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ANALYSIS AND ASSESSMENT OF MATERIAL FLOWS IN RELATION TO THE DESIGN OF A NEW PRODUCT

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Abstract:
The article include the current status of SEZ Krompachy a.s. and a description, which applies to systems analysis, identified deficiencies that follow from it while introducing a new design of a new product. This new product will structural modifications to meet US standards, but also the needs of the US market to which the product is intended. For a new product, it is necessary to make changes to the material flow, which later compared and describe their differences with the current material flow. For full capacity gaps to be determined from the system analyzes are carried out calculations for the options for addressing these deficiencies, which resulted from adding a new product to the current production plan at Assembly residual current device. On possible solutions to the performance of economic recovery, it calculates the return on new product development and assess the results to be acquired.

Key words:
logistics, material flow, design, system, capacity of system

INTRODUCTION

SEZ Krompachy (Figure 1) SpA Hornádska is located on a street in Krompachy. It operates in the electronics market 66 years and is a traditional instrument manufacturer, and low and high voltage, which include mainly breaker up to 125 A, residual current circuit breakers, cam switches, switchboards, Wiring Accessories, external and internal Disconnecting switches [1].

Fig.1 *Company LOGO* [2]

1 ANALYSIS OF THE CURRENT STATE

Market demand and new product development

In connection with the breakers exporting to the US market requirement was established to develop and produce circuit breaker for use in North America. This area is subject to normalization as European standardization and standards for this area are marked with UL. Based on this guidance were adopted development activities to develop and certify RCDs according to UL standards. Engineers and technologists took up the challenge and started working on new product development.

Design and surface respectively design differences from UL and EU standardization RCD [1]:

1) different frequency electrical current in the power supply (60 Hz versus 50 Hz)
2) different requirements for clearances and creepage distances between phases.

On the left (Figure 2) is a product which has been designed according to the EU and to the right is a product that had engineering and design adapt to meet the criteria according to UL.

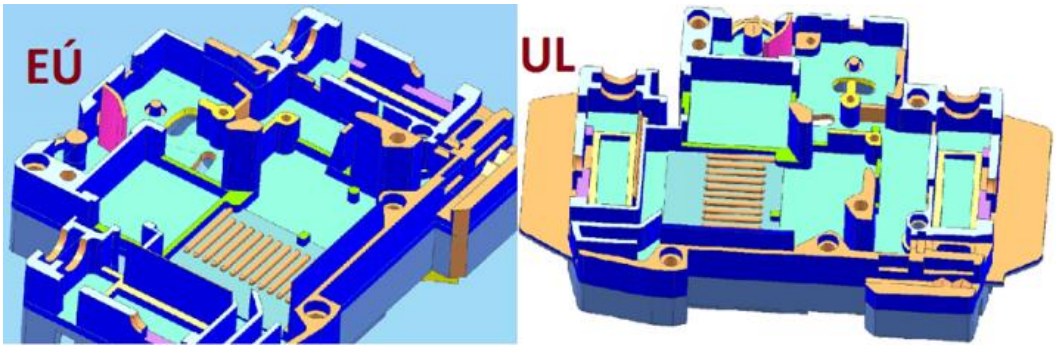

Fig.2 *Comparison of product design in accordance with EU standards and UL*

2 THE CURRENT MATERIAL FLOW AND PROJECTED DEMANDS FOR THE INTRODUCTION OF A NEW PRODUCT TO ITS PRESENT COURSE

In this section, the current material flow may encounter problems related to the introduction of new products into production, which is adapted to the product itself and its production.

For this type of introducing a new product into production in the industry it is essential is found or anticipated gaps in current production sequence. For irregularities found in the larger company is well used system analysis, which allows the system which the material flow and which is created from different departments that will form the subsystems.

The entire production process of the product, which can be seen in (Figure 3), it was necessary to explore and see what are its shortcomings, preconditions for introduction into a new product but instead a strong individual departments [1].

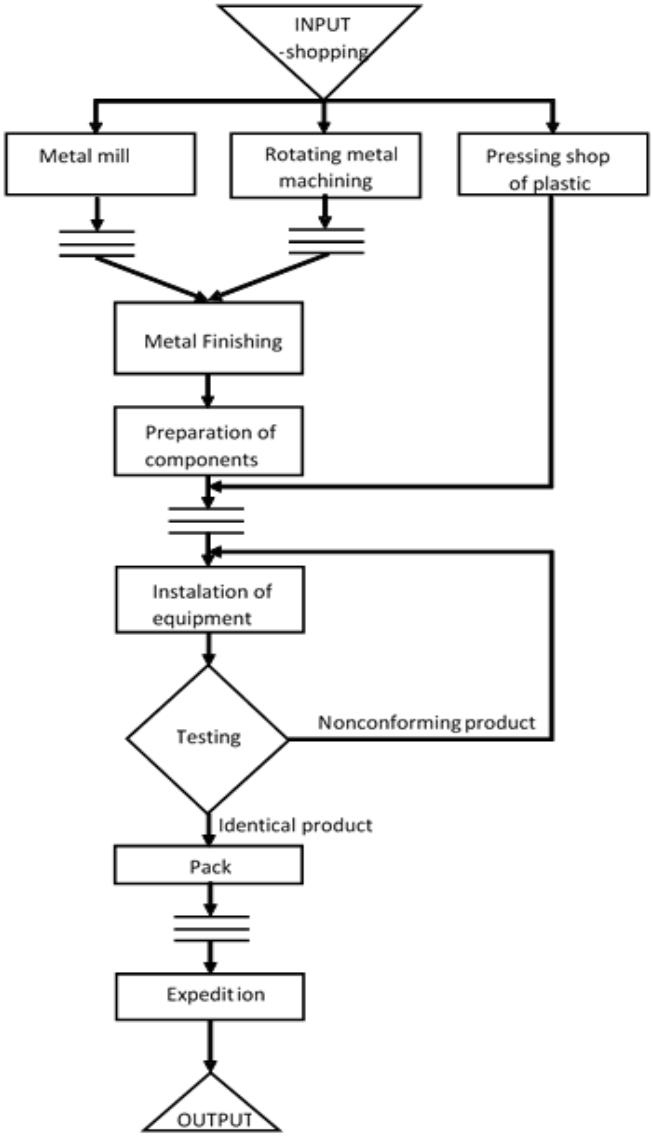

Fig.3 *Formalized scheme for the current material flow*

3 THE IRREGULARITIES FOUND BY THE SYSTEM ANALYSIS AND THE CREATION OF PRODUCTIVE CAPACITY

System analysis to assist in the analysis of the entire production system to specify how subsystems can when introducing a new product into production fail, either due to lack of parts manufactured to a higher productibility add a new product or for the actual production capacity which are not sufficient for production processes of new production plans [3].

For the new product had to adjust the flow of materials that have been shown to produce this new product without problems and also that the new product meets UL standard [4].

Therefore, the old material flow by adding new material flows for production of a new product. This new flow can be seen in (Figure 4), where the black line represents the old material flow and the red line represents by flows that are needed to produce a new product that is subject to UL standards. Along the black line and red line represents one system or whole [1].

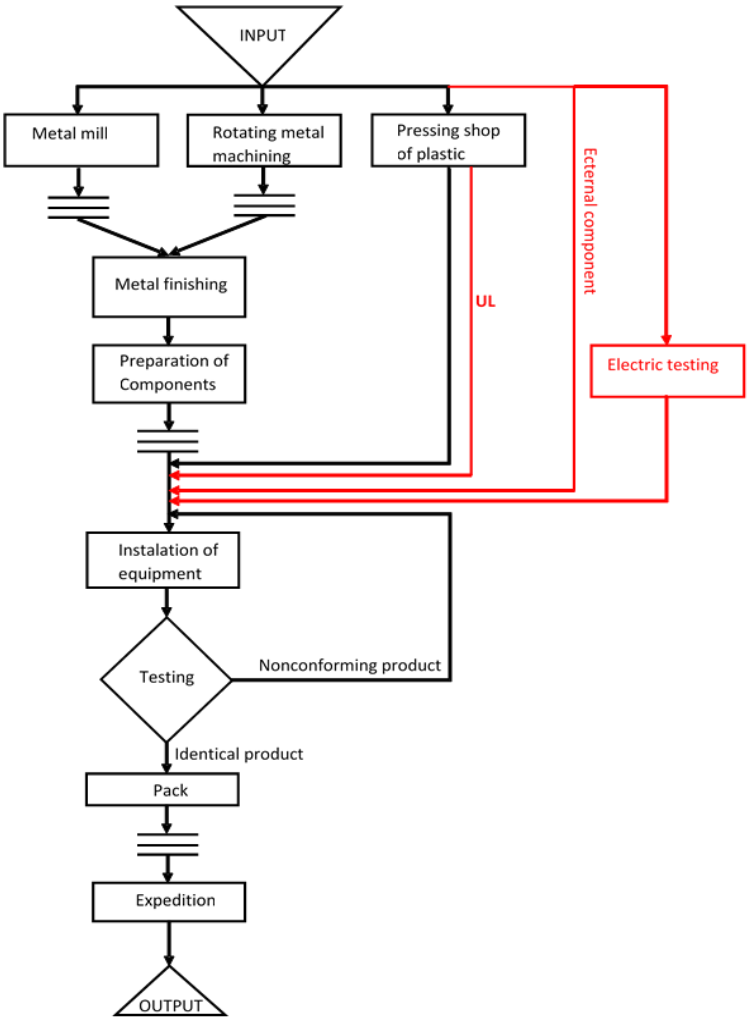

Fig.4 *Formalized scheme for new material flow*

4 CURRENT STATUS AND CREATING PRODUCTIVE CAPACITY IN THE SIDE OF THE OPERATION

To determine the current production capacity and the load should be calculated on the average monthly plan in the side of the operations, the load capacity. The company produces four types of components and their average monthly production of sub-assemblies is:

- P1 – 110 250 pieces
- P2 – 94 500 pieces
- P3 – 25 200 pieces
- P4 – 63 000 pieces

Duration of production components has the following times:
•P1 – 0,1 min.
•P2 – 0,15 min.
•P3 – 0,25 min.
•P4 – 0,30 min.

Of the six workers produce parts P1, P2, and only three of their full capacity exhaustion is 89%. Other 3 workers produce a sub-P3 and P4 and fatigue full capacity is 89%.

To permit installation of a new product needs to be produced per day by 800 units more parts P3 and P4 part of 400 pieces. Monthly production plan is increased monthly and has produced 127,050 units of parts P1 and 102,900 pieces of parts P2. After the calculation of full capacity after an increase in the production plan sub-assemblies P3 and P4 is fatigue full capacity of 99%.

Increase the capacity of the production plan of the pieces necessary to the installation of the new product is almost depleted to 99%, and any slight increase of the production plan is not possible, since it produces the required number of parts and the assembly will form the downtime. Therefore, the calculation is necessary to add one more worker and the capacities of the converted [1].

Tab. 1 *Calculation of full capacity and increase production plan and adding one worker*

Component	P1	P2
Daily disposable working time [min]	450	
The monthly number of units per worker	31 763	25 725
The daily number of pieces per worker	1 513	1 225
Duration manufacturing subassemblies 1 [min]	0,25 (15s)	0,30 (18 s)
The duration of daily production number of pieces of sub-assemblies [min]	151	184
Exhaustion full capacity	**74%**	

After adding staff is reduced the burden of production capacity by 25%. It is important to think about the fact that the company only expects it will produce for the market an average of 8,000 residual current devices a month but it can happen that orders will grow and capacity possibilities are almost exhausted and so will not be able to produce the required amount of sub-assemblies for installation in the necessary time and therefore it is wrong to create such reserves.

5 CURRENT STATUS AND CREATING PRODUCTIVE CAPACITY IN THE INSTALLATION OF RESIDUAL CURRENT DEVICES

After performing system analysis it is assumed that by adding a new product into production this part of the installation of the RCD is unlikely to be able to produce the required

number of pieces of residual current devices for the needs of the US market and it is necessary to calculate the capacity of the department for this part. As an example of the RCD with embedded components it can be seen in figure 5 [1].

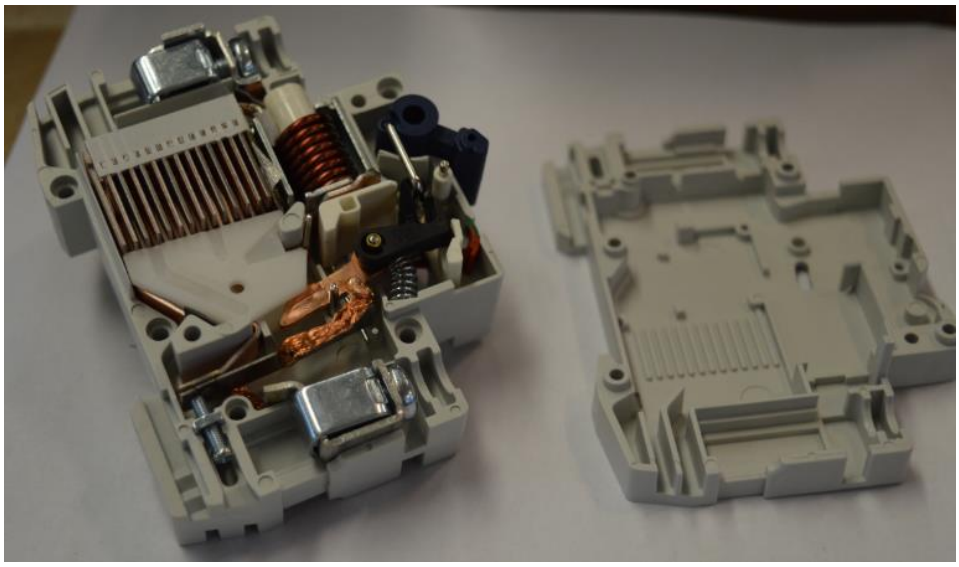

Fig.5 *Example RCD with embedded components*

The company assembles three types of residual current devices the average monthly orders for the manufacture of a product V1, V2 and V3 are currently following numbers:

- V1 – 10 080 pieces
- V2 – 12 600 pieces
- V3 – 14 784 pieces

In the assembly it is sixteen workers and those working in pairs representing eight pairs of work, so one pair have 450 minutes of work, as one worker made up breaker portion and the second guard portion of the same product at the same time. Each product is the production of otherwise difficult and therefore has different assembly times as follows:

- V1 – 2,5 min.
- V2 – 2 min.
- V3 – 1,5 min.

Currently, the capacity of some 96% depleted. The company plans to produce 8,000 pieces of residual current devices intended for the US market representing that the production process will be added V4 product that has the same time as the assembly V3.

After addition of the product, it was found that as part of the capacity will not be able to produce a burden is 112% which is 12% of capacity.

If the company had a 20 by workers that would form pairs sculpt the installation of residual current devices would be able to establish reserves, which would manage the assembly at a slightly elevated number of units in the increasing orders. Since fatigue with twenty-workers is 90%, so when produced 9,000 units of the new product V4 month would amount to 92%, with a monthly production of 10,000 units from V4 93%, and every increase in the production plan of 1,000 units would be the capacity of the reduced by about one percent.

6 IMPLEMENTATION OF THE RCD UL, RETURN AND PRICE ASSESSMENT

Residual current circuit breaker has undergone development tasks, which in economic terms represent a cost for its implementation. These investments amounted to wages, consumables, required certification but also the total investment for the future needs of a new product.

The return on investment have been spent on development tasks of the new product UL, shall be calculated according to the total costs incurred for the development of a new product monthly gain UL. Their share will determine in how many months they return all the investments incurred for product development and UL.

7 EVALUATION

The results of this work focuses on the production capacity, which after realizing calculations have increased by a percentage which should be sufficient for the operation of the production process for the manufacture of a new product and a residual current device intended for the US market. The results are directed to strengthen the staff, as in this case at Assembly capacity of residual current devices are employees.

Since the mass production of this product yet realized, these results are anticipated because of the contract and subsequent production at any time, after a certain time may increase and provisions run out.

The work was dedicated to it and what benefits are expected after the addition of a new product together, but also the profits of the products themselves, which are actually manufactured in the company. We specifically took shape on the projected earnings of the new product, which will then use the other results of work. Development tasks, which were calculated, facilitated the calculation and subsequent conclusions, which are important for calculating return on investment spent on actual development of this new product.

8 CONCLUSIONS

The work focuses on the production capacities which, after realizing calculations have increased by a percentage which should be sufficient for the operation of the production process for the manufacture of a new product and a residual current device intended for the US market. The results are directed to strengthen the staff, as in this case at Assembly capacity of residual current devices are employees. Since the mass production of this product yet realized, these results are anticipated because of the contract and subsequent production at any time, after a certain time may increase and provisions run out.

The work is mentioned and elaborated how profits are expected after the addition of a new product together, but also the profits of the products themselves, which are actually manufactured in the company. Specifically, solution focused on the expected profit of a new product, which will then use the other results of work. Development tasks, which were calculated, facilitated the calculation and subsequent conclusions, which are important for calculating return on investment spent on actual development of this new product.

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