Final inspection is the inspection of attributes of a final product (functional, dimensional), with the number of inspected items being higher than at self-inspection. Each workplace of final inspection has to be approved by a quality manager and substantiated with documents for approving the obligatory items for final inspection. Inspection items are updated according to the number of non-conformities, and work description is defined (what items, how they should be inspected, in what frequency, how to detect non-conformity and how to proceed in such a case). Standardised work at final inspection is tested by audits in selected time intervals.

This contribution deals with the data collection of non-conformities at final inspection, data processing and evaluation of the quality of front seats by Pareto analysis. Critical non-conformities are determined and remedies and precautions are proposed to improve the quality for the next period.

More than 1,000 parts enter into the manufacturing process of front seats. The main inputs are foams, metal frames, covers, head rests, back rests and plastic parts (Fig. 1).

One of the basic quality management tools used on the production line is a Poka Yoke system, i.e. a 100 % quality control. For safety regulations, legal requirements or product characteristics that affect assembly, Poka Yoke is defined in FMEA and control plans (Andrássyová, 2011). Other important approach to quality control within the production process is self-inspection done by operators.

Data collection

Data of non-conformities are collected at the end of the production line (Tab. 1), according to records on final inspection and inspected items for six months (from July to December 2011). Remedies and precautions are applied after a half-year evaluation in case of critical non-conformities. Data collection is repeated in the following period of time (from January to June 2012).

Data are analysed by Pareto analysis and graphically depicted in a Pareto chart. Absolute and relative frequencies (depicted in a histogram) as well as cumulative absolute and cumulative relative frequencies (depicted in diagram by the curve of cumulative relative frequency) are calculated.

Pareto analysis from 2011 (Tab. 2) showed the highest frequencies of non-conformities of front seats from final inspection.

Recorded and calculated frequencies were plotted into the histogram and curve of cumulative relative frequency (Fig. 2). The most critical non-conformity (with the highest frequency) was dirty or oily cover, plastic part, metal, head

**Results and discussion**

Pareto analysis from 2011 (Tab. 2) showed the highest frequencies of non-conformities of front seats from final inspection.

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### Table 1: Collected data of final inspection in the second half of year 2011 and in the first half of year 2012

<table>
<thead>
<tr>
<th>Non-conformity</th>
<th>Frequency in individual months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>July</td>
</tr>
<tr>
<td>Dirty or oily cover, plastic part, metal, head rest</td>
<td>60</td>
</tr>
<tr>
<td>Crimp of rest part</td>
<td>40</td>
</tr>
<tr>
<td>Crimp of upper rest part cover from side</td>
<td>27</td>
</tr>
<tr>
<td>Crimp of rest part cover in front</td>
<td>22</td>
</tr>
<tr>
<td>Opening between drawer and side piece of seat</td>
<td>26</td>
</tr>
<tr>
<td>Fitting of drawer and seat</td>
<td>5</td>
</tr>
<tr>
<td>Damaged cover - rest part, seat, head rest</td>
<td>7</td>
</tr>
<tr>
<td>Function of rest part button</td>
<td>16</td>
</tr>
<tr>
<td>Cover pulled out of drawer</td>
<td>1</td>
</tr>
<tr>
<td>Crimp of head rest with LCD monitor</td>
<td>0</td>
</tr>
<tr>
<td>Head rest does not move into lower position without pressed button</td>
<td>4</td>
</tr>
<tr>
<td><strong>Number of inspected seats</strong></td>
<td><strong>3,791</strong></td>
</tr>
</tbody>
</table>
rest (24.93%), the second one was crimp of a rest part (21.48%), then crimp of an upper rest part cover from the side (14.49%), crimp of a rest part cover in the front (13.03%), and opening between a drawer and side piece of the seat (9.64%). They generated 83.58% of the percentage of non-conformities detected in final inspection.

Remedies and precautions were applied to the production line of front seats to reduce or completely eliminate the non-conformities (Tab. 3). The application of remedies and precautions to the manufacturing process brought new results of non-conformity frequencies from final inspection. The following half-year period of 2012 was evaluated by Pareto analysis (Tab. 4).

The most critical non-conformities of the first half-year of 2012 were dirty or oily cover, plastic part, metal, head rest (28.63%); crimp of a rest part (23.02%), crimp of an upper rest part cover from the side (17.07%), crimp of a rest part cover in the front (14.43%). Those four non-conformities generated 83.15% of the total percentage of non-conformities. The non-conformity head rest does not move into a lower position without pressed button was completely eliminated.


defined non-conformity remedies precautions
Dirty or oily cover, plastic part, metal, head rest
– definition of part where the non-conformity occurs
– definition of non-conformity location on seat
– definition of variant (leather, leatherette, fabric, etc.)
– definition of dirt type (lubrication, oil, etc.)
– modification of usage of working equipment

Crimp of cover
– definition of variant (leather, leatherette, fabric, etc.)
– definition of non-conformity location on seat
– checking the working procedure of ironing

Opening
– definition of variant (leather, leatherette, fabric, etc.)
– definition of non-conformity location on seat and its size
– modification of fixture for fixing the seat
– changes in assembly procedure of drawer and seat

The total quotient of non-conformities during the period from July until December 2011 was $p_n = 0.059$, and in the following period from January until June, it was reduced to $p_n = 0.03$. Non-conformities in the first half-year of 2012 were reduced by 49%.

Defined tools instruct to a double inspection (quality wall) in case of frequent non-conformities in organisation
Responsible operator inspects the defined quality characteristics that are not detectable within self-inspection or final inspection. If the operator detects any non-conformity, there should be an immediate feedback into a responsible workplace of the manufacturing process. Remedies for the prevention of the same non-conformity (description is coincident) are applied immediately.

The Pareto chart is an analytical tool which takes into consideration defined criterions and enables defining the most important problems in such methods as FMEA and FMECA (Bujna, 2012). Remedies for the prevention of the same non-conformity (description is coincident) are applied immediately.

The Pareto chart is an analytical tool which takes into consideration defined criterions and enables defining the most important problems in such methods as FMEA and FMECA (Bujna, 2012) – those ones that need a lot of attention. The usage of this quality management tool is connected with other tools for determining the causes and effects, i.e. Ishikawa diagram or brainstorming that enables revealing many different ideas of studied issues (Prístavka, 2011) and giving a better view of problems.

**Conclusion**

Final inspection is one of the most important quality inspections of automobile seats. It is the last workplace where the non-conformity could be detected before it reaches the customer. Therefore, it is important to record, analyse and evaluate the results of final inspection. A decisive standpoint has to be adopted for remedy. Remedies are applied depending on an exact specification of the non-conformity. The most critical non-conformities can be listed by Pareto analysis (according to the rule of 80 % / 20 %). Quality management procedures and tools such as brainstorming, Ishikawa diagram, 5 Whys should be recommended for a more detailed analysis of non-conformities. More complicated problems require tools and procedures such as 8D report, affinity diagram, relative diagram, etc. Each selected tool or procedure has to be effective for analysis.

**References**


Documentation of Faurecia Slovakia, s.r.o. (private limited company), Lozorno plant. 2011.


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