

GLASS DELIVERIES IN SPARE PARTS

Case Kalmar Parts

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ABSTRACT

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This thesis is written for Cargotec Finland Oy, Kalmar. It is guided by Seppo Haapala, manager of logistics from Kalmar and by Dr. Anasse Bouhlal at TAMK.

The idea for this thesis came from increased transportation costs and FOC orders that Kalmar sends to compensate broken glasses to customers. The profit made from glass is lost when they have to be replaced for free.

The goal is to find some kind of solution or common ground on how to streamline this operation at Cargotec Finland Oy/Kalmar. This includes having a guide on what to check on claims, which claims to approve, how to monitor glass deliveries and so on. On some items streamlining may mean having individual packages and moving the responsibility from warehouse in the packing side.

The source material is based on interviews of employees at Kalmar and data provided by the company via SAP. SAP 6.0 is the main ERP used at Cargotec and it contains all deliveries, sales and purchases. Theoretical background is built from various sources of literature which provide the base on how items move in the company and how this is monitored.

The result will be recommendations on handling claims, monitoring shipments and to show how to choose which glasses to invest to with individual wooden packaging.

Key words: glass transportation, logistics, 3PLs, cost monitoring, claim procedures, SAP 6.0

CONTENTS

1	INTRODUCTION.....	6
2	Thesis in a nutshell.....	7
2.1	Research problems and questions.....	7
2.2	Objectives of the study.....	7
2.3	Thesis structure.....	8
3	Theoretical background.....	10
3.1	Qualitative and quantitative research.....	10
3.2	Glass.....	11
3.2.1	Factors to consider at storing glass.....	11
3.2.2	Inventory control.....	12
3.2.3	Measuring inventory control.....	15
3.3	Transportation types.....	15
4	Kalmar case.....	17
4.1	Kalmar's supply chain management.....	17
4.2	Overview of the glass process.....	18
4.3	Scope for the research and getting related information.....	23
4.4	Shipment costs.....	25
4.4.1	Glasses.....	25
4.4.2	Other items sent free of charge.....	26
5	Purchasing.....	27
5.1	Quality.....	27
5.2	Costs of FOCs and relation between bought and broken.....	28
5.2.1	Individual packing.....	29
6	Logistics.....	32
6.1	Handling inbound.....	32
6.2	Warehousing incidents.....	32
6.3	Leaving glass shipments.....	33
6.3.1	Compensation for the deliveries without pallet.....	36
6.3.2	Carrier's issues.....	36
6.3.3	Correcting methods for missing stickers.....	38
7	Sales.....	40
7.1	Sales orders.....	40
7.1.1	Issues at selling glass.....	41
7.1.2	Benchmarking.....	41
8	Conclusion.....	43
8.1	Recommendations.....	43

8.2 Follow up	44
REFERENCES.....	46
APPENDICES	47
Appendix 1. Example of a quality certificate that suppliers provide.	47
Appendix 2. Blueprint of the European distribution centre (EDC).....	48
Appendix 3. Email sent out to inform about the improvement.	49

ABBREVIATIONS AND TERMS

SCM	Supply chain management
FOC	Free of Charge (delivery)
FLU	Front-line (sales) unit
zsd_soreport	SAP code for sales report history (FOCs)
FI89	US Distribution centre (serves mainly Americas)
FI91	FIN Distribution centre (serves mainly Finland and Russia)
FI92	Nordic Distribution centre (serves mainly Norway and Sweden)
FI93	European Distribution centre (Global)
FI98	Asian Distribution centre (serves mainly Asia and Australia)
Neovia	3PL who operates FI93 and FI92
Transval	3PL who operates FI91
DHL GF	DHL Global forwarding, Kalmar's air freight carrier

1 INTRODUCTION

Glass business is a difficult industry because the product is so fragile to begin with. Since Kalmar delivers glass/windows to its own reach stackers, RTG's and other terminal equipment, it also has to deal with negative side of transporting glass.

There are different perspectives and aspects to include, beginning from sourcing and ending at sales. Ideally glass would be packed lightly, but firmly so it does not take much space but still keeps the item safe. The problem is; how to do this cost efficiently.

Some practical issues are e.g. that supplier's take their own cut if they have to start packing individually and those packages costs a lot to store as they are large. On the other hand, delivering multiple pieces at once means that warehouse/distribution centres have to separate these glasses and that is difficult to do fast without damaging the glasses and creating a bottleneck for inbound (Fredenhall, Hill, 2001, 83). Lastly, the customer wants to receive the item safe and sound but without a large package because that is costly for them as well.

By introducing the glass transportation aspects and showing a company working on the industry, a picture of the business is given. Then with the help of research and discussions with several people, some suggestions for Kalmar to deliver glasses are given.

This result can be anything from changing vendors, relocating packaging or dealing with carriers and customers differently in the future.

2 Thesis in a nutshell

2.1 Research problems and questions

At the time when research for this thesis started, Kalmar had the following replacement structure: customer makes a claim to parts department database via sales, then warehouse comments packaging respected and opens a transportation claim to the carrier. This claim to carriers is often rejected due inadequate packaging and then if the value is enough, Cargotec fills an insurance form. Regardless of the results from insurance company, Kalmar replaces the glass to the customer. None of these steps were questioned much and that turn out to be one of the issues as later shown in this thesis.

This blind trust to all mentioned parties has been the practice as the attention of the claim handler is also divided for all other outbound issues and glasses seem like a small part of it. Customers are believed to keep satisfaction high and there has been disregard to the aspect that also receiver has responsibilities while accepting deliveries. The same goes for the warehouse. The packaging process was not checked at all by the claim handlers, even though the measurements and weight of every shipment can be found from SAP. Also carriers have been tempering with the deliveries, but as that is not the assumption, they were trusted to inspect the claims thoroughly without questioning.

Looking into all these points, 4 main questions were raised:

- Are claims made by customers valid, do they have the proof?
- How to monitor warehouse packaging?
- How to improve packages that break regularly?
- What actions can be taken to control deliveries better?

2.2 Objectives of the study

The main objectives are to check data from SAP which provides information for everything shipped from Kalmar spare parts operations. Then with the data, compare and

raise those items that are costing a lot of money and also check shipping expenses as those are generally higher than the items individual buying value.

After this the claim database process is to be checked and studied. Up until now Kalmar replaces all broken glasses with or without pictures, reserve markings or any other proof. Also warehouse has been claiming until this study that everything is always packed accordingly so this has to be proved and scoped and then same goes for the carriers.

When all others points are inspected, there still is the founding issue that glasses are getting broken so the last objective is to check what sort of correcting methods should and can be implemented within reasonable costs.

2.3 Thesis structure

The study will be divided into 5 sections. At first the theory behind inventory, logistics and ways of measuring it, then introducing Kalmar's current supply chain management which is followed by department chapters. Below divided more accurately:

The first chapter introduces the theory of which is used to control inventories and how stocking decision are made. This opens up the reasons why Kalmar stores items in certain ways and how it is monitored. The main idea is to show that glasses cannot just be sent to where or however as there is a certain logic behind it all. Otherwise there would be non-moving items stored all over the world in Kalmar's front line units and this storing would be not only be expensive but also difficult to replace when needed.

Second chapter shows the placement of Kalmar units and how items go through the system. Then the overview of the glasses is shown and the scope is introduced. The scope is followed by key point items and showing the figures behind the study.

Third chapter explains the situation from purchasing point and what can be done there to prevent breaking.

Fourth is logistics and there inbound, warehousing and outbound are studied to point out their position in this glass problem. This chapter also includes the carrier and 3PL

issues which were brought up in the research. The logistics section has also some related correcting methods.

Last main chapter is about sales and all the problems they have with these constantly breaking items. This chapter explains why fixing this issue is critical from image and customer view.

After these a conclusion and recommendations are made based on discoveries through the chapters.

3 Theoretical background

3.1 Qualitative and quantitative research

Qualitative research for this thesis will be answering the research questions and determining with carriers' and 3PLs which methods can and cannot be implemented. This will be done based on recommendations, instructions and contracts.

These discussions that happened weekly with some party guided the direction that was decided to take. They gave a big picture of the processes and understanding why some actions would not be taken. To give an example, one idea was that all replacement deliveries (FOCs) would be in wooden box and basically that could be done via SAP by writing instructions on the sales order, but EDC would need to then store empty wooden boxes and then extra space needs to be made for boxes that do not even include parts.

Besides the discussions, also literature gave the thesis some direction as elements of inventory planning needed to be included. It would not make sense to send money and time on items that represent only a fraction of the operations. Therefore, the more important ones needed to be spotted by using the theory behind inventory management used at Kalmar.

The third qualitative method was delivery claim database which had information about all the broken glasses and pictures. The claims showed the way that claims were handled individually and there it was established that Kalmar is replacing all glasses, but rarely gets any money back from carriers, insurance company or warehouse. Based on delivery claims, also transportation claims were made which were used to discuss with outside parties.

Quantitative method was the founding data behind all the research. Data extracted from SAP gave all the information about volumes and costs used on glasses. With this information all the sorting for purchasing, logistics and sales was able to get done. The calculations had to be sorted many times as the information was not always correctly inserted to SAP but after redoing the excel time after time, it finally represented the actual figures that actions can be based on.

3.2 Glass

Glass as a material can be used for many purposes such as building, home decoration, eye wear and so on. In this context glass is used in technology industry and to specify; in terminal handling machines. The size of the glass object can vary from 2 kilos to 30 kilos a piece and measurements are between 10x7x10 and 180x80x130 depending how standing. In the system and in this study also mirrors are calculated into the glass group due similar elements such as breakability and function at usage.

The main purpose of the glass items used by Kalmar is to cover the sides on the cabins and provide visibility for the operating machine handler (Rantanen, 2016).

3.2.1 Factors to consider at storing glass

To sell glass, planning for its logistics must be done also. According to Dr. Bensalem (2015) storing can be divided for:

1. raw materials
2. consumable supplies
3. service and repair parts
4. work in process
5. maintenance
6. safety/buffer stock
7. actual goods to be sold / finished goods

In this case Kalmar does not manufacture the glass materials or have them for own use so the storing classes are safety stock and goods to be sold. These item categories just like others, need planning to include certain factors to be efficient and those are (Pouri, 1983, 8):

- reliability of the supplier
- availability
- quality
- economical manufacturing sizes

- lead time
- distance of the supplier
- price and its stability
- storing space

In Kalmar's case the reliability of the supplier is 50-90% depending on item. This is based on the information in SAP so the program also calculates itself the needed buffer stock. This calculating remains the same throughout the year as availability has to be around the year due terminals operating around the year. Quality and its monitoring as explained at Quality section.

Economical manufacturing size varies upon the glass product, but in every case the glass is specifically manufactured as the glass suppliers use make-to-order model. Kalmar's lead time is on average 6 weeks and the suppliers are in Finland. The distance to the distribution centre in France, which is on focus point in this study, is one week after arriving to the Finnish warehouse for sorting.

According to the buyer Tuija Teräs, 2016 prices are relatively stable, but sometimes there are changes like e.g. due to new environmental laws, the energy cost is recently included to the prices.

One of the most important things to include is the storing space as that is limit and contract based. Kalmar sells large windshields to terminal handling machines which require space to store. This is handled and planned by 3PL in Cargotec warehouses. In EDC and NDC it is done by Neovia logistics, in ADC by DHL and in AS by Transval. USDC is currently operated by Kalmar personnel.

3.2.2 Inventory control

Due to the previously mentioned points at glass storing, the inventory is bought to have supply not only for the demand, but also to have items for the production time. Kalmar uses continuous control system and to know how many pieces to order, a certain formula is used; $EOQ = \text{Economic order}$ (Fredenhall, Hill, 2001, 193).

$$\text{EOQ} = \frac{\sqrt{2CoD}}{C}$$

Where the root of 2 * Ordering cost * Demand is divided by Holding cost.

Economic order quantity gives the amount that needs to be ordered, but also the reordering point needs to be calculated to tell when this order should be placed in the system (Bloomberg, LeMay, Hanna, 2002, 149). The ERP system automatically calculates this for the items, but the theory behind it is the same as calculated by hand (Fredenhall, Hill, 2001, 191-192). Counting reorder point:

$$\text{ROP} = dL + \text{safety stock}$$

Where reorder point is Demand * Leadtime + Buffer stock.

Buffer stock comes from wanted service level * root of lead time. Service level wanted at Kalmar is 92% in 2016 (Parts Policy, 2016, 37)

Below details of one specific part:

Rear view mirror 921702.0002

ROP: 76 pieces

Lead time: 47d

Annual demand: 524.8=523 pieces.

If periodic system would be used larger quantities are ordered as there is no real time control. Using this system, the calculation requires the following aspects: average demand rate, fixed time between orders, lead time, standard deviation of demand, safety stock and inventory.

At choosing the right inventory management style, two different calculations can be used: inventory turnover and stock cover (Bensalem, 2015):

$$\text{Inventory turnover} = \frac{\text{Cost of goods sold during 12 months}}{\text{Current net inventory value of goods}}$$

If an item has a slow inventory turnover, then the quantity ordered should/could be smaller. For example, total value of the stock is 1500 EUR and value of annual usage is 6000 EUR. That means an inventory turnover of 4. (6000/1500) and out of 365 days of the year, the inventory turns 4 times a year and time at hand for one turn time is $365/4=91,25$ days. In Kalmar item is considered slow-moving if inventory turnover is below 0,85 and non-moving if there are no activities in two years' time (Parts Policy, 2016, 19).

To see if there is overstock, stock cover can be calculated:

$$\text{Stock cover} = \frac{\text{Current stock} \times 50}{\text{Forecast annual usage}}$$

Example of a case; item is categorized as A-class based on pareto principal. (20% of amount, 80% of value item). Ideal stock cover is 1-4 weeks and the total value at stock is 1500 EUR as before. Therefore $1500 \times 50 / 6000 = 12,5$ which means that there is an overstock situation and inventory on hand should be smaller.

The ideal stock covers depend on the industry but generally can be divided as following (Bensalem, 2015):

A-class 1-4 weeks

B-class 2-8 weeks

C-class 3-20 weeks

The relation between these classes is the key so inventory value is controlled. Time may vary depending where the items are going. For example, in food industry it is days, in technology weeks and in construction industry it can be months.

3.2.3 Measuring inventory control

In inventory control availability and completeness are encountered to show service level. Availability tells how many ordered lines were delivered and completeness tells how many orders were delivered completely without backorders (Parts Policy, 2016, 14).

$$\text{Availability} = \frac{\text{Completely delivered sales order lines}}{\text{Total number of sales order lines}}$$

$$\text{Completeness} = \frac{\text{Number of orders delivered complete}}{\text{Total number of orders}}$$

3.3 Transportation types

There are several different ways to transport goods. Rail, road, air, combination and pipe (Karrus, 2000, 114). For this case air and road are the most significant ones because glasses are ordered by companies usually when one breaks and they need a replacement fast.

When it comes to availability, road transportation is the best because it is the only door-to-door possibility. It is also the cheapest for short distance and there are multiple service providers because the fixed costs for the start-up are much lower than e.g. for air freight operators and plane owners. Road transportation is charged either by weight or volume. The highest weight is the one always used. Volume is calculated as following:

$$\text{height m} \times \text{length m} \times \text{depth m} \times 400$$

Air freight is more challenging to use as the space is limit. Planes do not fit as big volumes as truck do. DHL Global Forwarding which is Kalmar's carrier in air freight has restrictions for carriage and those are 360x180x160. If glass does not fit to those measurements packed, a special quotation has to be asked from service providers for a special plane. Charging of an air freight is naturally also different than with trucks and done based on either: actual weight, cubic dimensional weight or the minimum weight (where applicable). The dimensional weight is calculated as following:

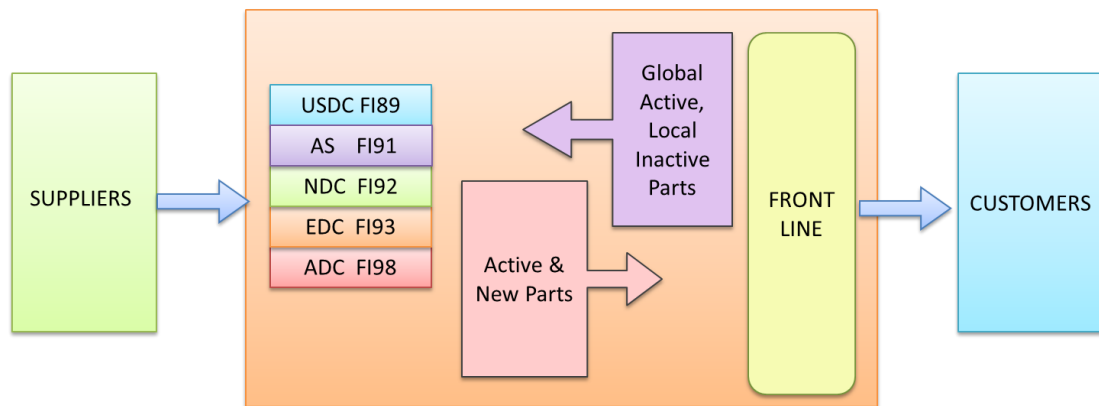
$$\begin{aligned} & \text{height m x length m x depth m x } 167 \\ & \text{or/same as} \\ & \text{height m x length m x depth m x } 1000 / 6 \end{aligned}$$

The highest weight of these is always the one used.

4 Kalmar case

4.1 Kalmar's supply chain management

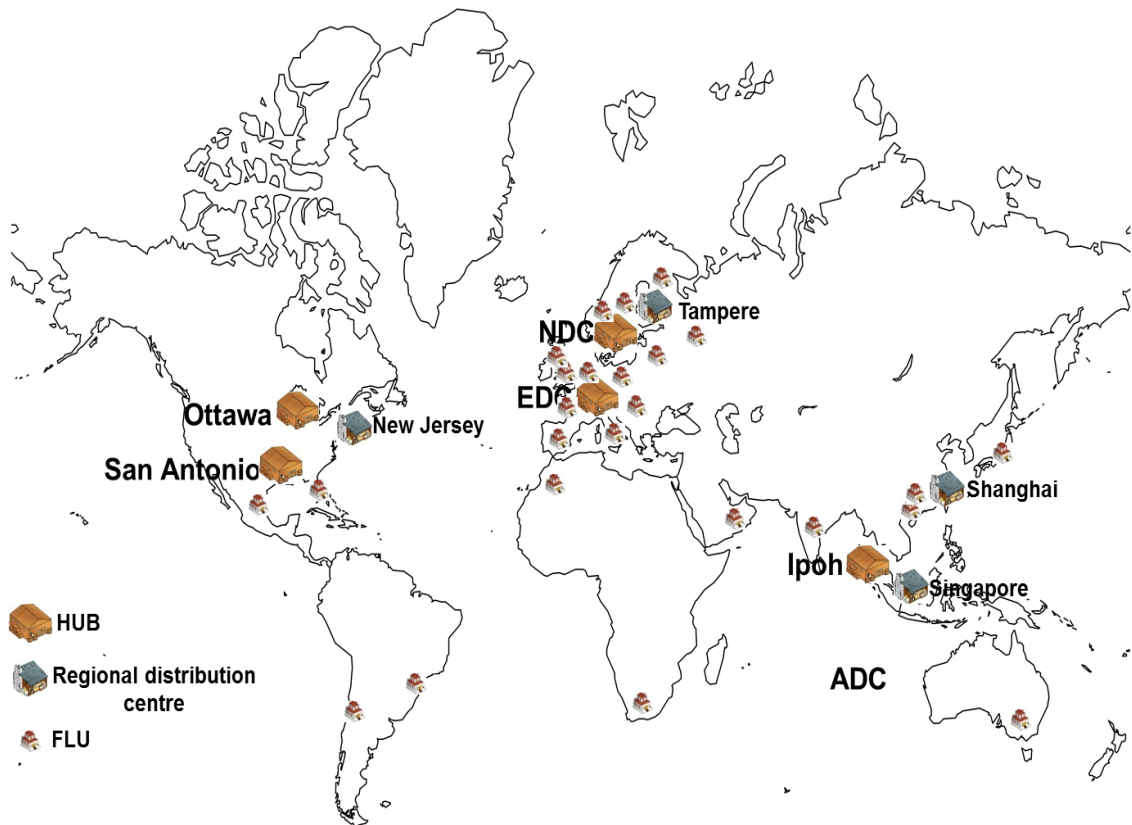
The flow of products is as in the picture below.



Picture 1 Material flow in Kalmar's SCM

As glasses come from suppliers, they are checked into distribution centres and from there sold to the customers. EDC is the main distribution centre with the highest volumes and since most glass manufacturers are from Finland, glass is often brought first to the local warehouse in Tampere (AS FI91). From AS, also referred as Transval, glass is consolidated and moved as stock replenishment delivery to EDC in France.

The logistics network of spare parts is divided as following:



Picture 2 Logistics network of Kalmar spare parts (Avoimet ovet presentaatio_2015/Kalmar/Logistics U-drive)

4.2 Overview of the glass process

The fact at the moment is that a lot of glasses are breaking and the design of the package is not sufficient enough. Below are examples for airfreight, then express deliveries and after those multiple glass delivery -packages.



Picture 3 How straight windows should be packed (Kalmar's Packing and labelling guide)



Picture 4 How curved glass is packed ((Kalmar's Packing and labelling guide)

Unfortunately, this is not how they look once arriving to the destination.

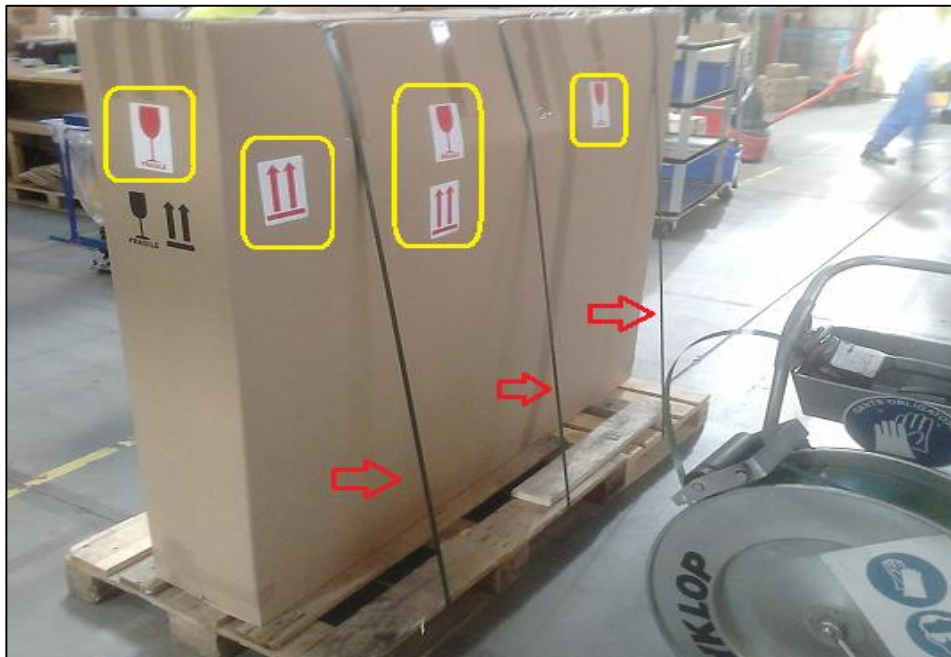


Picture 5 How glasses arrive. Example 1. (Kalmar SharePoint Delivery Claim Database)

The presented air freight wooden frames have been changed mostly to air express packages which are carton boxes. Below pictures from the guide; the packaging is stable looking and according to Kalmar guidelines.



Picture 6 Kalmar's guide on foam for express glass, this prevents shaking (Cargotec Pack Express guide)



Picture 7 Packages should also be secured on a parcel. (Cargotec Pack Express Guide)



Picture 8 Delivered item. Packing not respected on this case and the corner is broken. (Kalmar Share-Point Delivery Claim Database)

The damages glasses are broken in many ways and there does not seem to be one single reason which is causing them to break.



Picture 9 Completely broken tempered glass

Below example of one supplier's glass shipment with their packaging. This packaging is more effective in space than Kalmar's when it comes to shipping several glasses at the same time.



Picture 10 Picture of how one supplier did direct shipment. This was more cost effective than Kalmar's wooden box.



Picture 11 Kalmar's package with the same amount of windows. This is higher and takes more volume space.

As seen in the pictures, there are broken items and corrective methods are needed. In the beginning of the study, the only issue seemed to be the packaging based on these and several other pictures so that is where the research was started.

4.3 Scope for the research and getting related information

While determining the scope, not only for the amounts of compensation deliveries, but also the reoccurring items needed to be spotted. To begin, information and raw data was needed about the free of charge deliveries.

SAP and its transactions like “*zsd_soreport*” are crucial at this point to get a list of items that have been sent as FOC’s. From that the scope building began starting by sorting the correct material group: W, which is glass, window and related materials category. Then the time scope was determined to start from November 2013, because that is when SAP 6.0 was implemented by Cargotec. With the found material list the hunt for shipment and delivery numbers began.

The first concrete problem was that not all materials are inserted correctly to the SAP. Some machine designers e.g. list glass door under other materials and not as glass, even though that would describe the material itself better. This issue made listing targets much harder, but after finding out the main glass suppliers; the search could be narrowed and listed by vendors who deliver glass. Excluding other materials is easier, because glass manufacturers sell mainly glass. By creating an excel file with related information, some numbers could be drawn:

The pieces of glass sent free of charge:

33 items between 1.11.2015-1.6.2016

66 item during 2015

55 items during 2014

10 items from November-December 2013

Top glasses sent as FOC between from November 2013 till 1.6.2016

Material	Description	Pieces sent as FOC
Item 1	FRONT WINDOW	21
Item 2	FRONT WINDOW	19
Item 3	REAR VIEW MIRROR	9
Item 4	GLASS, GREEN	8
Item 5	GLASS	7
Item 6	MIRROR	7
Item 7	GLASS	5
Item 8	WINDSCREEN	5
Item 9	GLASS, GREEN	5
Item 10	FRONT WINDOW	5

Table 1 10 most replaced glasses based on quantities

*new material code xxxxx

** new material code xxxxxx

4.4 Shipment costs

To get actual numbers and to have perspective, the shipment costs for glasses and other items have to be compared. These figures and the scope are the base for the purchasing, logistics and sales chapters.

4.4.1 Glasses

Once again to find out the shipment prices, SAP has to be used. Transactions vi 11 gives directly shipments numbers for each FOC. Sorting these lead to some issues such as the fact, that replacement shipments might include others items. To have the numbers being as realistic as possible, items that are not part of category W, are deleted and based on weight, their input can be decreased from the shipment cost.

The total amount of just shipment costs since November 2013 till first of June 2016 escalated into xxxx€. To this sum the actual purchase price of the glasses needs to be added in order to find out the total lost/spent amount. Also the transportation cost of the bought glass should be added to get even more detailed numbers but that is not possible to get accurately so estimated are left out. The glasses which are most of the time sent from EDC, come there as part of a consolidation, so the price for each piece is nearly impossible to estimate.

Based on the data given by various transactions in SAP, it can be concluded that many FOCs have been sent with the highest delivery priority; 3 and this is optimized as air express to most countries. Simply by not sending glasses by air express, costs can be cut down. E.g. the highest shipping costs came from a delivery to Poland where 5 glass items, 4 doors and 1 window were shipped. These could have been sent approximately at the same duration but much cheaper with a truck, if priority 2 would have been chosen for that. This is where the so called “real life” problems step in: there is no sure

knowledge why glasses have been instructed to be sent with the highest priority, but this can be fixed now that the issue came to light.

Shipping price	Special proc
xxxxx	AEXP

Figure 1 The line with shipping costs of over xxxxx EURs.

4.4.2 Other items sent free of charge

To compare the costs between glass freights and other freights, the large volume costs of glass deliveries can be seen.

Year	Glass	Others	All	Unit	Glass %
Scope	164	3363	3527	PCS	5 %
End of 2013	10	73	83	PCS	12 %
2014	55	861	916	PCS	6 %
2015	66	1396	1462	PCS	5 %
2016 1.1-1.6.	33	1030	1063	PCS	3 %

Table 2 Relation between glass in units and other items in units.

Year	Glass	Others	All	Currency	Glass %
Scope	xxxx	xxxx	xxxx	EUR	xx%
End of 2013	xxxx	xxxx	xxxx	EUR	xx%
2014	xxxx	xxxx	xxxx	EUR	xx%
2015	xxxx	xxxx	xxxx	EUR	xx%
2016 1.1-1.6.	xxxx	xxxx	xxxx	EUR	xx%

Table 3 How much glass freights have cost compared to other items

The high shipments costs can be partially explained by their large volumes, but also streamlining the delivery priority and shipment mode (truck-air-express) can be now acknowledged and chosen more carefully. Also as year 2013 and 2014 are compared, there are nearly double figures used on 2015 on shipments. As the amount of glasses from table 1 has only increased a 1/6 part, the misguidance of using air express seems to have happened there. In the following chapter, also the purchasing costs are looked into.

5 Purchasing

To monitor the inbound, quality is one part that needs attention. Otherwise it cannot be known if the glasses get broken just because the quality is not sufficient enough.

5.1 Quality

This chapter about quality is solely based on interview given by Pasi Rantanen, manager of mechanical engineering at Kalmar.

Quality of the glasses is not supervised by Kalmar, but manufacturers are trusted to manufacture according to industry standards. Purchasing works are following: orders certain glass types are ordered and those are manufactured for the company. Some glasses are clear and some tinted. Actual certificates of which are which are given rarely by the supplier and those are just as rarely asked for any purpose. If they are needed, they need to be ordered beforehand, because later on it is nearly impossible to give any guarantee of the quality. If the certificates would be wanted every time, this would mean having double purchasing lines for each item and that practice is not implemented. Example of certificate as appendix 1.

To prove later that glasses are from Kalmar and not another supplier, stamps are put in all the glasses.

The few quality standards Kalmar demands for floor glasses, is having laminated, tempered material which is strong enough to handle cleaning of the surface. Floors are manufactured from two-layered glass and windows are made from one layer. Windows do not always need to be laminated unlike floors, but they have to be tempered. Some countries like USA demand all glasses to be laminated whether it is for the cabin window, wall or floor. In all countries the floor glass is thicker, but that is not guaranteed to carry human weight. Some customer may order this kind of special glass, but it is rarely bought or provided.

The testing is done by the supplier; they do a test called DIN 356. Kalmar does not test these at all. The cabins themselves have mechanical safety measurements that prevent the driver of the terminal machine from falling.

5.2 Costs of FOCs and relation between bought and broken.

To determine Kalmar's purchase-sales efficiency, it is crucial to compare the numbers between bought, sold and FOCs. By using SAPs transactions, this comparison with bought and free of charge pieces can be done.

At closer look, these FOCs can be divided for two purchasing categories. The first one is the amount of money spent on buying new ones and that is the first table below. The total sum of new glasses that needed to replace the broken ones is xxxx EUR. The second one is the relation in percentages of how many of bought items get broken. On both these tables mostly the same items come up. Those items that show in the second table are the ones purchasing will request to be packed individually as it appears based on this that Kalmar's general packaging is not enough to protect them.

Material code	FOC Pieces	PO Price	PCs*PO price
Item 1	21	xx	xxx
Item 2	19	xx	xxx
Item 3	9	xx	xxx
Item 4	8	xx	xxx
Item 5	7	xx	xxx
Item 6	7	xx	xxx
Item 7	5	xx	xxx
Item 8	5	xx	xxx
Item 9	5	xx	xxx
Item 10	5	xx	xxx

Table 4 View of how much 10 most sent glasses have cost to purchase again. Prices in EURs.

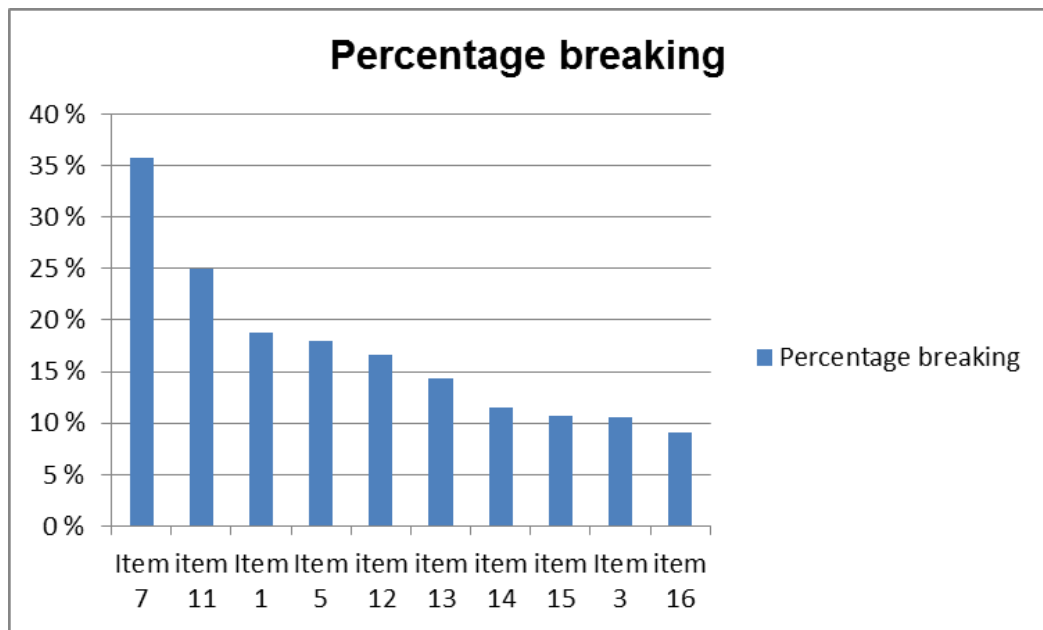


Figure 2 Top 10 items that get broken of the purchased ones

Out of all the items that have been even once sent as a FOC, the relation is 164 FOCs out of 5654 bought pieces, which is 2,9 %.

5.2.1 Individual packing

According to data extracted from SAP; the top breaking glasses have varying relation between purchase and FOC deliveries. From the table above it can be seen that some items have acceptable percentage of pieces breaking, but some of those: e.g. Item 7, item 17 and item 11 are breaking more frequently. Since these items are not broken on various occasions by third party logistics (read more in logistics section) and they have a high percentage of FOCs with bought units, it can be concluded that these glasses have a package that is not sufficient enough.

Out of the top ten glasses, 2 are bought from USDC and they can be changed in SAP to be individually packed. Glass item 15 turned out already be individually packed but the amount of broken ones is so small (2) that further actions are not needed. Item 17 on the other hand repacking code P: repacking at picking so that needs to be changed to S like item 15 is. That means keep supplier package and no repacking done at EDC.

Other glasses Kalmar will be quoting from suppliers and warehouse FI91 which can also provide individual packaging. The items that were selected to be packed are based the following logic; is this following sentence TRUE or FALSE:

Individual packaging + bought items - FOC pieces
is smaller than
FOC items + shipment costs + other bought?

Based on this variation some glasses should be packed individually, even though the purchasing cost would rise. An individual wooden frame costs depend on the size needed, below a table with suggested packaging for some glasses.

Description	Item	Measurements	Package measurements
FRONT WINDOW	item 11	xxxx	1400 x 460 x 1200mm
FRONT WINDOW	Item 1	xxxx	1400 x 460 x 1200mm
WINDSCREEN	item 17	xxxx	1400 x 460 x 1200mm
SIDE WINDOW	item 12	xxxx	1400 x 460 x 600mm
GLASS, GREEN	item 14	xxxx	1400 x 460 x 1200mm
WINDSCREEN	item 15	xxxx	1400 x 460 x 1200mm
FRONT WINDOW	item 18	xxxx	1400 x 460 x 1200mm
GLASS, GREEN	item 19	xxxx	1400 x 460 x 1200mm
PANES	item 20	xxxx	1400 x 460 x 1200mm
GLASS	Item 7	xxxx	1400 x 460 x 1200mm
GLASS	Item 5	xxxx	1400x460x1400mm
FRONT WINDOW	Item 2	xxxx	1400 x 460 x 1200mm
WINDSCREEN	Item 8	xxxx	1400 x 460 x 1200mm

Table 5 Glasses that have been quoted for individual packaging

Prices for 10 wooden boxes are between xx-xx euros but for 1 piece they vary from xx-xx to xx euros (Tirronen, 2016). Few examples on the table to come, on how glasses are scoped for individual packaging. Some will be packed also if they break often, even if financial value is not gained. This is done to stop certain glasses from constantly being replaced. To be noted that the calculation behind the table below is naïve and presumes that wooden boxes will not get broken.

Description	Material code	FOC Pieces	Purchased	Supplier
GLASS	Item 7	5	14	Supplier 1
GLASS	Item 5	7	39	Supplier 2
SIDE WINDOW	Item 12	2	12	Supplier 3
FRONT WINDOW	Item 11	2	8	Supplier 4
FRONT WINDOW	Item 1	21	112	Supplier 4
New Cost	FOCs and bought	Shipments	Change?	Difference
XXXX	XXXX	XXXX	TRUE	XXXX
XXXX	XXXX	XXXX	TRUE	XXXX
XXXX	XXXX	XXXX	TRUE	XXXX
XXXX	XXXX	XXXX	TRUE	XXXX
XXXX	XXXX	XXXX	TRUE	XXXX

Table 6 Glasses that will be packed individually based on cost estimate.

The final decision about raising prices to produce more steadily packed glasses will fall to Kalmar sales team, as the choice between branding (offering more expensive and better packed) or pricing (having cheaper prices with only carton package) is the question. These decisions can be made once Kalmar is provided with the offers to have individual packaging.

6 Logistics

6.1 Handling inbound

The first thing for items to do once they come to Kalmar's distribution centre(s) is to check the repackaging code. This code tells whether the item needs to be repacked into Kalmar package or if it can be shelved e.g. in the supplier's package. There are several codes used by Kalmar so to list few, there are e.g.:

S	= Keep supplier's package
P	= Repack at picking
R	= Repack at receiving

Approximately 20% of the items are coded beforehand and rest in reception. The coding at EDC is done this year based on weight, value and description. The thumb rule is that everything over 20kg only gets the Kalmar sticker. Glasses do not have any specific coding at use. (Haapala, 2016)

The problem with glasses for warehouses at inbound is that they are too tightly packed and difficult to separate. The amount of broken glasses upon arrival is relatively small compared to outbound. The total is xxxx EUR within the scope time. 4 of these pieces came to FI93 (France) and 7 to FI91 (Finland).

6.2 Warehousing incidents

At warehouse glasses break also in handling. To track these events there are different reason codes used between Kalmar and 3PLs. These codes tell which party to hold responsible and what these actions cost. For business relationship between Kalmar and Neovia's these are found in a "black book". This black book is combined between the parties every year and reasons checked. The year 2015 led to 25 damaged glasses at EDC and cost Neovia xxxx €. Below a screen shot from this black book and how it is scoped. Year 2014 collected 18 incidents with damages worth of xxxx € and 2013 since November accumulated to xxxx €. 2016 cannot be joined as black book is always done at the end of the year.

Year	Amount in EUR
2013 Nov-Dec.	XXXX
2014	XXXX
2015	XXXX
All by end of 2015	XXXX

Table 7 Warehouse incidents with glass material

X

Picture 12 Material description and reason for movement give specific incidents related to glass (Kalmar's black book, internal hard drive for logistics)

To reduce these incident, an idea came to use an own packaging code for glasses. As dangerous good have their own; a similar one could be used for W. This code could bring extra caution to the handling and warn workers that this item is fragile but it was found too difficult to implement as 3PLs use their own system and SAP categories would affect so many other aspects as well and this would not be wanted. Therefore, that idea was dropped.

6.3 Leaving glass shipments

USDC sends out all Kalmar glasses to be packed individually because their volumes are much smaller so this next chapter is only about EDC:

As Kalmar has specific instructions on glass packing, it is assumed that this is how they leave the warehouse. The research to the outbound deliveries proved though that many express deliveries arrived without the pallet which is crucial in keeping the items standing, (referring to Picture 7 Packages should also be secured on a parcel. (Cargotec Pack Express Guide). The scoping of issue subjects from the entire delivery claim database is done from several categories which are:

- 1) wrong part
- 2) wrong quantity

- 3) part damaged (bad packing)
- 4) part damaged (bad handling)
- 5) shipment lost
- 6) mixed case label
- 7) excess quantity
- 8) incomplete part
- 9) other
- 10) delayed shipping

From these all bad handling/packaging claims can be chosen and out of those by individually checking; the glass items can be found. Below picture of excel to which into claims have been exported from SharePoint site.

F	G
Claim Type	Issue Subject
04 - Kalmar Claim	03 - Part Damaged (Bad Packing)
04 - Kalmar Claim	03 - Part Damaged (Bad Packing)
01 - Warehouse Claim	04 - Part Damaged (Bad Handling)
02 - Transportation Claim	04 - Part Damaged (Bad Handling)
01 - Warehouse Claim	03 - Part Damaged (Bad Packing)
01 - Warehouse Claim	03 - Part Damaged (Bad Packing)
01 - Warehouse Claim	04 - Part Damaged (Bad Handling)
01 - Warehouse Claim	03 - Part Damaged (Bad Packing)
02 - Transportation Claim	03 - Part Damaged (Bad Packing)

Picture 13 Selecting a scope from delivery claim database to track wrongly packed glass.

This research pointed out that several deliveries were not actually sent according to the instructions. This information came from two main sources: firstly, based on responses from customers on how the glasses arrived and secondly, by comparing the glasses' weight against the weight with pallet. From that data it can be seen that shipments' handling unit weights were less or equal to item gross weight so they could not possibly have been sent with 15kg pallets.

G	H	I	J	K	L
Item weight	HU weight	Issue	HU dimension	Pallet weight	Pallet size
21kg	80kg	ok	240x80x140	15	80x120
8 kg	11kg	weight	180x30x71	15	80x120
19kg	27kg	weight	172x32x136	15	80x120
15kg	20kg	weight	176x23x100	15	80x120
17,80 kg	14kg	weight	170x110x21	15	80x120
21kg + 14kg	41kg	weight	176x115x24	15	80x120
14,24 kg	68kg	dimensions	180x60x138	15	80x120
19kg	68kg	dimensions	180x60x138	15	80x120
5 kg	11kg	dimensions/weight	80x60x60	15	80x120
14,24 kg				15	80x120
19kg				15	80x120
21 kg	44kg	ok	180x80x218	15	80x120

Picture 14 Calculation difference between weight, dimensions and handling units.

After that also some FOC deliveries were found to have gross weight more than shipment weight. As shipment weight is controlled always and Kalmar is billed based on it, it became obvious that some glasses do not have correct weights at SAP. E.g. glass item 21 was marked 30kg but handling unit weight was 27kg. After re-weighting, it turned out that the glass is actually only 19kg.

After this first result, the others on the list had to be checked. The only way to check this is to ask special request from EDC and as warehouse labour hours cost a lot, it was decided that only items marked with x or y spending would be weighted again. The classification of X, Y, Z is done as following (Parts Policy, 2016):

XYZ -classification

Sales frequency (Sales actions / year) at Central Operation(s)

X	Y	Z1	Z2	N
>50	12-49	3-11	1-2	0

By using this system, resources are not used on items that are not sent often. At this point is also good to note that sending out FOCs increases statistically the demand so some items can be ordered e.g. 2 times a year but even 1 compensation delivery makes it a Z1 item and so on. (FOC is statistically a sales order in SAP 6.0 and that is why it will show as one and does not create a different mark on the consumption.) This is why

the scope is only on Y and X products are they attend to have sales higher as well and the compensation deliveries will be the reason behind it.

After weighting several glasses, the list of items sent without pallets could be proven and the amount with replacement freight costs went above xxxxx €. As discussed previously in the shipping costs segment; the total amount for FOCs is xxxx € so this number is remarkable part of that and explains also why so many shipments arrive broken.

6.3.1 Compensation for the deliveries without pallet

After completing the excel with accurate information, it was proven that EDC had sent several glasses without the appropriate package and Kalmar could ask for refund. Another sheet for done for the carriers as some deliveries were received without the pallet even though EDC put one. Those cases are claimed from carriers.

EDC's warehouse manager agreed to compensate the ones without pallets by them for Kalmar as the study evolved. EDCs total amount is xxxx EUR and those in the scope 2013-1.6.2016 is xxxx, (of which xxxx TNT compensated based on automatic delivery claim done.) This little below xxxx EUR figure already decreases the shipment costs by nearly 19% and as discussions with carrier continue, even more is coming from there.

6.3.2 Carrier's issues

As this matter was discussed between DHL GF, Neovia (warehouse operator) and Kalmar (I), DHL informed us they find Kalmar's packaging insufficient. After this study is finished it will be decided how much they will refund for the removed pallets as relation to the fact that DHL does not see them appropriate even with the pallet.

To not have an insufficient packaging, DHL GF has five rules that all glass materials should follow and those are (DHL GF, 2015):

1/ Using a reinforced wooden crate;



2/ Using an outer packing that could be easily handled with a forklift;



3/ Choosing an adequate inner packing to prevent the glass from moving inside and being damaged.

4/ Sticking specific direction labels (see example: “this way up”) or painting direction markings on the crate



5/ Sticking specific labels indicating that shipment is fragile or has to be handled with care (see examples below)

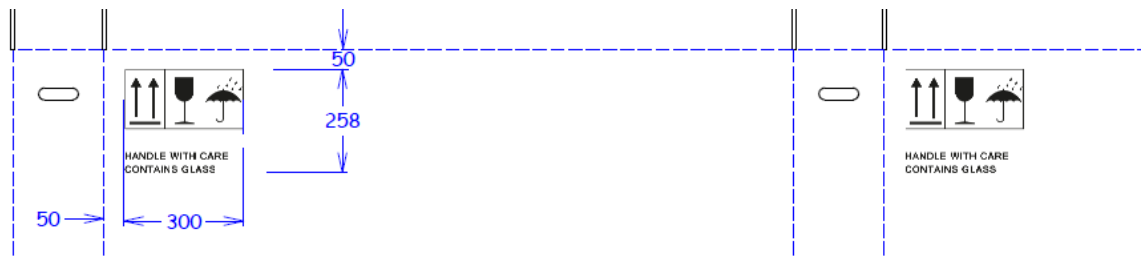
Kalmar follows all except the first; (wooden box) as carton is used. Neovia has informed that storing multiple wood boxes is not possible due space limits so that is why Kalmar uses carton. Blueprint of EDC as appendix 2.

Another point that came up during the discussion and via some claims was that Neovia does not always use the sticker (this way up) so they will source for carton boxes that have it already. To fix this reoccurring issue of missing stickers, ideas from Benchmarking section can be implemented.

6.3.3 Correcting methods for missing stickers

Kalmar asked for a quotation for the carton boxes that are used for glasses. The cost is as following:

1. Unit cost = xx € (instead of xx €)
2. Tooling cost = xx € (one time only cost)



Picture 15 Drawing on how new label looks like on opened carton box.

This change was decided to implement so the 3PL does not have to remind employees to add stickers constantly and claim handler(s) do not have to discuss this issue anymore with Neovia. The matter is quite small but it creates unnecessary issues for daily communication via claim database.

This marking is also requires and/or recommended by the carriers such as TNT and DHL so Neovia and Kalmar have no need to raise this issue anymore with them. For transportation reasons, it is smart to have the “contains glass” stated on so handling people, throughout the supply chain, see that it is a fragile package.

Previously Kalmar had the markings on the carton boxes as well but those were removed when the boxes got changed from one piece to two pieced items. That was done for safety reasons and markings got left out while designing the new box. (Comba, 2016)

7 Sales

7.1 Sales orders

Sales have problem with glass in different way than purchasing. Both would of course want those undamaged at destination but sales are also responsible to the final customer. As purchasing orders multiple pieces to warehouses, it is less stressing to handle the glass claims as often only one or two break and there are many still at the warehouse that can be sold. But sales only send one or two at the time to the customer and if they are broken, the replacement is a completely new delivery.

The freight costs are also expensive, so as calculated on the FOC chapter; the replacement freights cost more than the item itself and as learnt; the delivery priority should not be always the fastest and the most expensive one (3). It is not even necessarily fastest to the customer as e.g. trucks within EU go faster than flights because of their pit stops at HUBs.

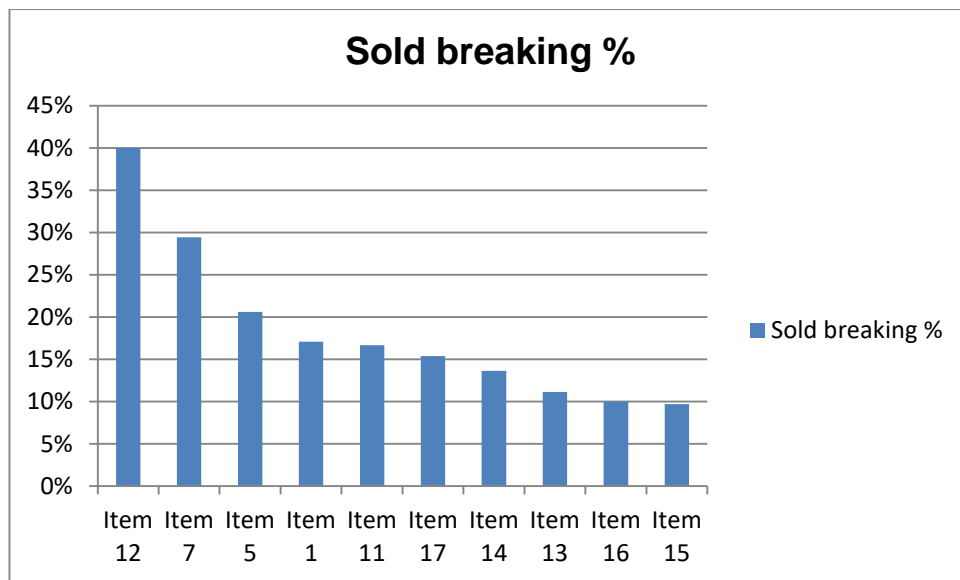


Table 8 10 most replaced sold glasses

Corrective actions for sales and these percentages are written on the chapter about Individual packing.

7.1.1 Issues at selling glass

One of the problems sales people have are the high freight costs and the lead time with sending a replacement far. Problems areas Kalmar's sales personnel gave were: South-Africa, South-America and Asia. The Asia area is planned to be covered by the new distribution centre at Singapore, but there are still (07/2016) only few glasses items and stock replenishments take weeks to fill the need. EDC will also stay as the core centre so only the X classified items will be located at Asia. Therefore, Asia as the others mentioned, will stay an expensive replacement area.

Americas on the other hand are nowadays (since April 2016) supplied also by Cargotec Finland Oy owned USDC which buys their own glass. This means that within the company, lead time and freight costs are smaller in that market area.

The packaging is another concern. Few direct shipments from suppliers to customers have shown that they pack more efficiently and charge half for the freight compared to us. (Picture 10 Picture of how one supplier did direct shipment. This was more cost effective than Kalmar's wooden box.) This packaging will be sourced now by the 3PL Neovia so Kalmar can send multiple pieces also more efficiently. Otherwise the packaging was sourced by benchmarking similar customers as ours are.

7.1.2 Benchmarking

To do comparison, a fieldtrip to Tampereen Tuulilasimyynti was made. There some pictures of the packages were taken to see how Pilkington sends their windshields to customers. The package itself it not very different, the differences were already labelled warning signs on boxes and having a one-piece carton box, as EDC's is two pieced; top and bottom. Based on this it was decided that Kalmar will start using also labelled carton boxes instead of having stickers on them. More of this action in 6.3.3.



Picture 16 Pilkington the supplier of Tampereen Tuulilasimyynä Oy has these printed on the carton



Picture 17 Their logo and text clearly indicate that there is glass inside. Something Kalmar does not use now.

8 Conclusion

The idea of the thesis is at first to find a way to reduce replacement shipment by finding a better package and possibly implementing TILT watches. As the research for all aspects got deeper, new issues and reasons were found. The biggest surprises came from warehouse packaging and carriers removing pallets.

The research showed, by raw data extracted from SAP, that glasses are replaced constantly and often with very high shipment costs. As the total costs of these FOCs are $xxxxx\text{€}$ (shipments) + $xxxxx\text{€}$ (moving price) = $xxxxx\text{€}$, this number can be reduced by scoping out those that are not Kalmar's responsibility as shown in the logistics section about warehouse and carrier's actions. To prevent this problem from reoccurring some action are listed in the recommendations section.

Also as Kalmar uses actively categorisation (X, Y, Z, N) it is in the interest of the company to keep this category truthful and therefore decrease the replacement pieces sent. The category classification determines many decisions done in planning and inventory. To mention two: whether to store in ADC and in frontlines or to have the item solely in EDC.

Also another point that came out during the study was that different departments have different interests. Purchasing department could buy less if there are less FOCs and make savings in bought items. Logistics does not have to spend so much time on the claims, follow up and sending replacements and sales do not suffer from branding issues as much when the FOC numbers decrease, but also less time dealing with claims, their filling and having to discuss that with customers.

8.1 Recommendations

At first clear guidelines should be made for which priority to use for FOC deliveries. Then the optimizer has to be updated so shipments do not leave as express or sea freight unless that is attended. The personnel working with claims and doing FOCs need to include optimizer checking to their routine before shipping large quantities. To keep the

replacements to minimum, also claims that come from customers need to be checked as there are tools in SAP which support this.

Secondly TILT watches on the carton boxes is an upgrade and now implemented. It will inform mishandlings during transportation and when Kalmar will not refund to customers without notification about the watches, customers become more active to report in order to get a new glass. TILT watches also provide needed proof for claiming the carriers and this naturally reduces disputing. As a part of this the information on the packaging, meaning having pallets, should be spread by sales personnel and they should inform logistics immediately if the arriving glass shipment is not packed accordingly.

Third point is having individually packed glasses for those that have attendance to break easily. These items are those that have high FOC percentage with reference to bought items. E.g. every third bought glass breaks on a way to customer so therefore having it packed individually, and not in carton, is a safer package. These items are usually large curvy windshields that are difficult to pack safely by Kalmar, because glass is not Kalmar's specialty and there is no space to store multiple special wooden frames for them. Individual packaging has proved to be working for e.g. Fritzmeier glasses which are sold regularly but did not come up in the FOC listings. That shows that those are supplied without issues.

Forth recommendation based on information discovered during this study is to use carton boxes with markings as now used. Having stickers on the boxes was solely relayed on warehouse workers and sometimes they forgot to add them. Even though this is then warehouse's (Kalmar's 3PLs) responsibility, it would be best for all parties if they would be already printed on so there is no possibility for human error on that part. The general interest is that glasses are delivered safe and sound.

8.2 Follow up

In order for this thesis to have impact also after the study is done, the excel sheet done for the FOC amount compared to bough/sold items should be updated once there are offers for the individual packaging and then calculate as before, if the change should be done or not. The average increase for the prices with individual packaging is approximately xx EURs.

The TILT watch implementation also requires attention as it is still new practice and some customers might not be aware of it despite the info-email sent. This info email is attached as appendix 3.

The final effect of the carriers' cost will be known only when they have conducted the investigations and the disputing for details is sorted. Once those are settled for the deliveries within the time scope, the figures from refunds are known. At the time of finishing this report, the refunds for Kalmar are xxxx EURs from carriers.

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APPENDICES

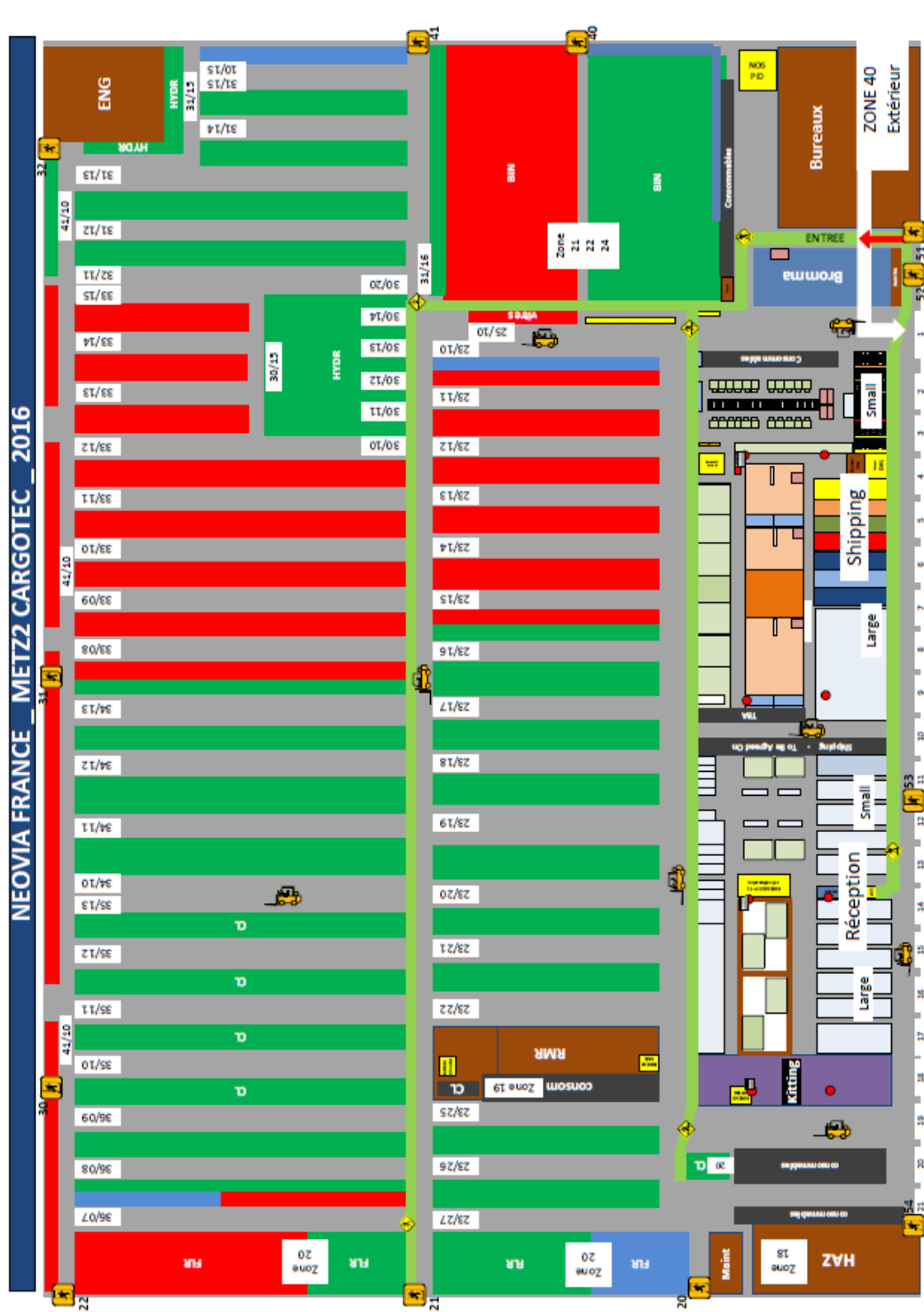
Appendix 1. Example of a quality certificate that suppliers provide.

Provided by Pasi Rantanen from Kalmar Global.

Supplier's certificate X

Appendix 2. Blueprint of the European distribution centre (EDC).

Provided by Neovia Logistics.



Appendix 3. Email sent out to inform about the improvement.

Hi all,

we are implementing TILT watches for our glass shipments so kindly do as following before opening a delivery claim:

The spot in the middle of the watcher will turn red if the box has been mishandled and in that case; this should be noted with the driver on site and the glass checked.

Those who have night deliveries have to inform the carrier immediately themselves about this, because the window is 24h.

If the light is red and the receiver has not informed the driver and marked it on the CMR, the claim to Kalmar can be refused based on this.

This implementation should discourage mishandling of our pallets.

Also if the glass shipment arrives without pallet (even with TILT remaining grey), kindly note that on the reserve as we **do not** send carton boxes without pallets.

Attached you will find pictures of how the glass shipment looks like and where the TILT is placed.

If you have any questions, don't hesitate to revert back to me. Thank you.

p.s inform your FLUs.

Ystävällisin terveisin, Best regards,

Suvi Koskipalo

Logistics Trainee, Parts, Kalmar

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Attached pictures of the email above:



Picture 18 TILT watch close up



Picture 19 TILT watch on a pallet