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# INVENTORIES CONTROL IN THE PROCESS OF PRODUCTION OPERATED BY PULL SYSTEM

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***Abstract:*** The inventories are one of the main indicators in the company management. To reduce them, the companies start up the control methods of PULL systems. Only application of methods is not sufficient. It is necessary to evaluate and control them systematically. The article is focused on the methods of the inventories control, to define the potential of inventory store reduction and its acquirement.

***Key words:*** PULL system, Kanban, average - design level of the inventory, the potential of inventory store reduction

## 1 INTRODUCTION

The inventories in the logistic chain are necessary but on the other hand undesirable components. The character of physical processes itself, from ordering, assessment to physical distribution, is not possible to realise without the inventories. The principle of the systematic logistic is to minimize the total inventory in so far to satisfy the requirement of the target customer acceptably – to reach so-called optimal level of services. It is quite fallacious to yield to idea that we do not need the inventories. The modern conception of material motion control based on the PULL systems (mainly concept JIT) can not eliminate the inventories. The way to minimize the inventories in the company is their effective regulation. [1]

## 2 INVENTORIES CONTROL

The control means the realization of all activities required for direction. It is the creation of the control aim, the knowledge of the control process, permanent monitoring of the system status according the input, the comparison of this what we want to achieve with the present condition, the solution of method, the algorithmization of activities to eliminate the differences of our intentions and definitive effect in the control system to eliminate them.

The inventories control task is to preserve the inventories on the value which allows the continuous running of the production process with the lowest preservation of financial tools.

For inventory control is necessary to follow several basic levels of inventories. The most frequently are studying:

- **maximal stock** – it represents the highest level of stock, which is reached at the moment of new delivery,
- **minimal stock** – it represents the stock exactly before the arrival of new delivery. It is given by the summary of the safety, technological and disrepair stocks. If the company does not keep technological and disrepair stocks, it is identical with safety one,
- **average stock** - in ideal case it represents the arithmetic average of daily situation of physical stock in certain time (Picture 1). [2]

During the regular usage the stock is among the safety stock and maximal stock, which is reached at the moment of new delivery receiving. It is indicated like usual or turnover stock (Fig. 1). [2]

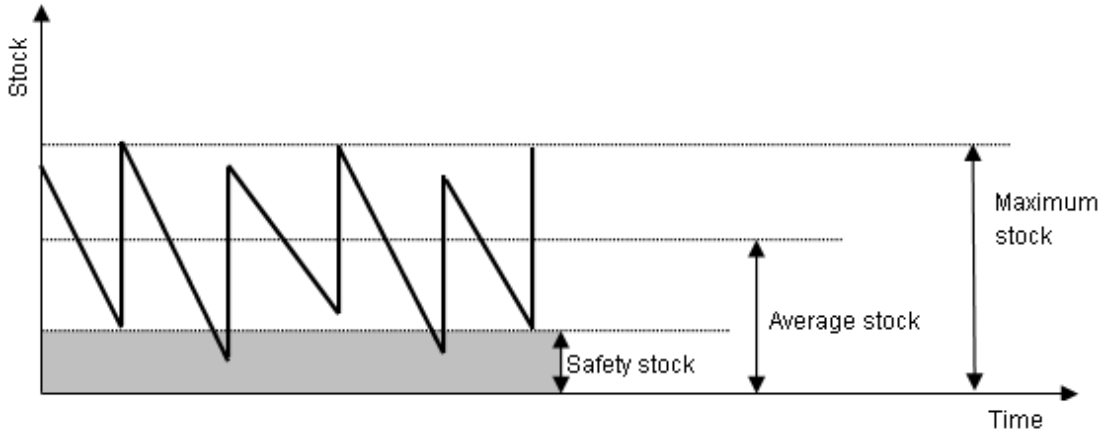


***Fig. 1** Stocks structure and their creation [2]*

The levels are calculated using the formula:

$$Z_{\max i} = c.s + p.s + t.s \quad (1)$$

$$Z_{\min i} = p.s + t.s \quad (2)$$

$$Z_{avei} = (Z_{\max i} + Z_{\min i})/2 \quad (3)$$

**Where:**

$Z_{ave\ i}$ – average usual stock of i-th material,
$Z_{max\ i}$ – maximal stock of i-th material,
$Z_{ss\ i}$ – safety stock of i-th material.

c – delivery time,
s – average daily usage,
p – safety stock
t - technical stock.[3]

## 2.1 Methods of inventories control by PULL system

The methods of inventories control are the strategic decision of the company. In the field of logistic, transport and store economic are used several methods of inventories control. Different method is suitable for other types of material and another type of production/ trade. The most common using method of PULL systems in practise is Kanban system which supports JIT concept.

### 2.1.1 Inventories control by Kanban system

The operation of inventories control by Kanban system means direction and ordering of material on the base of visual management directly by operators in the production. Each ordering quantity has one Kanban card. Empty place is the signal for new booking of material. Each material in storage has only one storage place what supply the transparency of the storage measure and eliminate to make needless stocks. Required stocks quantity has exactly defined and marked area according to the size of ordering quantity.

**1. Set up Kanban system** requires the calculation of the Kanban equation. It determines the required stocks quantity and number of ordering signals (Kanban cards) to cover the needs of production. [4],[5]

The Kanban equation is calculated on the base of the terms of delivery (taken amount, lead time, daily usage, safety stock).

$$\sum KK = \frac{DU * (LT + SS) + 1}{KQ} \tag{4}$$

**Where:**
KK – the number of Kanban cards
DU – Daily Usage
LT.- Lead Time – the time needed for transport of component from sending signal until the acceptation of component
SS – Safety Stock
KQ – Ordering (Kanban) Quantity

**2. Definition of design level** is the determination of average inventories level, which allows given delivery terms. For Kanban system of inventories control is valid average storage according to formula [4],[5]:

for more Kanban cards

$$Z_{ave} = (\sum KK - 0{,}5) * KQ - (LT * DU) \tag{5}$$

for one Kanban card

$$Z_{ave} = 0{,}5 \times KQ + ROP - LT \times DU \tag{6}$$

**Where:**
KQ – Kanban Quantity
LT – Lead Time
ROP – Reorder Point

**3. Potentiality for inventories reduction** expresses the difference between the high of storage inventories and design level (Fig. 2), where design level is the sum of average inventories defining by using method of control for i-th material according to formula:

$$\textbf{\textit{Design level}} = \sum_i^n Z_{avei} \qquad n = 1,2.....n \tag{7}$$

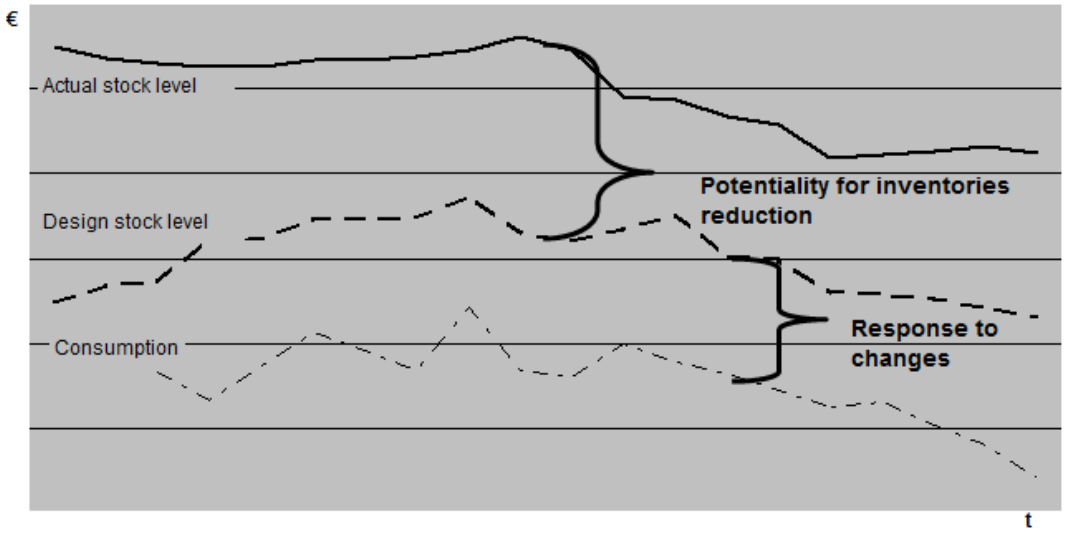


***Fig. 2*** *Graphical statement of design inventories level*

The calculation is based on the entered date like ordering quantity, lead time and daily usage. When some parameters are changed, the calculation of signals and design level is changed too.

# 3 REDUCTION OF INVENTORIES STORAGE

Every inventory represents blocked resources. Optimization of the organization and direction of inventories in the company is one of the most important tools for expenses lowing.

## 3.1 Improvement of the inventories control indicators

The key to successful direction is measure and control. The inventories control indicators in the company are measured by the level of inventories storage and inventories circulation.

1. **Level of inventories storage** is influenced by the control of inventories storage. During the control of inventories storage is monitored the line of individual invnetories level like:
   - **actual value of stocks** – measure on the daily base,
   - **average (design) value of the store** - average value of the store, which could be reached by keeping the system of control, is updated after each system recount,
   - **actual versus average (design) stocks level** – the difference between actual and average inventories level, (potential for inventories reduction). To achieve the reduction of inventories is necessary the control of state, defining the causes of the difference and application of corrective remedy to eliminate them. It ensures the discipline to keep rules of the control system and ongoing work on reducing and improving inventory management. [6]

2. **Inventory turnover** – achieved reducing of the actual level of inventories has a direct impact on improving inventory turns.

The overall benefit of improving indicators of inventory management by methods of PULL systems is to reduce the inventory levels by **30% to 60%**. This leads to increase the inventory turns and release the commitment of the financial capital.

### 3.2 Flexibility of inventory management system

In dynamical changing market environment it does not suffice only the change to PULL system. Blind copying of PULL systems causes the problems too. It is necessary to discuss in depth, unify processes and make rules for functioning in the whole company. As a result of it is the creation of agility for system, based on:

- whole company control – more effective control – measure, control – immediate correction of errors,
- regular calculation of Kanban system – the changes in the market/usage or terms of delivery cause that the design level and needed quantity of inventories are changed too (Picture 2),
- audite – the security to abide by the rules and function of the system, based on the discipline of staffers.

## 4 CONCLUSION

Applied methods of inventories control are well-known today all over the world. All good companies use them. It determines them the high level of control. Our companies are placed on the first class in the world. They reach this pattern they use world tools of control.

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**References**

[1] Kolektív autorov; Logistika v praxi, Verlag Dashöfer, 2008, ISBN 80-86229-71-8

[2] Spišák, J.: Logistika služieb – učebné texty, Košice, 1999

[3] Dindeský, P.,: Zásobovanie podniku, Slovenská technická univerzita, Bratislava, 2007

[4] Mičieta, B.; Gregor, M.; Quirenc, P.; Botka, M.: Kanban – Ste na ťahu, Slovenské centrum produktivity, Žilina, 2001, ISBN 80-968324-2-5

[5] Geiger, G., Hering, E., Kummer, R.: Kanban – Optimale Steuerung von Prozessen, Cal Hanser Verlag München, 2003, ISBN 978-3-446-21894-9

[6] Szentiványi, S: Racionalizácia procesu riadenia zásob vo výrobe komponentov pre elektrotechnický priemysel, The International Journal of Transport & Logistics, Volume 11/2011, ISSN 1451 – 107X