833	0	0
117E005240	INSUL. WIRE CLAMP	2P	1.00000	HD	24000	D	1200	3070	0	0	0	0	0	0	1	0.000833	0	0
117E008430	WIRE GOLD PLATED	2P	0.80000	HD	64000	D	1000	3030	0	0	0	0	0	0	1	0.0008	0	0
236W000551	NUT PUSH ON	2P	2.00000	HD	180000	D	9000	12	0	0	0	0	0	0	1	0.000222	0	0
400W000440	SPRING-COMPR SQ	2P	1.00000	HD	60000	D	3000	15	0	0	0	0	0	0	1	0.000333	0	0
409W000591	SPRING-COMPR SQ	2P	2.00000	HD	20000	D	1000	14	0	0	0	0	0	0	1	0.002	0	0
063E000610	HOTMELT VS703/1 20KG	2P	0.00020	CC	4	--	0	11	0	0	1	0.00005	0	0	0	0	0	0
074K001520	MNAT PALLET	2P	0.02500	HH	11	--	0	11	0	0	0	0	1	0.002273	0	0	0	0
091E022780	BARCODE LBL 24240200	2P	0.04170	HK	60000	K	6000	11	0	0	0	0	0	0	0	0	1	7.0E-06
095E032480	TAPE 810 19MMX66MTR	2P	0.00200	HD	480	D	24	11	0	0	0	0	0	0	1	0.000083	0	0
502P003767	CARTON LABEL	2P	2.00000	HD	240000	D	12000	11	0	0	0	0	0	0	1	0.000167	0	0
502P010761	INSTRUCTION SHEET	2P	1.00000	CD	4000	D	200	11	0	0	0	0	0	0	0	0	0	0
502P010777	1618MTR/ROLL METAL F	2P	0.00070	AA	6	--	0	11	1	0.000117	0	0	0	0	0	0	0	0
502P031044	COMMON END-CAP	2P	2.00000	HK	168	K	8	11	0	0	0	0	0	0	0	0	1	0.25
502P053119	CARTON DIS SPEC.	2P	1.00000	ZZ	540	--	0	11	0	0	0	0	0	0	0	0	0	0
502P053120	END PAD.	2P	2.00000	AA	5000	--	0	11	1	0.0004	0	0	0	0	0	0	0	0
504E003470	WRAPP 500MM-ROLL A	2P	0.00050	AA	12	--	0	11	1	0.000042	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0

5014	100

		AGV-ADRESSES																
5014	CUMMULATIVE	AGV 1	AGV 2	AGV 3	AGV 4	AGV 5	AGV 6	AGV 7	AGV 8	AGV 9	AGV 10	AGV 11	AGV 12	AGV 13	AGV 14	AGV 15	AGV 16	AGV 17
AA [#/DAY]	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.00
CC * [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH * [#/DAY]	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.26	0.00	0.26	0.00	0.00	0.00	0.00
** D [#/DAY]	11.00	0.05	0.06	0.07	0.03	0.16	0.06	0.05	0.00	0.25	1.00	0.25	0.00	0.10	0.00	0.00	0.00	0.00
** K [#/DAY]	8.95	0.00	0.00	0.62	0.00	0.18	0.00	5.02	2.50	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00
# AA places	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
# CC * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# HH * places	5	0	0	0	0	0	0	0	0	0	1	1	0	3	0	0	0	0
# ** D places	29	3	2	2	1	3	2	1	1	1	2	1	0	1	0	0	0	0
# ** K places	9	0	0	2	0	1	0	2	1	0	0	0	3	0	0	0	0	0

	AGV-ADRESSES																
5014	AGV 18	AGV 19	AGV 20	AGV 21	AGV 22	AGV 23	AGV 24	AGV 25	AGV 26	AGV 27	AGV 28	AGV 29	AGV 30	AGV 31	AGV 32	AGV 33	AGV 34
AA [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CC * [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH * [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** D [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** K [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
# AA places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# CC * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# HH * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# ** D places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# ** K places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

CODE	TRANSPORT-UNIT TO ASSEMBLYLINE
AA *	BOX-PALLET (FULL HIGHT, WOODEN, FOR INTERNAL USE)
CC *	BOX-PALLET (HALF HIGHT, WOODEN, FOR INTERNAL USE)
HH *	GROUNDPALLET
** D	MN 2 / TOTE TN

5014	1JB = Special Materials	1SB = PMS	2P = STORE
AA [#/DAY]	0.00	0.00	0.36
CC * [#/DAY]	0.00	0.00	0.00
HH * [#/DAY]	0.00	0.00	0.94
** D [#/DAY]	0.00	0.00	2.04
** K [#/DAY]	0.00	0.00	8.95
# AA places	0	0	2
# CC * places	0	0	0
# HH * places	0	0	5
# ** D places	0	0	19
# ** K places	0	0	9

Partnumber	Description	PMGP	QTY	XRPK	XMV	XCON	XIPQ	AGV	# of AA-places	Qty AA	# of CC-places	Qty CC *	# of HH-places	Qty HH *	# of D-places	Qty ** D	# of K-places	Qty ** K
002E031460	HSG XERO MOD	1SB	0.00000	HK	72	K	4	2	0	0	0	0	0	0	0	0	0	0
002K028120	CVR ASSY FRNT	2P	1.00000	HH	400	K	60	11	0	0	0	0	1	0.0025	0	0	0	0
002K031410	COVER ASSEMBLY	2P	1.00000	HK	144	K	20	7	0	0	0	0	0	0	0	0	1	0.05
006E017560	SHAFT DRUM	2P	1.00000	HD	3200	D	100	10	0	0	0	0	0	0	1	0.01	0	0
007E014220	GEAR PADDLE	2P	1.00000	HD	76800	D	1200	5	0	0	0	0	0	0	1	0.000833	0	0
007E014230	GEAR IDLER	2P	1.00000	HD	96000	D	1500	5	0	0	0	0	0	0	1	0.000667	0	0
008R060200	DUSTING POUCH	2P	0.00300	HD	6400	D	100	8	0	0	0	0	0	0	1	0.00003	0	0
008R060200	DUSTING POUCH	2P	0.00300	HD	6400	D	100	10	0	0	0	0	0	0	1	0.00003	0	0
015E012690	PLATE GRIDED	2P	1.00000	HD	128000	D	2000	7	0	0	0	0	0	0	1	0.0005	0	0
015E012720	SUPPORT BRKT	2P	1.00000	HD	25600	D	400	11	0	0	0	0	0	0	1	0.0025	0	0
019E016010	FINGER DRUM	2P	1.00000	HD	25600	D	400	9	0	0	0	0	0	0	1	0.0025	0	0
020K003140	DRUM ASSY	2P	1.03000	HH	240	X	20	10	0	0	0	0	1	0.004292	0	0	0	0
020K003770	WHEEL ASSY	1L	3.00000	HD	512000	D	8000	2	0	0	0	0	0	0	1	0.000375	0	0
027E001670	NUT SPEED	2P	1.00000	HD	640000	D	10000	5	0	0	0	0	0	0	1	0.0001	0	0
033E001750	PADDLE	2P	1.00000	HK	2800	K	560	5	0	0	0	0	0	0	0	0	1	0.001786
033K000700	BLADE ASSY	2P	1.00000	HK	5400	K	40	8	0	0	0	0	0	0	0	0	1	0.025
035E011180	SEAL BLADE I B	2P	1.00000	HD	192000	D	3000	3	0	0	0	0	0	0	1	0.000333	0	0
035E011190	SEAL BLADE O B	2P	1.00000	HD	160000	D	2500	3	0	0	0	0	0	0	1	0.0004	0	0
035E011210	SEAL DRUM O B	2P	1.00000	HD	256000	D	4000	6	0	0	0	0	0	0	1	0.00025	0	0
035E011220	SEAL DRUM I B	2P	1.00000	HD	192000	D	3000	6	0	0	0	0	0	0	1	0.000333	0	0
035E090590	SEAL PADDLE	2P	1.00000	HD	256000	D	4000	4	0	0	0	0	0	0	1	0.00025	0	0
035K002560	SEAL ASSY TNR	2P	1.00000	HK	1000	K	200	3	0	0	0	0	0	0	0	0	1	0.005
091E045470	LABEL	2P	0.00000	HK	20	K	4	12	0	0	0	0	0	0	0	0	0	0
091E061880	LABEL BAR CODE	2P	1.00000	HK	120000	K	6000	12	0	0	0	0	0	0	0	0	1	0.000167
091E061880	LABEL BAR CODE	2P	1.00000	HK	120000	K	6000	7	0	0	0	0	0	0	0	0	1	0.000167
095K008260	ASSEMBLY,WRAPPING	2P	1.00000	HK	750	K	150	12	0	0	0	0	0	0	0	0	1	0.006667
121K003760	MAG RUBBER	2P	1.00000	HD	256000	D	4000	2	0	0	0	0	0	0	1	0.00025	0	0
063E000340	TAPE 75MM-1 ROLL =10	2P	0.00100	HK	36	K	4	3	0	0	0	0	0	0	0	0	1	0.00025
088K020470	5012/5014 COMMON CR	1L	0.00000		0		0	0	0	0	0	0	0	0	0	0	0	0
086K020472	UNIQUE Y-1 RX CRU	1L	0.00000		0		0	0	0	0	0	0	0	0	0	0	0	0
502P053658	BOX 5012/14 13R22	2P	1.00000	HH	600		0	13	0	0	0	0	1	0.001667	0	0	0	0
504E003690	TOP PAD 116X90CM 16-	2P	0.00000	HH	200		0	0	0	0	0	0	0	0	0	0	0	0
020P061463	STAR WHEEL	2P	3.00000	HD	1280000	D	20000	1	0	0	0	0	0	0	1	0.00015	0	0
030E051780	INNER SUPPORT	2P	3.00000	HD	1280000	D	20000	1	0	0	0	0	0	0	1	0.00015	0	0
030E051790	SUPPORT OUTER	2P	3.00000	HD	1280000	D	20000	1	0	0	0	0	0	0	1	0.00016	0	0
074K001520	M.NAT.PALLET	2P	0.01160	HH	13		0	13	0	0	0	0	1	0.000892	0	0	0	0
095E026260	BAG METALIZED 22	2P	1.00000	HK	10000	K	2000	12	0	0	0	0	0	0	0	0	1	0.0005
095E027230	METALIZED POLY ROLL	2P	0.00000	HH	6000		0	0	0	0	0	0	0	0	0	0	0	0
501K001600	END CAP ASSY 1012/50	2P	1.00000	AA	275		0	13	1	0.003636	0	0	0	0	0	0	0	0
502P010779	HOT MELT TYPE 242 26	2P	0.00000	CC*	0	X	0	0	0	0	0	0	0	0	0	0	0	0
502P010836	ADHESIVE INST SHT	2P	0.00000		0		0	0	0	0	0	0	0	0	0	0	0	0
504E003470	WRAPP 500MM-ROLL A	2P	0.00020	AA	12000	X	1000	13	1	1.7E-08	0	0	0	0	0	0	0	0
504E003690	TOP PAD 116X90CM 16-	2P	0.01000	HH	200		0	13	0	0	0	0	1	0.00005	0	0	0	0
002K031400	MODULE ASSY	1L	1.00000		0		0	0	0	0	0	0	0	0	0	0	0	0
502P010822	INSTRUCTIONS 5012/50	2P	1.00000	HD	64000	D	1000	13	0	0	0	0	0	0	1	0.001	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0

5017	100

		AGV-ADRESSES																
5017	CUMMULATIVE	AGV 1000	AGV 1010	AGV 1020	AGV 1030	AGV 1060	AGV 1050	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x
AA [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CC * [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH * [#/DAY]	0.51	0.00	0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** D [#/DAY]	11.09	0.00	1.34	9.61	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** K [#/DAY]	51.67	0.00	1.67	0.00	0.00	0.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
# AA places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# CC * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# HH * places	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# ** D places	37	0	12	20	0	0	3	0	0	0	0	0	0	0	0	0	0	0
# ** K places	2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

	AGV-ADRESSES																
5017	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x
AA [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CC * [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH * [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** D [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** K [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
# AA places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# CC * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# HH * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# ** D places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# ** K places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PRODUCT	DAYRATE
5017	100

5017	1 JB = Special Materials	1 SB = PMS	2P = STORE
AA [#/DAY]	0.00	0.00	0.00
CC * [#/DAY]	0.00	0.00	0.00
HH * [#/DAY]	0.00	0.00	0.51
** D [#/DAY]	0.00	0.00	11.68
** K [#/DAY]	3.57	0.00	51.87
# AA places	0	0	0
# CC * places	0	0	0
# HH * places	0	0	1
# ** D places	0	0	42
# ** K places	0	0	3

CODE	TRANSPORT-UNIT TO ASSEMBLYLINE
AA *	BOX-PALLET (FULL HIGHT, WOODEN, FOR INTERNAL USE)
CC *	BOX-PALLET (HALF HIGHT, WOODEN, FOR INTERNAL USE)
HH *	GROUNDPALLET
** D	MN 2 / TOTE TN
** K	MN 5 - BOX

Aanname: PMS produkten worden in het begin van de lijn op de pallet gezet,
en niet over de lijn in dozen vervoerd.

Partnumber	Description	PMGP	QTY	XRPK	XMV	XCON	XIPQ	AGV	# of AA-places	Qty AA	# of CC-places	Qty CC *	# of HH-places	Qty HH *	# of D-places	Qty ** D	# of K-places	Qty ** K
0007000000	WIRE	2P	A;R	??	0	?	0	0	0	0	0	0	0	0	0	0	0	0
0007000000	KYNER	0	1	??	0	?	0	0	0	0	0	0	0	0	0	0	0	0
052K090160	PIPE ASSY	2P	1	HD	6400	D	64	1020	0	0	0	0	0	0	1	0.015625	0	0
013E092560	BEARING I.B	2P	1	HD	135000	D	2000	1020	0	0	0	0	0	0	1	0.0005	0	0
007E080140	GEAR PADDLE	2P	1	HD	192000	D	3000	1020	0	0	0	0	0	0	1	0.000333	0	0
158W027665	SCREW	2P	1	HD	640000	D	10000	1020	0	0	0	0	0	0	1	0.0001	0	0
020K090910	DRUM ASSY	2P	1	HH	198	R	198	1020	0	0	0	0	1	0.005051	0	0	0	0
007E080130	GEAR PADDLE	2P	1	HD	320000	D	5000	1020	0	0	0	0	0	0	1	0.0002	0	0
015E082971	PLATE STOP	2P	1	HD	14080	D	220	1020	0	0	0	0	0	0	1	0.004545	0	0
013E092550	BEARING O.B	2P	1	HD	16000	D	250	1020	0	0	0	0	0	0	1	0.004	0	0
048K91693	COVER ASSY XERO	1 JB	1	HH	288	Q	288	1040	0	0	0	0	0	0	0	0	0	0
026E082620	SCREW TAPPING	2P	4	HD	640000	D	10000	1040	0	0	0	0	0	0	1	0.0004	0	0
158W027655	SCREW (DEL TITE)	2P	5	HD	640000	D	10000	1040	0	0	0	0	0	0	1	0.0005	0	0
158W027655	SCREW (DEL TITE)	2P	2	HD	640000	D	10000	1020	0	0	0	0	0	0	1	0.0002	0	0
007E080100	GEAR IDLER	2P	1	HD	115200	D	1800	1020	0	0	0	0	0	0	1	0.000556	0	0
007E080120	GEAR IDLER	2P	1	HD	192000	D	3000	1020	0	0	0	0	0	0	1	0.000333	0	0
158W027655	SCREW (DEL TITE)	2P	4	HD	640000	D	10000	2	0	0	0	0	0	0	0	0	0	0
158W028055	SCREW	2P	1	HD	640000	D	10000	1020	0	0	0	0	0	0	1	0.0001	0	0
002E072760	COVER CART	1 JB	1	HK	280	K	28	1040	0	0	0	0	0	0	0	0	1	0.035714
125K090682	COROTRON ASSY	2P	1	HD	2304	D	36	1020	0	0	0	0	0	0	0	0	0	0
158W027656	SCREW (DEL TITE)	2P	3	HD	640000	D	10000	3	0	0	0	0	0	0	0	0	0	0
026P063516	SCREW TAPPING	2P	2	HD	640000	D	10000	3	0	0	0	0	0	0	0	0	0	0
140K063750	PWB ASSY CRU	2P	1	HD	22400	D	350	1040	0	0	0	0	0	0	1	0.002857	0	0
002E071661	COVER RAIL	1 JB	1	HK	1500	K	75	1040	0	0	0	0	0	0	0	0	0	0
035E080250	SEAL HOUSING	2P	2	HD	960000	D	4000	1010	0	0	0	0	0	0	1	0.0005	0	0
121E091020	MAG. RUBBER	2P	1	HD	51200	D	800	1010	0	0	0	0	0	0	1	0.00125	0	0
035E080261	SEAL SIDE	2P	2	HD	512000	D	8000	1010	0	0	0	0	0	0	1	0.00025	0	0
002E071640	HOUSING ASSY	1 JB	1	HK	110	K	6	1000	0	0	0	0	0	0	0	0	0	0
009E082780	SPRING COMPRES	2P	1	HD	720000	D	3000	1040	0	0	0	0	0	0	1	0.000333	0	0
251W024251	WASHER T=0.8	2P	1	HD	640000	D	10000	1040	0	0	0	0	0	0	1	0.0001	0	0
005E080360	SHAFT FINGER	2P	1	HK	32000	K	500	1040	0	0	0	0	0	0	0	0	1	0.002
035K090930	FILM SEAL	2P	1	HD	6400	D	3000	1010	0	0	0	0	0	0	1	0.000333	0	0
019K090880	FINGER ASSY	2P	2	HD	76800	D	1200	1040	0	0	0	0	0	0	1	0.001667	0	0
354W021251	RING E	2P	1	HD	640000	D	10000	1020	0	0	0	0	0	0	1	0.0001	0	0
354W021251	RING E	2P	0	HD	640000	D	10000	1020	0	0	0	0	0	0	0	0	0	0
006K091730	SHAFT ASSY AUGER	2P	2	HD	2000	D	100	1020	0	0	0	0	0	0	1	0.02	0	0
007E080110	GEAR AUGER	2P	1	HD	192000	D	3000	1020	0	0	0	0	0	0	1	0.000333	0	0
033K090461	PADDLE ASSY	2P	1	HD	5120	D	80	1020	0	0	0	0	0	0	1	0.0125	0	0
013K090310	BEARING ASSY	2P	1	HD	384000	D	6000	1020	0	0	0	0	0	0	1	0.000167	0	0
033K090450	BLADE ASSY	2P	1	HD	3072	D	48	1020	0	0	0	0	0	0	1	0.020833	0	0
009E082750	SPRING EXTENSION	2P	1	HD	1440000	D	6000	1020	0	0	0	0	0	0	1	0.000167	0	0
026E082620	SCREW TAPPING	2P	2	HD	640000	D	10000	1020	0	0	0	0	0	0	1	0.0002	0	0
354W021251	RING E	2P	1	HD	640000	D	10000	1040	0	0	0	0	0	0	1	0.0001	0	0
035E080550	SEALDRUM O.B	2P	1	HD	192000	D	3000	1010	0	0	0	0	0	0	1	0.000333	0	0
016K093581	PLATE ASSY MAG	2P	1	HD	4480	D	70	1020	0	0	0	0	0	0	1	0.014286	0	0
035E080560	SEAL DRUM I.B	2P	1	HD	192000	D	3000	1010	0	0	0	0	0	0	1	0.000333	0	0
000P063169	STOPPER MODULE	2P	1	HD	128000	D	2000	1010	0	0	0	0	0	0	1	0.0005	0	0
158W027656	SCREW (DEL TITE)	2P	3	HD	640000	D	10000	1010	0	0	0	0	0	0	1	0.0003	0	0
068E071971	BRACKET PLATE	2P	1	HD	12800	D	200	1010	0	0	0	0	0	0	1	0.005	0	0
354W021251	RING E	2P	1	HD	640000	D	10000	1010	0	0	0	0	0	0	1	0.0001	0	0
007E080090	GEAR FINGER	2P	1	HD	32000	D	500	1010	0	0	0	0	0	0	1	0.002	0	0
016K093740	PLATE ASSY FRONT	2P	1	HK	1200	K	60	1010	0	0	0	0	0	0	0	0	1	0.016667
007E080080	GEAR IDLER	2P	1	HD	25600	D	400	1010	0	0	0	0	0	0	1	0.0025	0	0
006R090127	CHEYENNE TONER	2P	0.002	HH	192	X	96	9	0	0	0	0	0	0	0	0	0	0
003R090102	COPY PAPER A3/80GRMS	2P	0.012	HH	100	--	0	9	0	0	0	0	0	0	0	0	0	0
504E003470	WRAPPING	2P	1	HH	2400	-	0	10	0	0	0	0	0	0	0	0	0	0
095E020260	BAG	2P	1	HD	28160	D	440	1050	0	0	0	0	0	0	1	0.002273	0	0
091E061880	BARCODE LABEL	2P	3	HD	2304000	D	36000	1050	0	0	0	0	0	0	1	0.000083	0	0
074K001520	PALLET	2P	0.02	HH	11	-	0	12	0	0	0	0	0	0	0	0	0	0
0007000000	PALLETLABEL	2P	0.04	HD	40960	D	640	12	0	0	0	0	0	0	0	0	0	0
0007000000	DESICCANT	0	1	??	0	?	0	1050	0	0	0	0	0	0	0	0	0	0
0007000000	INSTRUCTION	2P	1	HD	128000	D	20000	1050	0	0	0	0	0	0	1	0.00005	0	0
0007000000	CAP (PAIR)	2P	1	HK	200	K	4	12	0	0	0	0	0	0	0	0	0	0
0007000000	BOX	2P	1	HK	260	K	2	1050	0	0	0	0	0	0	0	0	1	0.5
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0

SUPERSTAR	100

SUPERSTAR	CUMMULATIVE	AGV-ADRESSES AGV 2050	AGV 2060	AGV 2070	AGV 1000	AGV 2110	AGV 2120	AGV 2130	AGV 2140	AGV 2600	AGV 2510	AGV 2520	AGV 2530	AGV 2540	AGV 2550	AGV 2560	AGV 2570	AGV 2580
AA [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CC * [# DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH * [# DAY]	2.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** D [#/DAY]	9.23	0.97	0.00	0.00	0.18	1.08	4.50	0.03	0.00	0.00	0.00	0.68	0.00	0.09	0.25	0.00	0.02	0.00
** K [#/DAY]	64.60	0.60	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.00	0.00	2.00	0.00	6.67

# AA places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# CC * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# HH * places	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# ** D places	58	7	0	0	5	5	6	1	0	0	0	5	0	3	2	0	2	0
# ** K places	10	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1

SUPERSTAR	AGV-ADRESSES AGV 2590	AGV 2600	AGV 2610	AGV 2620	AGV 2700	AGV 2710	AGV 2720	AGV 2730	AGV 2800	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x	AGV x
AA [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CC * [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH * [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** D [#/DAY]	0.16	1.03	0.00	0.00	0.04	0.05	0.02	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** K [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

# AA places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# CC * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# HH * places	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
# ** D places	2	2	0	0	3	1	1	3	0	0	0	0	0	0	0	0	0
# ** K places	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0

PRODUCT	DAYRATE
SUPERSTAR	100

SUPERSTAR	1JB = Special Materials	1SB = PMS	2P = STORE
AA [#/DAY]	0.00	0.00	0.00
CC * [#/DAY]	0.00	0.00	0.00
HH * [#/DAY]	0.00	0.00	2.88
** D [#/DAY]	0.00	0.00	9.52
** K [#/DAY]	0.00	0.00	64.60

# AA places	0	0	0
# CC * places	0	0	0
# HH * places	0	0	2
# ** D places	0	0	54
# ** K places	0	0	10

CODE	TRANSPORT - UNIT TO ASSEMBLYLINE
AA *	BOX-PALLET (FULL HIGHT, WOODEN, FOR INTERNAL USE)
CC *	BOX-PALLET (HALF HIGHT, WOODEN, FOR INTERNAL USE)
HH *	GROUNDPALLET
** D	MN 2 / TOTE TN
** K	MN 5 - BOX

Partnumber	Description	PMGP	QTY	XRPK	XMV	XCON	XIPQ	AGV	# of AA-places	Qty AA	# of CC-places	Qty CC *	# of HH-places	Qty HH *	# of D-places	Qty ** D	# of K-places	Qty ** K
283EP00124	PADDLE SHAFT	2P	1	HD	256000	D	4000	1000	0	0	0	0	0	0	1	0.00025	0	0
283EP00123	PADDLE	2P	1	HK	6600	K	330	1000	0	0	0	0	0	0	0	0	1	0.00303
283EP00127	GEAR IDLER	2P	1	HD	51200	D	800	1000	0	0	0	0	0	0	1	0.00125	0	0
283EP00140	HSG XEROX	1SB	1	HH	90	Q	90	1000	0	0	0	0	0	0	0	0	0	0
283EF00125	FELT PADDLE	2P	1	HD	2560000	D	40000	1000	0	0	0	0	0	0	1	0.000025	0	0
283EP00126	GEAR PADDLE	2P	1	HD	224000	D	3500	1000	0	0	0	0	0	0	1	0.000286	0	0
283EO00128	P STOP (*1*)	2P	1	HD	2560000	D	400000	1000	0	0	0	0	0	0	1	2.5E-06	0	0
283EM00121	SPRING SHAFT	2P	1	HD	640000	D	10000	2520	0	0	0	0	0	0	1	0.0001	0	0
283EO00128	P STOP (*2*)	2P	1	HD	2560000	D	400000	2520	0	0	0	0	0	0	1	2.5E-06	0	0
283EP00119	LINK A	2P	1	HD	38400	D	600	2520	0	0	0	0	0	0	1	0.001667	0	0
283EM00120	LINK B	2P	1	HD	16000	D	250	2520	0	0	0	0	0	0	1	0.004	0	0
283EP00141	COVER OPC	2P	1	HK	4160	K	208	2520	0	0	0	0	0	0	0	0	1	0.004785
283EO00129	SEAL PADDLE	2P	1	HD	64000	D	1000	2520	0	0	0	0	0	0	1	0.001	0	0
283EO00130	SEAL CLEAN	2P	4	HD	2560000	D	40000	2540	0	0	0	0	0	0	1	0.0001	0	0
035K095430	SEAL ASSY TONER	2P	0	HD	1	D	50	2540	0	0	0	0	0	0	0	0	0	0
283EO00132	SEAL DRUM O.B	2P	1	HD	160000	D	2500	2540	0	0	0	0	0	0	1	0.0004	0	0
283EO00133	MAG RUBBER	2P	1	HD	32000	D	500	2550	0	0	0	0	0	0	1	0.002	0	0
283EO00131	SEAL DRUM I/B	2P	1	HD	160000	D	2500	2540	0	0	0	0	0	0	1	0.0004	0	0
026E098040	SCREW M3 (*1*)	2P	6	HD	76800	D	12000	2550	0	0	0	0	0	0	1	0.0005	0	0
033K095280	BLADE DOCTOR ASSY	2P	1	HK	600	K	50	2560	0	0	0	0	0	0	0	0	1	0.02
283AS00721	BLADE ASSY	2P	1	HD	2048000	D	32000	2570	0	0	0	0	0	0	1	0.000031	0	0
026E098040	SCREW TAPPING (*1*)	2P	2	HD	768000	D	12000	2570	0	0	0	0	0	0	1	0.000167	0	0
283AS00137	DRUM ASSY	2P	1	HK	400	K	15	2580	0	0	0	0	0	0	0	0	1	0.066667
283AS00109	CS ASSY	2P	1	HD	6272	D	96	2600	0	0	0	0	0	0	1	0.010204	0	0
026E086180	SCREW M3 (*1*)	2P	1	HD	76800	D	12000	2600	0	0	0	0	0	0	1	0.000083	0	0
283AS00117	SHAFT OB ASSY	2P	1	HD	80000	D	1250	2590	0	0	0	0	0	0	1	0.0008	0	0
283AS00114	SHAFT IB ASSY	2P	1	HD	80000	D	1250	2590	0	0	0	0	0	0	1	0.0008	0	0
026E086180	SCREW M3 (*2*)	2P	2	HD	76800	D	12000	15	0	0	0	0	0	0	1	0.000167	0	0
283EP00729	PIN CONNECT	2P	2	HD	768000	D	12000	2700	0	0	0	0	0	0	1	0.000167	0	0
283EM00704	SPRING O/B	2P	1	HD	640000	D	10000	2700	0	0	0	0	0	0	1	0.0001	0	0
283EM00703	SPRING I/B	2P	1	HD	512000	D	8000	2700	0	0	0	0	0	0	1	0.000125	0	0
090E004000	LABEL M/N CARTRIDGE	2P	1	HD	128000	D	2000	2710	0	0	0	0	0	0	1	0.0005	0	0
283EP00139	COVER CARTRIDGE	1SB	1	AA	110	K	0	2710	0	0	0	0	0	0	0	0	0	0
026E098040	SCREW M3 (*2*)	2P	2	HD	76800	D	12000	2720	0	0	0	0	0	0	1	0.000167	0	0
090E086730	LABEL NO.3	2P	1	HD	1280000	D	20000	2730	0	0	0	0	0	0	1	0.00005	0	0
283EO00752	TAPE LEVER	2P	1	HD	768000	D	1200	2730	0	0	0	0	0	0	1	0.000833	0	0
283AS00716	SEAL LEVER	2P	1	HD	160000	D	2500	2730	0	0	0	0	0	0	1	0.0004	0	0
095E037490	BOX CRU (V-US)	2P	1	HK	640	K	2	2800	0	0	0	0	0	0	0	0	1	0.5
095E088360	PAD BOTTOM	2P	1	HH	52	-	0	2800	0	0	0	0	1	0.019231	0	0	0	0
095E088380	BAG	2P	1	HK	64000	K	1000	2800	0	0	0	0	0	0	0	0	1	0.001
094K095050	WICK ASSY	2P	1	HK	3640	K	182	2800	0	0	0	0	0	0	0	0	1	0.005495
0007000000	BAG WICK	2P	1	HD	128000	D	2000	23	0	0	0	0	0	0	1	0.0005	0	0
095E088370	PAD TOP	2P	1	HH	104	-	0	2800	0	0	0	0	1	0.009615	0	0	0	0
600E096270	INSTRUCTION (V)	2P	1	HK	1000	K	50	2800	0	0	0	0	0	0	0	0	1	0.02
0007000000	BAG TC	2P	1	HD	128000	D	2000	23	0	0	0	0	0	0	1	0.0005	0	0
0007000000	T/C ASSY	2P	1	HK	1000	K	50	2800	0	0	0	0	0	0	0	0	1	0.02
283EP00728	GEAR AGITATOR	2P	1	HD	8640	D	135	2050	0	0	0	0	0	0	1	0.007407	0	0
283EP00753	HSG DEVE LOWER	1SB	1	HH	200	R	200	2050	0	0	0	0	0	0	0	0	0	0
283EP00732	HSG DEVE UPPER	1SB	1	HH	3200	K	160	2050	0	0	0	0	0	0	0	0	0	0
283EP00723	BUSH AGITATOR	2P	1	HD	384000	D	6000	2050	0	0	0	0	0	0	1	0.000167	0	0
283AS00719	AGITATOR ASSY SUB	2P	1	HK	4000	K	200	2050	0	0	0	0	0	0	0	0	1	0.005
283EP00705	SEAL INNER	2P	1	HD	512000	D	8000	2050	0	0	0	0	0	0	1	0.000125	0	0
283EF00707	RING FELT	2P	1	HD	384000	D	6000	2050	0	0	0	0	0	0	1	0.000167	0	0
283AS00713	SEAL RIM ASSY	2P	1	HD	64000	D	1000	2050	0	0	0	0	0	0	1	0.001	0	0
283ER00706	RING RUBBER	2P	1	HD	3072000	D	48000	2050	0	0	0	0	0	0	1	0.000021	0	0
0007000000	TONER	1JB	610 GR	HH	200	-	200	2050	0	0	0	0	0	0	0	0	0	0
021E095370	CAP TONER	2P	1	HD	76800	D	1200	2050	0	0	0	0	0	0	1	0.000833	0	0
283EF00709	SEAL MAG (O/B)	2P	1	HD	640000	D	10000	2100	0	0	0	0	0	0	1	0.0001	0	0
033K095271	ASSY BLADE	2P	1	HD	7680	D	120	2110	0	0	0	0	0	0	1	0.008333	0	0
283EO00751	SEAL MAG	2P	2	HD	1152000	D	1800	2110	0	0	0	0	0	0	1	0.001111	0	0
283EP00712	SEAL BLADE	2P	1	HD	43776	D	684	2100	0	0	0	0	0	0	1	0.001462	0	0
283EF00708	SEAL MAG (I/B)	2P	1	HD	640000	D	10000	2100	0	0	0	0	0	0	1	0.0001	0	0
026E087840	SCREW FLANGE	2P	2	HD	768000	D	12000	2110	0	0	0	0	0	0	1	0.000167	0	0
283EP00725	GEAR MAG	2P	1	HD	192000	D	3000	2120	0	0	0	0	0	0	1	0.000333	0	0
283EP00755	BEARING O/B	2P	1	HD	9216	D	144	2120	0	0	0	0	0	0	1	0.006944	0	0
283EP00727	GEAR IDLER 2	2P	1	HD	76800	D	1200	2110	0	0	0	0	0	0	1	0.000833	0	0
121K097960	ASSY ROL MAG	2P	1	HD	600	D	30	2120	0	0	0	0	0	0	1	0.033333	0	0
283EP00724	ROLL TRACKING	2P	2	HD	384000	D	6000	2120	0	0	0	0	0	0	1	0.000333	0	0
283EP00754	BEARING I/B	2P	1	HD	17920	D	280	2120	0	0	0	0	0	0	1	0.003571	0	0
283EP00726	GEAR IDLER 1	2P	1	HD	160000	D	2500	2110	0	0	0	0	0	0	1	0.0004	0	0
283EM00722	BEARING PLATE O/B	2P	1	HD	128000	D	2000	2120	0	0	0	0	0	0	1	0.0005	0	0
026E098040	SCREW TAPPING (*2*)	2P	4	HD	768000	D	12000	2130	0	0	0	0	0	0	1	0.000333	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0

product (family)	period 1 products/day	period 1 7 (days)	period 2 5 (days)	period 3 3 (days)	period 4 7 (days)	period 5 7 (days)	period 6 5 (days)	period 7 3 (days)	period 8 7 (days)
5014	1182	1182				1182			
5017	642		642				642		
CBOW	1173			1173				1173	
LV4	1084				1084				1084
YANKTON	1210			1210					
5026	1142	1142	1142		1142	1142	1142	1142	1142
5014	1182								

AGV–ADRESSES

5014	CUMMULATIVE	AGV 1	AGV 2	AGV 3	AGV 4	AGV 5	AGV 6	AGV 7	AGV 8	AGV 9	AGV 10	AGV 11	AGV 12	AGV 13	AGV 14	AGV 15	AGV 16	AGV 17
AA (#/DAY)	4.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30	0.00	0.00	0.00	0.00
CC * (#/DAY)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH * (#/DAY)	11.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.07	2.96	0.00	3.08	0.00	0.00	0.00	0.00
** D (#/DAY)	425.92	0.53	0.74	0.87	0.30	1.69	0.69	0.59	0.04	2.96	11.86	2.96	0.00	1.18	0.00	0.00	0.00	0.00
** K (#/DAY)	401.33	0.00	285.60	6.21	0.00	2.11	0.00	59.30	29.55	0.00	0.00	0.00	8.67	0.00	0.00	0.00	0.00	0.00
# AA places	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
# CC * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# HH * places	5	0	0	0	0	0	0	0	0	0	1	1	0	3	0	0	0	0
# ** D places	30	3	2	2	1	3	2	1	1	1	2	1	0	1	0	0	0	0
# ** K places	10	0	1	2	0	1	0	2	1	0	0	0	3	0	0	0	0	0

AGV–ADRESSES

5014	AGV 18	AGV 19	AGV 20	AGV 21	AGV 22	AGV 23	AGV 24	AGV 25	AGV 26	AGV 27	AGV 28	AGV 29	AGV 30	AGV 31	AGV 32	AGV 33	AGV 34
AA (#/DAY)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CC * (#/DAY)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH * (#/DAY)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** D (#/DAY)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** K (#/DAY)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
# AA places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# CC * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# HH * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# ** D places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# ** K places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

CODE	TRANSPORT–UNIT TO ASSEMBLYLINE
AA *	BOX–PALLET (FULL HIGHT, WOODEN, FOR INTERNAL USE)
CC *	BOX–PALLET (HALF HIGHT, WOODEN, FOR INTERNAL USE)
HH *	GROUNDPALLET
** D	MIN 2 / TOTE TIN

5014	1JB = Special Materials	1SB = PMS	2P = STORE
AA (#/DAY)	0.00	0.00	4.30
CC * (#/DAY)	0.00	0.00	0.00
HH * (#/DAY)	0.00	0.00	11.11
** D (#/DAY)	0.00	0.00	24.14
** K (#/DAY)	0.00	0.00	401.33
# AA places	0	0	2
# CC * places	0	0	0
# HH * places	0	0	5
# ** D places	0	0	19
# ** K places	0	0	10

Partnumber	Description	PMGP	QTY	XRPK	XMV	XCON	XIPQ	AGV	# of AA-places	Qty AA	# of CC-places	Qty CC *	# of HH-places	Qty HH *	# of D-places	Qty ** D	# of K-places	Qty ** K
002E031460	HSG XERO MOD	2P	1.00000	HK	72	K	4	2	0	0	0	0	0	0	0	0	1	0.25
002K028120	CVR ASSY FRNT	2P	1.00000	HH	400	K	80	11	0	0	0	0	1	0.0025	0	0	0	0
002K031410	COVER ASSEMBLY	2P	1.00000	HK	144	K	20	7	0	0	0	0	0	0	0	0	1	0.05
006E017560	SHAFT DRUM	2P	1.00000	HD	3200	D	100	10	0	0	0	0	0	0	1	0.01	0	0
007E014220	GEAR PADDLE	2P	1.00000	HD	78000	D	1200	5	0	0	0	0	0	0	1	0.000833	0	0
007E014230	GEAR IDLER	2P	1.00000	HD	96000	D	1500	5	0	0	0	0	0	0	1	0.000667	0	0
008R060200	DUSTING POUCH	2P	0.00300	HD	6400	D	100	6	0	0	0	0	0	0	1	0.00003	0	0
008R060200	DUSTING POUCH	2P	0.00300	HD	6400	D	100	10	0	0	0	0	0	0	1	0.00003	0	0
015E012690	PLATE GRID ED	2P	1.00000	HD	128000	D	2000	7	0	0	0	0	0	0	1	0.0005	0	0
015E012720	SUPPORT BRKT	2P	1.00000	HD	25600	D	400	11	0	0	0	0	0	0	1	0.0025	0	0
019E016010	FINGER DRUM	2P	1.00000	HD	25600	D	400	9	0	0	0	0	0	0	1	0.0025	0	0
020K003140	DRUM ASSY	2P	1.03000	HH	240	X	20	10	0	0	0	0	1	0.004292	0	0	0	0
020K003770	WHEEL ASSY	1L	3.00000	HD	612000	D	8000	2	0	0	0	0	0	0	1	0.000375	0	0
027E001670	NUT SPEED	2P	1.00000	HD	640000	D	10000	5	0	0	0	0	0	0	1	0.0001	0	0
033E001750	PADDLE	2P	1.00000	HK	2600	K	560	5	0	0	0	0	0	0	0	0	1	0.001786
033K000700	BLADE ASSY	2P	1.00000	HK	5400	K	40	8	0	0	0	0	0	0	0	0	1	0.025
035E011180	SEAL BLADE I B	2P	1.00000	HD	192000	D	3000	3	0	0	0	0	0	0	1	0.000333	0	0
035E011190	SEAL BLADE O B	2P	1.00000	HD	160000	D	2500	3	0	0	0	0	0	0	1	0.0004	0	0
035E011210	SEAL DRUM O B	2P	1.00000	HD	256000	D	4000	6	0	0	0	0	0	0	1	0.00025	0	0
035E011220	SEAL DRUM I B	2P	1.00000	HD	192000	D	3000	6	0	0	0	0	0	0	1	0.000333	0	0
035E090590	SEAL PADDLE	2P	1.00000	HD	256000	D	4000	4	0	0	0	0	0	0	1	0.00025	0	0
035K002560	SEAL ASSY TNR	2P	1.00000	HK	1000	K	200	3	0	0	0	0	0	0	0	0	1	0.005
091E045470	LABEL	2P	0.00000	HK	20	K	4	12	0	0	0	0	0	0	0	0	0	0
091E061880	LABEL BAR CODE	2P	1.00000	HK	120000	K	6000	12	0	0	0	0	0	0	0	0	1	0.000167
091E061880	LABEL BAR CODE	2P	1.00000	HK	120000	K	6000	7	0	0	0	0	0	0	0	0	1	0.000167
095K008260	ASSEMBLY.WRAPPING	2P	1.00000	HK	780	K	150	12	0	0	0	0	0	0	0	0	1	0.006667
121K003780	MAG RUBBER	2P	1.00000	HD	256000	D	4000	2	0	0	0	0	0	0	1	0.00025	0	0
063E000340	TAPE 75MM–1 ROLL=10	2P	0.00100	HK	36	K	4	3	0	0	0	0	0	0	0	0	1	0.00025
068K020470	5012/5014 COMMON CR U	1L	0.00000		0		0	0	0	0	0	0	0	0	0	0	0	0
068K020472	UNIQUE Y–1RX CRU	1L	0.00000		0		0	0	0	0	0	0	0	0	0	0	0	0
502P063558	BOX 5012/14 13R22	2P	1.00000	HH	600		0	13	0	0	0	0	1	0.001667	0	0	0	0
504E003690	TOP PAD 116X90CM 10–	2P	0.00000	HH	200		0	0	0	0	0	0	0	0	0	0	0	0
020P061483	STAR WHEEL	2P	3.00000	HD	1280000	D	20000	1	0	0	0	0	0	0	1	0.00015	0	0
030E051780	INNER SUPPORT	2P	3.00000	HD	1280000	D	20000	1	0	0	0	0	0	0	1	0.00015	0	0
030E051790	SUPPORT OUTER	2P	3.00000	HD	1280000	D	20000	1	0	0	0	0	0	0	1	0.00015	0	0
074K001520	M.NAT.PALLET	2P	0.01160	HH	13		0	13	0	0	0	0	1	0.000892	0	0	0	0
095E026260	BAG METALIZED 22	2P	1.00000	HK	10000	K	2000	12	0	0	0	0	0	0	0	0	1	0.0005
095E027230	METALIZED POLY ROLL	2P	0.00000	HH	8000		0	0	0	0	0	0	0	0	0	0	0	0
501K001600	END CAP ASSY 1012/60	2P	1.00000	AA	275		0	13	1	0.003636	0	0	0	0	0	0	0	0
502P010779	HOT MELT TYPE 242 26	2P	0.00000	CC*	0	X	0	0	0	0	0	0	0	0	0	0	0	0
502P010836	ADHESIVE INST SHT	2P	0.00000		0		0	0	0	0	0	0	0	0	0	0	0	0
504E003470	WRAPP 500MM–ROLL A	2P	0.00020	AA	12000	X	1000	13	1	1.7E–08	0	0	0	0	0	0	0	0
504E003690	TOP PAD 116X90CM 10–	2P	0.01000	HH	200		0	13	0	0	0	0	1	0.00005	0	0	0	0
082K031400	MODULE ASSY	1L	1.00000		0		0	0	0	0	0	0	0	0	0	0	0	0
502P010822	INSTRUCTIONS 5012/60	2P	1.00000	HD	64000	D	1000	13	0	0	0	0	0	0	1	0.001	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0

	period 1	period 1	period 2	period 3	period 4	period 5	period 6	period 7	period 8
product (family)	products/day	7 [days]	6 [days]	3 [days]	7 [days]	7 [days]	6 [days]	3 [days]	7 [days]
5014	1182	1182				1182			
5017	642		642				642		
CBOW	1173			1173				1173	
LV4	1084				1084				1084
YANKTON	1210			1210					
5008	1142	1142	1142		1142	1142	1142	1142	1142
5014	1182								

AGV-ADRESSES

5014	CUMMULATIVE	AGV 1	AGV 2	AGV 3	AGV 4	AGV 5	AGV 6	AGV 7	AGV 8	AGV 9	AGV 10	AGV 11	AGV 12	AGV 13	AGV 14	AGV 15	AGV 16	AGV 17
AA [#/DAY]	4.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30	0.00	0.00	0.00	0.00
CC * [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH * [#/DAY]	11.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.07	2.96	0.00	3.08	0.00	0.00	0.00	0.00
** D [#/DAY]	425.92	0.63	0.74	0.87	0.30	1.88	0.69	0.66	0.04	2.96	11.86	2.96	0.00	1.18	0.00	0.00	0.00	0.00
** K [#/DAY]	401.33	0.00	295.50	6.21	0.00	2.11	0.00	58.30	29.56	0.00	0.00	0.00	6.67	0.00	0.00	0.00	0.00	0.00
# AA places	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
# CC * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# HH * places	5	0	0	0	0	0	0	0	0	0	1	1	0	3	0	0	0	0
# ** D places	30	3	2	2	1	3	2	1	1	1	2	1	0	1	0	0	0	0
# ** K places	10	0	1	2	0	1	0	2	1	0	0	0	3	0	0	0	0	0

AGV-ADRESSES

5014	AGV 18	AGV 19	AGV 20	AGV 21	AGV 22	AGV 23	AGV 24	AGV 25	AGV 26	AGV 27	AGV 28	AGV 29	AGV 30	AGV 31	AGV 32	AGV 33	AGV 34
AA [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CC * [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH * [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** D [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
** K [#/DAY]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
# AA places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# CC * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# HH * places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# ** D places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# ** K places	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

CODE	TRANSPORT-UNIT TO ASSEMBLYLINE
AA *	BOX-PALLET (FULL HIGHT, WOODEN, FOR INTERNAL USE)
CC *	BOX-PALLET (HALF HIGHT, WOODEN, FOR INTERNAL USE)
HH *	GROUNDPALLET
** D	MIN 27 TOTE TIN

5014	1JB = Special Materials	1SB = PMB	2P = STORE
AA [#/DAY]	0.00	0.00	4.30
CC * [#/DAY]	0.00	0.00	0.00
HH * [#/DAY]	0.00	0.00	11.11
** D [#/DAY]	0.00	0.00	34.14
** K [#/DAY]	0.00	0.00	401.33
# AA places	0	0	2
# CC * places	0	0	0
# HH * places	0	0	5
# ** D places	0	0	19
# ** K places	0	0	10

Partnumber	Description	PMGP	QTY	XRPK	XMV	XCON	XIPQ	AGV	# of AA-places	Qty AA	# of CC-places	Qty CC *	# of HH-places	Qty HH *	# of D-places	Qty ** D	# of K-places	Qty ** K
000E031460	HSG XERO MOD	2P	1.00000	HK	72	K	4	2	0	0	0	0	0	0	0	0	1	0.25
002K028120	CVR ASSY FRNT	2P	1.00000	HH	400	K	50	11	0	0	0	0	1	0.0025	0	0	0	0
002K031410	COVER ASSEMBLY	2P	1.00000	HK	144	K	20	7	0	0	0	0	0	0	0	0	1	0.05
005E017550	SHAFT DRUM	2P	1.00000	HD	3200	D	100	10	0	0	0	0	0	0	1	0.01	0	0
[illegible]	GEAR PADDLE	2P	1.00000	HD	78000	D	1300	[illegible]	0	0	0	0	0	0	1	0.000833	0	0
007E014230	GEAR IDLER	2P	1.00000	HD	96000	D	1800	5	0	0	0	0	0	0	1	0.000667	0	0
008R060200	DUSTING POUCH	2P	0.00000	HD	6400	D	100	8	0	0	0	0	0	0	1	0.00003	0	0
008R060200	DUSTING POUCH	2P	0.00000	HD	6400	D	100	10	0	0	0	0	0	0	1	0.00003	0	0
015E013590	PLATE GRIDED	2P	1.00000	HD	128000	D	2000	7	0	0	0	0	0	0	1	0.0005	0	0
015E012720	SUPPORT BRKT	2P	1.00000	HD -	25600	D	400	11	0	0	0	0	0	0	1	0.0025	0	0
019E016010	FINGER DRUM	2P	1.00000	HD	25600	D	400	9	0	0	0	0	0	0	1	0.0025	0	0
020K003140	DRUM ASSY	2P	1.03000	HH	240	X	20	10	0	0	0	0	1	0.004292	0	0	0	0
020K003770	WHEEL ASSY	1L	3.00000	HD	512000	D	8000	2	0	0	0	0	0	0	1	0.000375	0	0
027E001870	NUT SPEED	2P	1.00000	HD	640000	D	10000	5	0	0	0	0	0	0	1	0.0001	0	0
033E001750	PADDLE	2P	1.00000	HK	2800	K	560	5	0	0	0	0	0	0	0	0	1	0.001786
033K000700	BLADE ASSY	2P	1.00000	HK	6400	K	40	8	0	0	0	0	0	0	0	0	1	0.025
035E011180	SEAL BLADE I B	2P	1.00000	HD	192000	D	3000	3	0	0	0	0	0	0	1	0.000333	0	0
035E011190	SEAL BLADE O B	2P	1.00000	HD	160000	D	2500	3	0	0	0	0	0	0	1	0.0004	0	0
035E011210	SEAL DRUM O B	2P	1.00000	HD	256000	D	4000	6	0	0	0	0	0	0	1	0.00025	0	0
035E011220	SEAL DRUM I B	2P	1.00000	HD	192000	D	3000	6	0	0	0	0	0	0	1	0.000333	0	0
035E090590	SEAL PADDLE	2P	1.00000	HD	256000	D	4000	4	0	0	0	0	0	0	1	0.00025	0	0
035K002560	SEAL ASSY TNR	2P	1.00000	HK	1000	K	200	3	0	0	0	0	0	0	0	0	1	0.005
091E045470	LABEL	2P	0.00000	HK	20	K	4	12	0	0	0	0	0	0	0	0	0	0
091E061680	LABEL BAR CODE	2P	1.00000	HK	120000	K	6000	12	0	0	0	0	0	0	0	0	1	0.000167
091E061680	LABEL BAR CODE	2P	1.00000	HK	120000	K	6000	7	0	0	0	0	0	0	0	0	1	0.000167
095K008260	ASSEMBLY,WRAPPING	2P	1.00000	HK	780	K	180	12	0	0	0	0	0	0	0	0	1	0.005667
121K003780	MAG RUBBER	2P	1.00000	HD	288000	D	4000	2	0	0	0	0	0	0	1	0.00025	0	0
063E000340	TAPE 75MM-1 ROLL =10	2P	0.00100	HK	36	K	4	3	0	0	0	0	0	0	0	0	1	0.00025
068K020470	5012/5014 COMMON CR U	1L	0.00000		0		0	0	0	0	0	0	0	0	0	0	0	0
068K020472	UNIQUE Y-1 RX CRU	1L	0.00000		0		0	0	0	0	0	0	0	0	0	0	0	0
502P063558	BOX 5012/14 13R22	2P	1.00000	HH	600		0	13	0	0	0	0	1	0.001667	0	0	0	0
504E003690	TOP PAD 116X90CM 16-	2P	0.00000	HH	200		0	0	0	0	0	0	0	0	0	0	0	0
020P081483	STAR WHEEL	2P	3.00000	HD	1280000	D	20000	1	0	0	0	0	0	0	1	0.00015	0	0
030E051780	INNER SUPPORT	2P	3.00000	HD	1280000	D	20000	1	0	0	0	0	0	0	1	0.00015	0	0
030E051790	SUPPORT OUTER	2P	3.00000	HD	1280000	D	20000	1	0	0	0	0	0	0	1	0.00015	0	0
074K001520	M NAT PALLET	2P	0.01150	HH	13		0	13	0	0	0	0	1	0.000882	0	0	0	0
095E026280	BAG METALIZED 22	2P	1.00000	HK	10000	K	2000	12	0	0	0	0	0	0	0	0	1	0.0005
095E027230	METALIZED POLY ROLL	2P	0.00000	HH	6000		0	0	0	0	0	0	0	0	0	0	0	0
501K001600	END CAP ASSY 1012/50	2P	1.00000	AA	276		0	13	1	0.003636	0	0	0	0	0	0	0	0
502P010779	HOT MELT TYPE 242 25	2P	0.00000	CC*	0	X	0	0	0	0	0	0	0	0	0	0	0	0
502P010836	ADHESIVE INST SHT	2P	0.00000		0		0	0	0	0	0	0	0	0	0	0	0	0
504E003470	WRAPP 500MM-ROLL A	2P	0.00020	AA	12000	X	1000	13	1	1.7E-08	0	0	0	0	0	0	0	0
504E003690	TOP PAD 116X90CM 16-	2P	0.01000	HH	200		0	13	0	0	0	0	1	0.00005	0	0	0	0
002K031400	MODULE ASSY	1L	1.00000		0		0	0	0	0	0	0	0	0	0	0	0	0
502P010822	INSTRUCTIONS 5012/50	2P	1.00000	HD	64000	D	1000	13	0	0	0	0	0	0	1	0.001	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	--	0	-	0	0	0	0	0	0	0	0	0	0	0	0

```
A:A10: [W13] '5014
A:B10: [W20] 1182
A:C15: 'AGV-ADRESSES
A:A16: [W13] +$A$10
A:B16: [W20] 'CUMMULATIVE
A:C16: 'AGV
A:C17: 1
A:A18: (F2) [W13] 'AA [#/DAY]
A:B18: (F2) [W20] @SUM(C18..S18)+@SUM(B33..R33)
A:C18: (F2) @DSUM($I$62..$K$142,2,C16..C17)*$B$10
A:A19: (F2) [W13] 'CC * [#/DAY]
A:B19: (F2) [W20] @SUM(C19..S19)+@SUM(B34..R34)
A:C19: (F2) @DSUM($I$62..$M$142,4,C16..C17)*$B$10
A:A20: (F2) [W13] 'HH * [#/DAY]
A:B20: (F2) [W20] @SUM(C20..S20)+@SUM(B35..R35)
A:C20: (F2) @DSUM($I$62..$O$142,6,C16..C17)*$B$10
A:A21: (F2) [W13] '** D [#/DAY]
A:B21: (F2) [W20] @SUM(C22..S21)+@SUM(B37..R36)
A:C21: (F2) @DSUM($I$62..$Q$142,8,C16..C17)*$B$10
A:A22: (F2) [W13] '** K [#/DAY]
A:B22: (F2) [W20] @SUM(C23..S22)+@SUM(B38..R37)
A:C22: (F2) @DSUM($I$62..$S$142,10,C16..C17)*$B$10
A:A24: (F2) [W13] '# AA places
A:B24: (F0) [W20] @SUM(C24..S24)+@SUM(B39..R39)
A:C24: (F0) @DSUM($I$62..$J$142,1,C16..C17)
A:A25: (F2) [W13] '# CC * places
A:B25: (F0) [W20] @SUM(C25..S25)+@SUM(B40..R40)
A:C25: (F0) @DSUM($I$62..$L$142,3,C16..C17)
A:A26: (F2) [W13] '# HH * places
A:B26: (F0) [W20] @SUM(C26..S26)+@SUM(B41..R41)
A:C26: (F0) @DSUM($I$62..$N$142,5,C16..C17)
A:A27: (F2) [W13] '# ** D places
A:B27: (F0) [W20] @SUM(C28..S27)+@SUM(B43..R42)
A:C27: (F0) @DSUM($I$62..$P$142,7,C16..C17)
A:A28: (F2) [W13] '# ** K places
A:B28: (F0) [W20] @SUM(C29..S28)+@SUM(B44..R43)
A:C28: (F0) @DSUM($I$62..$R$142,9,C16..C17)
```

```
A:N45: [W9] 'CODE
A:O45: [W9] 'TRANSPORT-UNIT TO ASSEMBLYLINE
A:N46: [W9] 'AA *
A:O46: [W9] 'BOX-PALLET
A:W46: [W9] 'PMGP
A:X46: 'XRPK
A:Y46: 'PMGP
A:Z46: 'XRPK
A:AA46: 'PMGP
A:AB46: 'XRPK
A:AC46: 'PMGP
A:AD46: 'XCON
A:AE46: 'PMGP
A:AF46: 'XCON
A:A47: [W13] +V47
A:B47: [W20] '1JB= Special Materials
A:C47: '1SB= PMS
A:D47: '2P= STORE
A:N47: [W9] '
A:O47: [W9] '(FULL HIGHT, WOODEN, FOR INTERNAL USE)
A:V47: (F2) [W10] +$A$10
A:W47: (F2) [W9] '1SB
A:X47: 'AA
A:Y47: (F2) '1SB
A:Z47: (F2) 'CC
A:AA47: (F2) '1SB
A:AB47: (F2) 'HH
A:AC47: (F2) '1SB
A:AD47: (F2) 'D
A:AE47: (F2) '1SB
A:AF47: (F2) 'K
A:A48: (F2) [W13] 'AA [#/DAY]
A:B48: (F2) [W20] +W56
A:C48: (F2) +W48
A:D48: (F2) +W52
A:N48: [W9] 'CC *
A:O48: [W9] 'BOX-PALLET
A:W48: (F2) [W9] @DSUM($C$62..$Q$142,8,W$46..X$47)*$B$10
A:X48: (F0) @DSUM($C$62..$Q$142,7,W$46..X$47)
A:Y48: (F2) @DSUM($C$62..$Q$142,10,Y$46..Z$47)*$B$10
A:Z48: (F0) @DSUM($C$62..$Q$142,9,Y$46..Z$47)
A:AA48: (F2) @DSUM($C$62..$Q$142,12,AA$46..AB$47)*$B$10
A:AB48: (F0) @DSUM($C$62..$Q$142,11,AA$46..AB$47)
A:AC48: (F2) @DSUM($C$62..$Q$142,14,AC$46..AD$47)*$B$10
A:AD48: (F0) @DSUM($C$62..$Q$142,13,AC$46..AD$47)
A:AE48: (F2) @DSUM($C$62..$S$142,16,AE$46..AF$47)*$B$10
A:AF48: (F0) @DSUM($C$62..$S$142,15,AE$46..AF$47)
A:A49: (F2) [W13] 'CC * [#/DAY]
A:B49: (F2) [W20] +Y56
A:C49: (F2) +Y48
A:D49: (F2) +Y52
A:N49: [W9] '
A:O49: [W9] '(HALF HIGHT, WOODEN, FOR INTERNAL USE)
A:A50: (F2) [W13] 'HH * [#/DAY]
A:B50: (F2) [W20] +AA56
A:C50: (F2) +AA48
```

```
A:D50: (F2) +AA52
A:N50: [W9] 'HH *
A:O50: [W9] 'GROUNDPALLET
A:W50: [W9] 'PMGP
A:X50: 'XRPK
A:Y50: 'PMGP
A:Z50: 'XRPK
A:AA50: 'PMGP
A:AB50: 'XRPK
A:AC50: 'PMGP
A:AD50: 'XCON
A:AE50: 'PMGP
A:AF50: 'XCON
A:A51: (F2) [W13] '** D [#/DAY]
A:B51: (F2) [W20] +AC56
A:C51: (F2) +AC48
A:D51: (F2) +AC52
A:N51: [W9] '* *  D
A:O51: [W9] 'MN 2 / TOTE TIN
A:V51: (F2) [W10] +$A$10
A:W51: (F2) [W9] '2P
A:X51: 'AA
A:Y51: (F2) '2P
A:Z51: (F2) 'CC
A:AA51: (F2) '2P
A:AB51: (F2) 'HH
A:AC51: (F2) '2P
A:AD51: (F2) 'D
A:AE51: (F2) '2P
A:AF51: (F2) 'K
A:A52: (F2) [W13] '** K [#/DAY]
A:B52: (F2) [W20] +AE56
A:C52: (F2) +AE48
A:D52: (F2) +AE52
A:W52: (F2) [W9] @DSUM($C$62..$Q$142,8,W$50..X$51)*$B$10
A:X52: (F0) @DSUM($C$62..$Q$142,7,W$50..X$51)
A:Y52: (F2) @DSUM($C$62..$Q$142,10,Y$50..Z$51)*$B$10
A:Z52: (F0) @DSUM($C$62..$Q$142,9,Y$50..Z$51)
A:AA52: (F2) @DSUM($C$62..$Q$142,12,AA$50..AB$51)*$B$10
A:AB52: (F0) @DSUM($C$62..$Q$142,11,AA$50..AB$51)
A:AC52: (F2) @DSUM($C$62..$Q$142,14,AC$50..AD$51)*$B$10
A:AD52: (F0) @DSUM($C$62..$Q$142,13,AC$50..AD$51)
A:AE52: (F2) @DSUM($C$62..$S$142,16,AE$50..AF$51)*$B$10
A:AF52: (F0) @DSUM($C$62..$S$142,15,AE$50..AF$51)
A:A54: (F2) [W13] '# AA places
A:B54: (F0) [W20] +X56
A:C54: (F0) +X48
A:D54: (F0) +X52
A:W54: [W9] 'PMGP
A:X54: 'XRPK
A:Y54: 'PMGP
A:Z54: 'XRPK
A:AA54: 'PMGP
A:AB54: 'XRPK
A:AC54: 'PMGP
A:AD54: 'XCON
```

```
A:AE54: 'PMGP
A:AF54: 'XCON
A:A55: (F2) [W13] '# CC * places
A:B55: (F0) [W20] +Z56
A:C55: (F0) +Z48
A:D55: (F0) +Z52
A:V55: (F2) [W10] +$A$10
A:W55: (F2) [W9] '1JB
A:X55: 'AA
A:Y55: (F2) '1JB
A:Z55: (F2) 'CC
A:AA55: (F2) '1JB
A:AB55: (F2) 'HH
A:AC55: (F2) '1JB
A:AD55: (F2) 'D
A:AE55: (F2) '1JB
A:AF55: (F2) 'K
A:A56: (F2) [W13] '# HH * places
A:B56: (F0) [W20] +AB56
A:C56: (F0) +AB48
A:D56: (F0) +AB52
A:W56: (F2) [W9] @DSUM($C$62..$Q$142,8,W$54..X$55)*$B$10
A:X56: (F0) @DSUM($C$62..$Q$142,7,W$54..X$55)
A:Y56: (F2) @DSUM($C$62..$Q$142,10,Y$54..Z$55)*$B$10
A:Z56: (F0) @DSUM($C$62..$Q$142,9,Y$54..Z$55)
A:AA56: (F2) @DSUM($C$62..$Q$142,12,AA$54..AB$55)*$B$10
A:AB56: (F0) @DSUM($C$62..$Q$142,11,AA$54..AB$55)
A:AC56: (F2) @DSUM($C$62..$Q$142,14,AC$54..AD$55)*$B$10
A:AD56: (F0) @DSUM($C$62..$Q$142,13,AC$54..AD$55)
A:AE56: (F2) @DSUM($C$62..$S$142,16,AE$54..AF$55)*$B$10
A:AF56: (F0) @DSUM($C$62..$Q$142,13,AE$54..AF$55)
A:A57: (F2) [W13] '# ** D places
A:B57: (F0) [W20] +AD56
A:C57: (F0) +AD48
A:D57: (F0) +AD52
A:A58: (F2) [W13] '# ** K places
A:B58: (F0) [W20] +AF56
A:C58: (F0) +AF48
A:D58: (F0) +AF52
A:J61: [W9] '# of
A:K61: [W9] 'Qty
A:L61: [W9] '# of
A:M61: [W9] 'Qty
A:N61: [W9] '# of
A:O61: [W9] 'Qty
A:P61: '# of
A:Q61: 'Qty
A:R61: '# of
A:S61: 'Qty
A:A62: [W13] 'Partnumber
A:B62: [W20] 'Description
A:C62: 'PMGP
A:D62: 'QTY
A:E62: 'XRPK
A:F62: 'XMV
```

```
A:G62: 'XCON
```

```
A:H62: 'XIPQ
A:I62: 'AGV
A:J62: [W9] 'AA-places
A:K62: [W9] 'AA
A:L62: [W9] 'CC-places
A:M62: [W9] 'CC *
A:N62: [W9] 'HH-places
A:O62: [W9] 'HH *
A:P62: 'D-places
A:Q62: '** D
A:R62: 'K-places
A:S62: '** K
A:A63: [W13] '002E031460
A:B63: [W20] 'HSG XERO MOD
A:C63: '2P
A:D63: (F5) 1
A:E63: 'HK
A:F63: (F0) 72
A:G63: 'K
A:H63: (F0) 4
A:I63: 2
A:J63: [W9] @IF($K63=0,0,1)
A:K63: [W9] @IF($E63="AA",$D63/$F63,0)
A:L63: [W9] @IF($M63=0,0,1)
A:M63: [W9] @IF($E63="CC",$D63/$F63,0)
A:N63: [W9] @IF(O63=0,0,1)
A:O63: [W9] @IF($E63="HH",$D63/$F63,0)
A:P63: @IF(Q63=0,0,1)
A:Q63: @IF($E63="HD",$D63/$H63,0)
A:R63: @IF(S63=0,0,1)
A:S63: @IF($E63="HK",$D63/$H63,0)
A:V63: [W10] 1
A:A64: [W13] '002K028120
A:B64: [W20] 'CVR ASSY FRNT
A:C64: '2P
A:D64: (F5) 1
A:E64: 'HH
A:F64: (F0) 400
A:G64: 'K
A:H64: (F0) 80
A:I64: 11
A:J64: [W9] @IF($K64=0,0,1)
A:K64: [W9] @IF($E64="AA",$D64/$F64,0)
A:L64: [W9] @IF($M64=0,0,1)
A:M64: [W9] @IF($E64="CC",$D64/$F64,0)
A:N64: [W9] @IF(O64=0,0,1)
A:O64: [W9] @IF($E64="HH",$D64/$F64,0)
A:P64: @IF(Q64=0,0,1)
A:Q64: @IF($E64="HD",$D64/$H64,0)
A:R64: @IF(S64=0,0,1)
A:S64: @IF($E64="HK",$D64/$H64,0)
A:V64: [W10] 1
A:A65: [W13] '002K031410
```

```
A:B65: [W20] 'COVER ASSEMBLY
A:C65: '2P
A:D65: (F5) 1
```

```
A:E65: 'HK
A:F65: (F0) 144
A:G65: 'K
A:H65: (F0) 20
A:I65: 7
A:J65: [W9] @IF($K65=0,0,1)
A:K65: [W9] @IF($E65="AA",$D65/$F65,0)
A:L65: [W9] @IF($M65=0,0,1)
A:M65: [W9] @IF($E65="CC",$D65/$F65,0)
A:N65: [W9] @IF(O65=0,0,1)
A:O65: [W9] @IF($E65="HH",$D65/$F65,0)
A:P65: @IF(Q65=0,0,1)
A:Q65: @IF($E65="HD",$D65/$H65,0)
A:R65: @IF(S65=0,0,1)
A:S65: @IF($E65="HK",$D65/$H65,0)
A:V65: [W10] 1
A:A66: [W13] '006E017560
A:B66: [W20] 'SHAFT DRUM
A:C66: '2P
A:D66: (F5) 1
A:E66: 'HD
A:F66: (F0) 3200
A:G66: 'D
A:H66: (F0) 100
A:I66: 10
A:J66: [W9] @IF($K66=0,0,1)
A:K66: [W9] @IF($E66="AA",$D66/$F66,0)
A:L66: [W9] @IF($M66=0,0,1)
A:M66: [W9] @IF($E66="CC",$D66/$F66,0)
A:N66: [W9] @IF(O66=0,0,1)
A:O66: [W9] @IF($E66="HH",$D66/$F66,0)
A:P66: @IF(Q66=0,0,1)
A:Q66: @IF($E66="HD",$D66/$H66,0)
A:R66: @IF(S66=0,0,1)
A:S66: @IF($E66="HK",$D66/$H66,0)
A:V66: [W10] 1
```

Appendix 5 Average number ofcontainer deliveries

In this appendix the average number of container deliveries is calculated, based on the assembly lay outs for the 5017 CRU, the Superstar CRU, the 5028 CRU and the 5014 CRU.

- Arrival pattern of containers with a dayrate of 100.
  (Voluminous PMS parts not included)

Superstar:	MN2	9.23;58*	
	MN5	14.6;9*	Average: 73.83/68* = 1.0857
	Box	50;1*	
5017:	MN2	11.09;37*	
	MN5	1.67;1*	Average: 62.76/39* = 1.6092
	Box	50;1*	
5028:	MN2	1.89;7*	
	MN5	4.52;3*	Average: 64.1/10* = 0.6410
5014:	MN2	2.08;30*	
	MN5	33.95;10*	Average: 36.03/40* = 0.9008
			Average arrival per container per 100 products = 1.06

- Average number of product parts (=containers) per station = 3.625
- Dayrate per station = 1200

Number of container deliveries = (1.06/100)×3.625×1200 = 46.11
(per day per station)

*: [containers per 100 products ; product parts].

Appendix 6

Simulation of part replenishment on the assembly conveyor.

The main purpose of theassembly conveyor is to transport the product pallets from one assembly station to the next. When a production scedule does not fully occupy the assembly conveyor, it is possible, with an aditional controlling system, to transport other pallets to the stations. These pallets can transport the parts containers to the different assembly stations.
It is difficult to calculate how much the assembly process will be disturbed by the aditional parts pallets on the assembly conveyor, and her's where simulation comes in handy.
The simulation of the several assembly conveyors is programmed with the program WITNESS version 4.0. by P. Coenen and N. Tissink. The conveyor which are simulated are the Van der Lande conveyors, which are already present or on order.
The input needed for such simulations are:

- The assembly conveyor layout;
- The station cycletimes;
- The station routings;
- Belt speed;
- Side conveyor speed;
- Transfer speed;
- Transfer lifting / lowering time;
- number of assembly pallets;
- The routing and volumes of part replenishment.

This last information is deduced from the calculations of the product parts in the LOTUS sheets, which are represented in appendix 6.
The outcome of these simulations is that it gives no significant disturbance to the assembly process, when the not voluminous parts are transported on the assembly conveyor. These not voluminous parts consist of $\pm 90\%$ of the number of parts of a product.
The voluminous parts are the PMS and packaging products. These products have such a high deliver frequency, when transported on a conveyor container, that they were left out for practical reasons. A specific solution should be found for these products.
One solution is to transport these products on wooden boxpallets to the head of the assembly conveyor, where these voluminous parts then can be directly mounted on the assembly conveyor pallet.

Appendix 7 The number of vehicles

On the next page of this appendix is shown that when the replenish routing is known, it is possible to calculate the needed capacity of vehicles, for forkliift trucks, AGV and manual replenishment.
This is not applicable for conveyors. An overhead conveyor with the transport velocity of 24 m per minute, devided in parts of 1 meter length, can transport 1440 objects per hour (theoretical: 1 object per 1 meter). This is more than sufficient for the required replenishment.
The assembly conveyor capacity can be determined with a simulation (see appendix 6).

5028	V(transport) [m/s]:	1.7	1.7	2 shifts, bring full & pick up empty
forklift	positoning time [sec]:	60		reactiontime XBMS:
	number of tote tins per transport:	4		

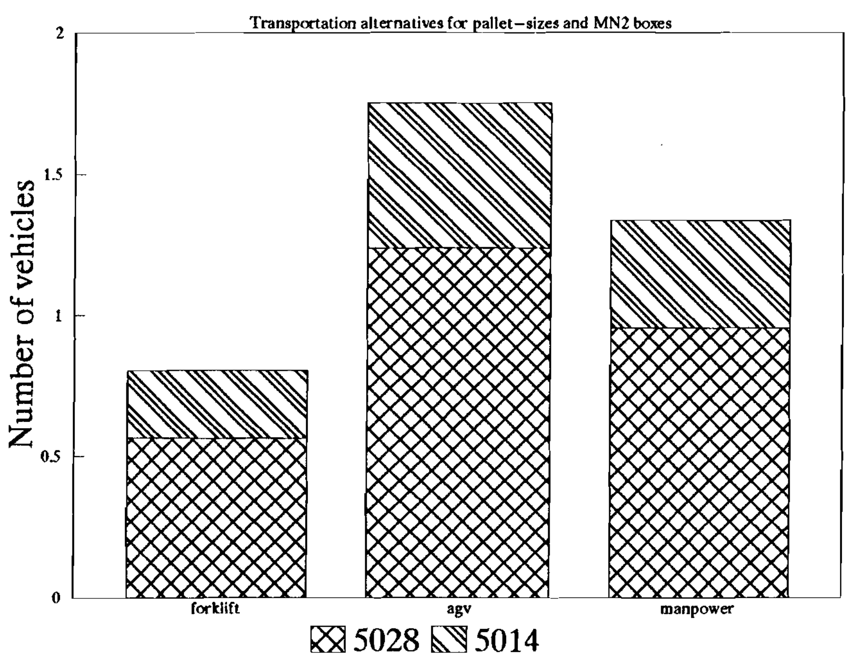
	FORKLIFT	AGV	manpower	Assy conv.	Overhead c.
V(transport) [m/s]:	1.7	0.71	0.82	2.4	0.45
positoning time per transport [sec]:	60	110	60	110	20
number of tote tins per transport:	4	4	4	1	1

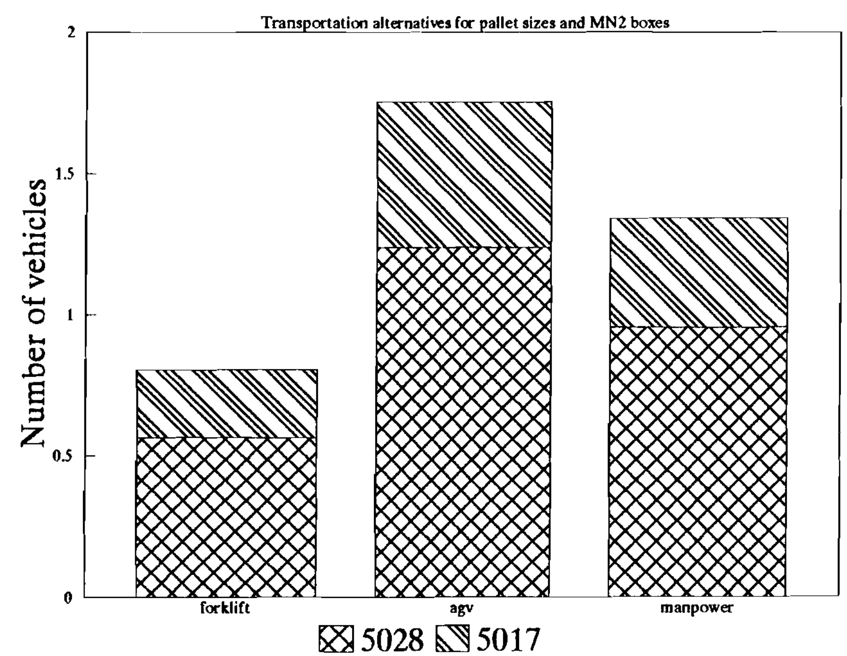
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Frequency:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distance from store:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D*F:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Needed transporttime:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Frequency:	20.18001	12.03858	3.255798	0.2284	3.161743	2.951897	0.523417	0	0.253778	0.148936	16.95758	2.525693	0.344619	8.906816	6.706078	5.392778	0
Distance from store:	235	235	235	235	235	235	235	235	235	235	0	235	235	235	235	235	0
D*F:	4742.303	2829.067	765.1125	53.674	743.0095	693.6958	123.0029	0	59.63778	34.99992	0	593.5379	80.98539	2093.102	1575.928	1267.303	0
Needed transporttime:	4000.39	2386.472	645.4141	45.27694	626.769	585.1702	103.7597	0	50.30771	29.52434	1017.455	500.6815	68.31559	1765.645	1329.381	1069.039	0
	108	110	115	124	141	156	169	182	176	154	10	177	180	186	193	124	0

		5028				
Accumulated transporttime [sec]:	14223.6	14223.6	31243.17	24106.47	20698.95	49397.87
available time per vehicle [min/shift]:	421	421	421	421	421	421
needed vehicles:	0.563088	0.563088	1.236864	0.954334	0.819436	1.955577
average transporttime [sec.]:	170.1874	170.1874	373.8289	288.4373	192.2963	458.9134
		heftruck	agv	manpower	Assembly c	Overhead

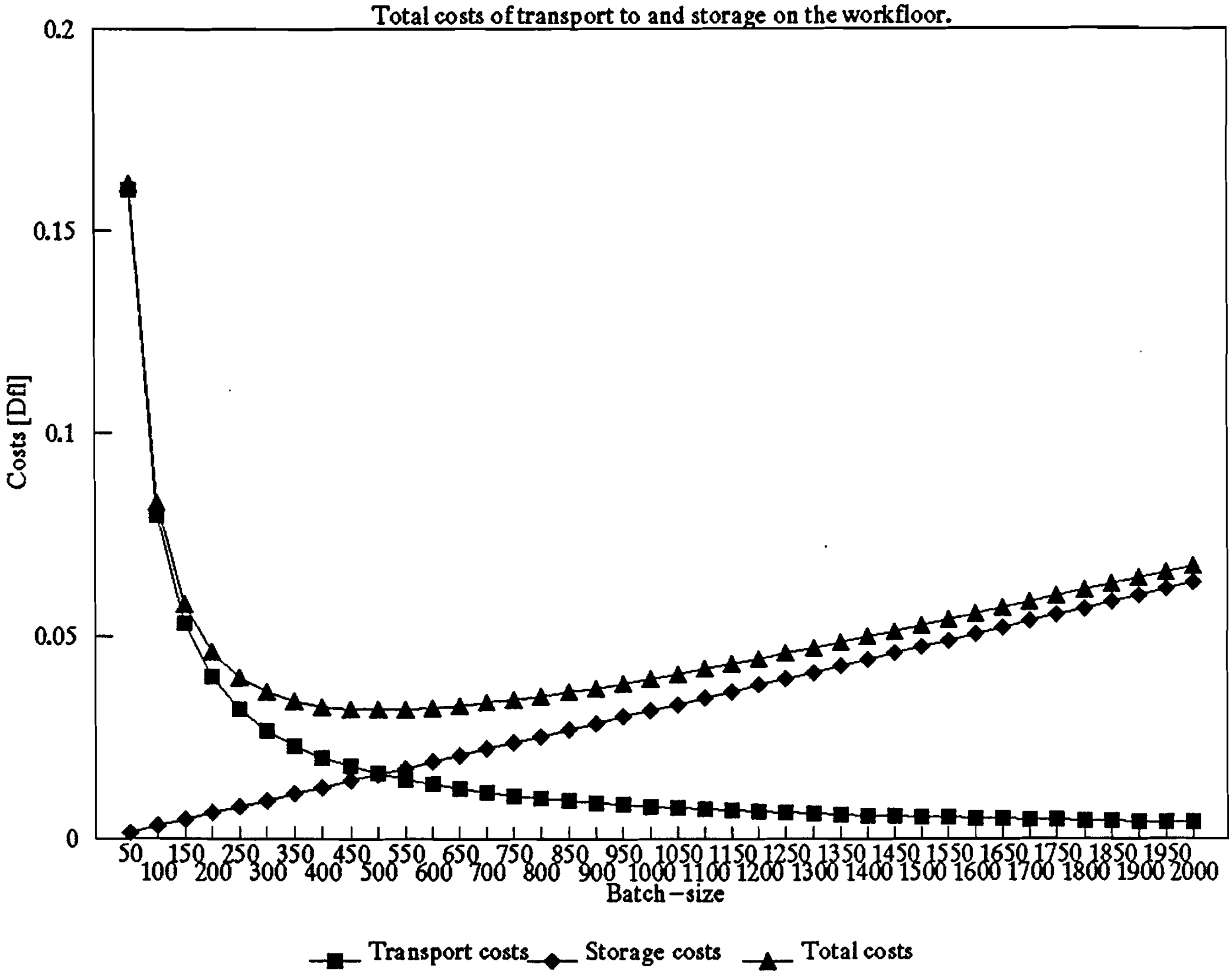
	forklift	agv	manpower	Assembly c	Overhead
5028	0.563088	1.236864	0.954334	0.819436	1.955577
5014	0.241315	0.515648	0.381407	0.350112	0.636068
	forklift	agv	manpower	Assembly c	Overhead
5028	0.563088	1.236864	0.954334	0.819436	1.955577
5017	0.239945	0.516502	0.386475	0.744188	1.531475





Appendix 8 **Costs: Transport vs. WIP**

In the following figure is shown, that an (average) batchsize can be determined with which the costs (due to transport and Work In Progress) are minimized.



transportcost per single transport:	8
average costs for keeping a (end)product in store per year:	8
year-rate:	253000

Appendix 9 Store capacity calculation

In this appendix the store capacity is calculated based on the assembly lay outs for the 5017 CRU, the Superstar CRU, the 5028 CRU and the 5014 CRU.

Container combinations at the 5017 assembly line

MN2	12	20	0	0	0	3			
MN5	1	0	0	0	0	1			

Container combinations the at Superstar assembly line

MN2	7	0	0	5	5	1	0	0	0	5	0	3
MN5	1	0	0	1	0	0	0	0	0	1	0	0
MN2	3	2	0	2	0	2	2	0	0	3	1	0
MN5	0	0	1	0	1	0	0	0	0	0	0	5

Container combinations at the 5028 assembly line

MN2	6	3	3	1	4	1	4	0	1	0
MN5	1	1	2	0	1	1	0	0	0	1

Container combinations at the 5014 assembly line

MN2	3	2	2	1	3	2	1	1	1	2	1	0	1
MN5	0	1	2	0	1	0	2	1	0	0	0	3	0

There are 39 container combinations, which need a container store. (See also table A22)
One container combination is 1/39 × 100% = 2.56% of all neede stores.
shelf length: 150 cm.
What does fit on two shelves? Everything < 300 cm.
→ Everything but combinations: 12 × MN2 + 1 × MN5 → 2.56%
20 × MN2 + 0 × MN5 → 2.56%
5.12%

Everything that does fit on 2 shelves of 150 cm = 100% - 5.12% = 94.88%

shelf length: 120 cm.
What does fit on two shelves? Everything < 240 cm.
→ Everything but combinations: 12 × MN2 + 1 × MN5 → 2.56%
20 × MN2 + 0 × MN5 → 2.56%
12 × MN2 + 1 × MN5 → 2.56%
7.68%

Everything that does fit on 2 shelves of 120 cm = 100% - 7.68% = 92.32%

Number of MN2 containers	Number of MN5 containers	Accumulated length [cm.]	Number of assy stations
0	0	0	(12)
1	0	30	7
0	1	40	2
2	0	60	6
1	1	70	2
3	0	90	4
2	1	100	1
1	2	110	1
0	3	120	1
4	0	120	1
3	1	130	3
2	2	140	1
5	0	150	1
4	1	160	1
3	2	170	1
5	1	190	2
0	5	200	1
6	1	220	1
7	1	250	1
12	1	400	1
20	0	600	1
		Totaal:	39

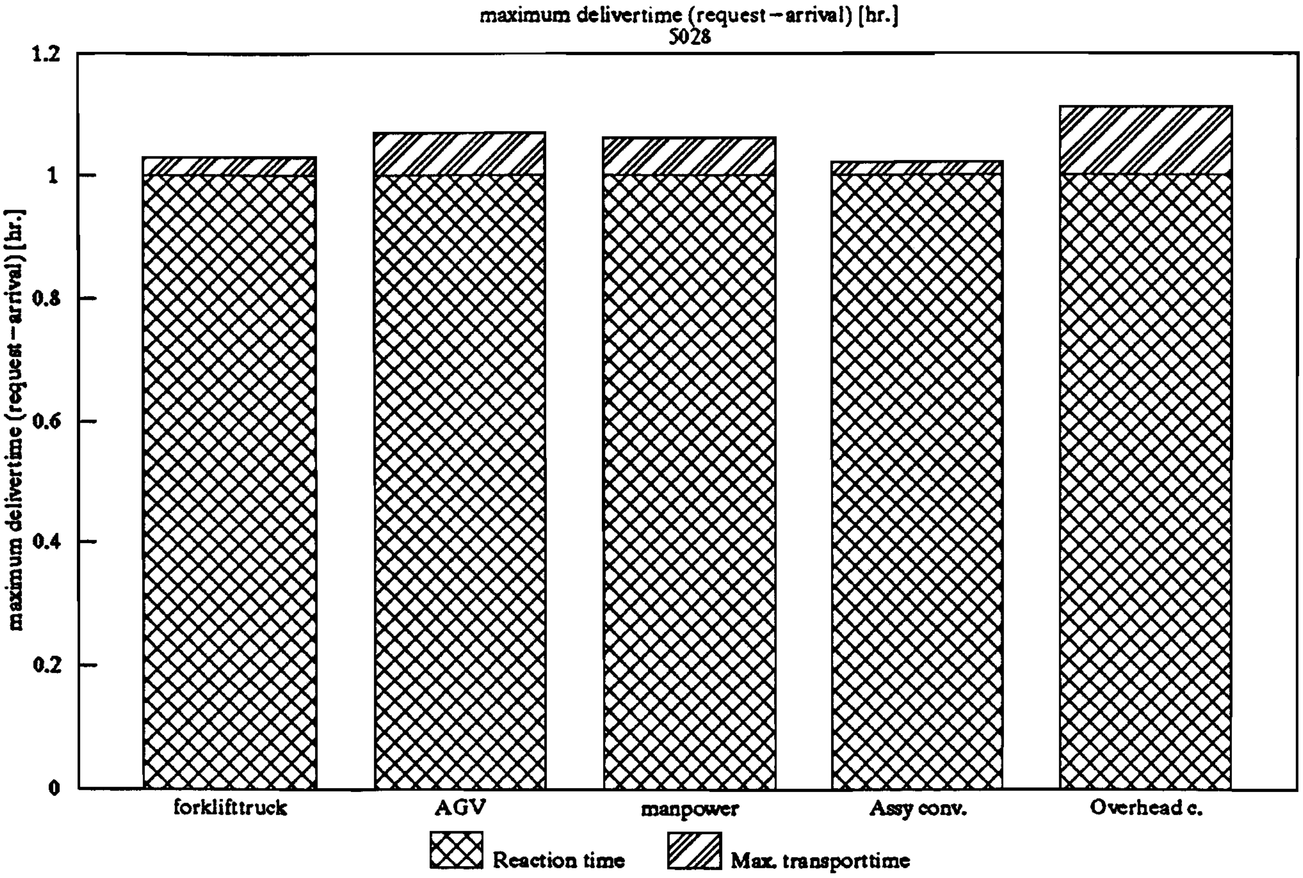
table A2.2.1

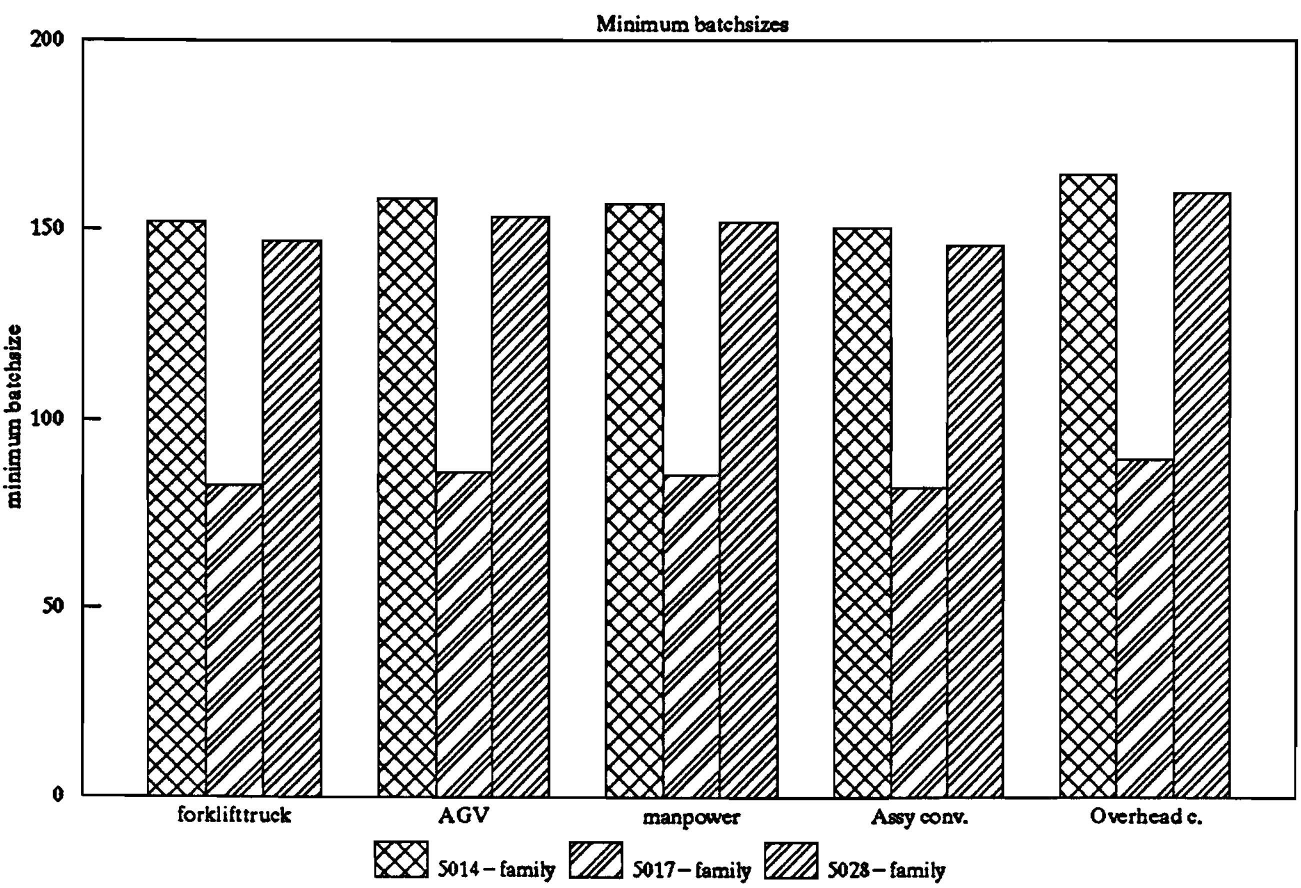
Accumulated width	Number of assy stations	Percentage of all assy stations
0-80	17	43.6
80-160	14	35.9
160-240	5	12.8
240-320	1	2.6
320-400	1	2.6
400-480	0	0
480-560	0	0
560-640	1	2.6

table A2.2.2

Appendix 10 Minimal batchsizes.

In the figures below the relation is shown between the reaction time, the maximum transporttime and the minimal batchsizes.





Appendix 11 Choises for the concept designs

The automation of the handling of the storing process can be devided in 4 actions:

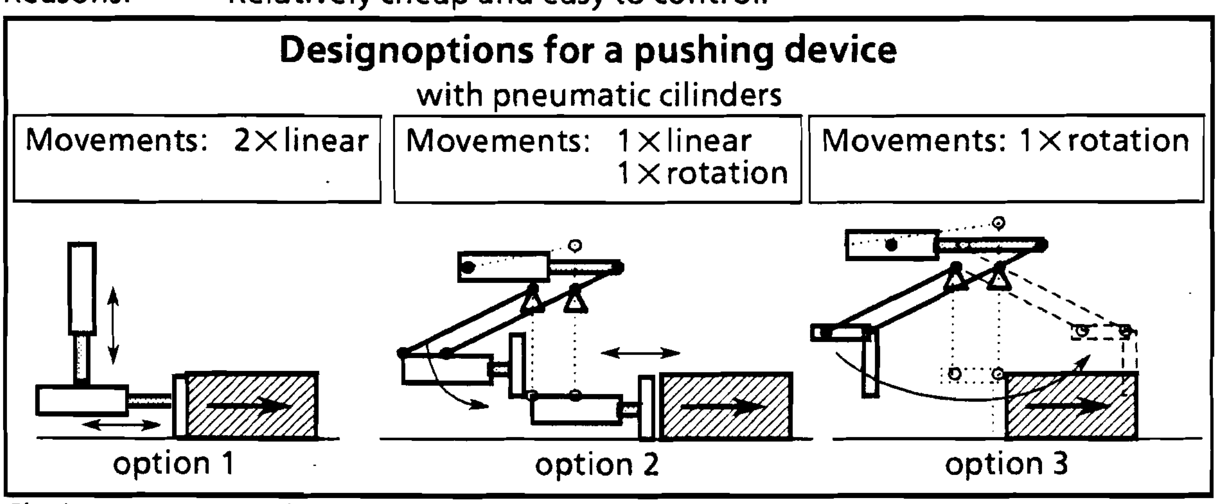
a. Container from assembly line
b. Container in store
c. Empty container on assyline.
d. Controling: the sensor & controlingsystem.

<u>a. Container from assembly line</u>

Options:

- Assembly conveyor adaption.
- Robot.
- Pushing device:
  - Pneumatic cilinders (pushing from behind).
  - Caterpillar push unit (traction from the top).

Choice: Pneumatic cilinders
Reasons: Relatively cheap and easy to control.



Choise: Option 2
Reasons: There is no load on the cilinders, perpendicular to the direction of movement , and the reach is sufficient. Option 1 and 3 do not meet these requirements.

b. Container in store

Options:

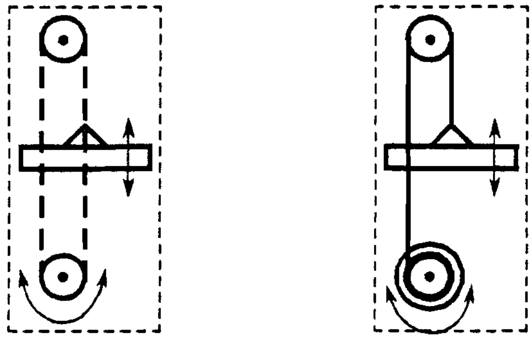
- Robot;
- Patre nostre;
- Lift-unit, with:
  - Pneumatic cilinder;
  - Electromotor;
  - propellor-shaft.

Choise: Lift-unit with an electric motor

Reasons: The reach of the lift would need an impractical long cilinder. Relatively cheap.

Designoptions for a lift-unit

with an electric motor



chain-drive / gears or toothed belt — option 1

cable / pulley — option 2

Choise: Option 1: Electromotor with toothed belt.

Reasons: Low noise production

Accurate position control

c. Empty container on assyline.

Options:

- Robot
- Empty containerstore, with:
  - Pushing device: - Pneumatic cilinders (pushing from behind)
    - Caterpillar/belt push unit (traction).

Choice: Pushing device with a pneumatic cilinders (pushing from behind).

Reason: Relatively cheap and easy to control.

d. Controling: the sensor & controlingsystem.

Automation means not only mechanizing a process, but also making a system that controls that mechanized process. The control system should be able to "observe" by means of sensors (input) and regulate the process with motors and/or pneumatic devices (output).

Appendix 12 The specification of input and subproblems

1. The product(parts) classification and volumes *(input)*;
   - Number of products that should be produced (specified by sort): S.P.A. volumes.
   - Sorts of products (classification).
     - division in product families.
     - division in product groups (per family).
     - Number of parts per box/container or pallet per parts group.
     - Sort(s) of originating point(s) of the parts that have to be transported: (Store, O.D.plant, PMS, ...).

2. Way of producing: Blockbuild, mixbuild: batchsizes *(input)*.
   - Blockbuild, mixbuild...
   - Batchsizes per product or product family.
   - Allowed tool change time.

3. Partscontrol *(subproblem)*;
   - Sort / way of partscontrol.
     - Push partscontrol: several possibilities adoptions and applications. (MRPII, XBMS).
     - Pull partscontrol: several possibilities adoptions and applications. (JIT)

4. Safety stock *(subproblem)*;
   - Demanded size of the safety stock at the assembly line per productpart; is also determined by minimalizing transportation and storing costs.

5. Batchsizes for the partssupply; frequency of the partssupply *(subproblem)*; is also determined by minimalizing transportation and storing costs.

6. Productcontainers *(subproblem)*;
   - Way of presenting to the operator/machine.;
   - Sort of productcontainers to store;
   - The number of product containers that can be present in the store at the same time.
   - Material, shape, length, heidht, width;
   - Special requirements / adjustments;
   - Costs.

7. Total available area of the workingfloor *(input)*;

8. The assembly layout *(input)*;
   - Number of different product parts per working place.
   - Number of working places per product;

9. Way(s) of transport *(subproblem)*;
   - Sort/way of transport (capacity of the transport). This is also determined by minimalizing transportation and storing costs.

   Properties:
     - Transport velocity;
     - Maximum carrying weight / maximum number of boxes/containers;
     - Sort of transport boxes/containers;
     - The needed floor area for transport;
     - Costs.

10. Way of floor lay out *(subproblem / input)*.
    - Working place layout:
      - Number of free palletplaces per workingplace / operator;

- Floorarea available for store / handling unit;
- Floorarea available for assembly.
- Requirements/designconditions for floor mapping design.
- The part of the total available area, that is available for transport.
- Distances from origin to destinatation.

11. Ergonomical demands (for the handling of / the supplying of the assembly operator) *(input)*;

12. Automation requirements (for the handling of / the supplying of the assembly machines) *(input)*;

13. Further design requirements: modular *(input)*.

14. Store / handling unit at assembly line *(subproblem)*;
    - Sort/way of storing / handling of the products or the constructive design of the supplying mechanism.
        - Way of presenting to the operator/machine.;
        - Way of transfering the containers from the transport to the store at the assembly line.
        - Sort of product containers to store;
        - The number of product containers that can be present in the store at the same time.
        - Material, shape, length, heidht, width;
        - Special requirements adjustments;
        - Costs.

15. Originating point of transport *(subproblem)*;
    - Deliver process properties;
        - Process properties of the production at the O.D. plant; production batchsizes (minimum and maximum), tool change times;
        - Buffer size at the O.D. plant;
        - Process properties of the P.M.S.: production batchsizes (minimum and maximum), tool change times;
        - Buffer size at the P.M.S. ;
        - Reaction time of the delivery process of parts from the store. production batchsizes (minimum and maximum).

Appendix 13 Ergonomic tables

Maximum acceptable weight of lift (kg) for females (Snook, 1978)
Vertical distance: 51 cm
Height level: from knockle to shoulder height

Box length (cm)	One lift every (time period)															
	5 sec		9 sec		14 sec		1 min		2 min		5 min		30 min		480 min	
	$\underline{x}$†	S*	$\underline{x}$	S	$\underline{x}$	S	$\underline{x}$	S	$\underline{x}$	S	$\underline{x}$	S	$\underline{x}$	S	$\underline{x}$	S
75	10	1.2	13	1.2	13	1.2	14	2.4	15	2.4	18	2.4	19	2.4	20	3.0
49	10	1.2	13	1.2	13	1.2	14	2.4	15	2.4	18	2.4	19	2.4	20	3.0
36	10	1.2	14	1.2	14	1.2	15	2.4	16	2.4	19	3.0	20	3.0	21	3.7

table 4.4.a

Maximum acceptable weight of lift (kg) for males (Snook, 1978)
Vertical distance: 51 cm
Height level: from knockle to shoulder height

Box length (cm)	One lift every (time period)															
	5 sec		9 sec		14 sec		1 min		2 min		5 min		30 min		480 min	
	$\underline{x}$†	S*	$\underline{x}$	S	$\underline{x}$	S	$\underline{x}$	S	$\underline{x}$	S	$\underline{x}$	S	$\underline{x}$	S	$\underline{x}$	S
75	15	3.0	20	4.2	23	4.9	24	5.5	25	6.1	25	6.1	32	6.7	34	7.3
49	15	3.6	20	4.2	23	4.9	24	5.5	25	6.1	25	6.1	32	6.7	34	7.3
36	16	3.0	21	4.2	24	4.9	26	6.1	27	6.7	27	6.7	34	7.9	36	8.5

†: $\underline{x}$ = mean; *: S = standard deviation

table 4.4.b

(dotted) : safe weight of lift (hatched) : absolute maximum	a few times a minute different object-widths object no longer than 75 cm					
	30 cm		40 cm		50 cm	
startposition from the ground	10	30	10	30	8	25
start 40 cm above the ground	15	45	13	40	11	30
start 75 cm above the ground	20	60	17	50	10	45

table 4.4.c *: K.J. Poll, NIA

safe weight of lift absolute maximum	different lift-frequencies per minute for a object with a width of 40 cm.					
	1 - 3		3 - 6		6 - 10	
startposition from the ground	7	20	5	15	2.5	7
start 40 cm above the ground	10	30	6	18	3	10
start 75 cm above the ground	13	40	9	27	4	13

table 4.4.d *:K.J. Poll, NIA