# INCOMING QUALITY TESTING FOR TEXTILE AUTOMOTIVE INDUSTRY

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**Abstract:** The paper presents the incoming inspection procedure of fabric employed in the automotive industry. The case of laminated fabric is introduced and typical laboratory tests are shown. The sampling method practiced for incoming inspection is described together with the decision diagram. A material test results bulletin used for quality inspection is then presented.

*Keywords: quality, inspection, automotive industry, testing*

## 1. Introduction

Product testing is carried out for a number of reasons, the main one being to ensure complete customer satisfaction [1]. Testing is also carried out for safety reasons, such as for the properties required for safety belts, airbags or life jackets, subject to government legislation.

In all cases, testing attempts to simulate the conditions of wear and tear over several years in either a single, or a series of short laboratory tests. This is not easy and testing must be carried out in the shortest possible time so the goods can be released for the production.

In most garment manufactures, the incoming tests are for used for conformity, pursuing the compliance between the test results and the incoming supplier quality specifications.

The production cycle starts with the delivery of raw material [2]. If the material is incorrect or sub-standard then it is impossible to produce the required quality of final product. The incoming material is checked for the required properties so that unsuitable material can be rejected or appropriate adjustments made to the production conditions.

Based on an industry experience, the paper presents in section 2, the method used for sampling in incoming inspection. Section 3 continues the application on a case study for the most common material used in automotive industry. The two types of tests carried out on laminated fabric are exposed.

## 2. Incoming sampling and inspection

In the case of an automotive textile manufacturer in Romania, producing seat-covers, headrests and door trims, incoming inspection is done in two phases: first technical inspection is taking place, with the packaging check and fabric supplier label identification [2]. Once the material has entered the company it has to be controlled by record keeping and labeling which includes the inspection status and whether the material has been verified as conforming to standard. There also should be guidelines for the

maintenance, storage, handling and use of the material while it is in the manufacturer's possession.

The next step is the incoming quality inspection, which is done with a frequency of 1 at 10 lots or in conformity with the control plan. Samples are extracted randomly from 10% of the whole lot.

If two thirds of the verified sample is non-conformed with the specification, the samples are extended to 30 % of the lot. If the test on the extended sample shows non-conformity, the entire lot will be rejected or the fabric can be used with the derogation from the client.

For the laboratory tests, the sample must have 1m length, the material width and must be cut at 150 mm from the edge and 3m at least from the beginning. Visible faults must not be included in the sample. From the samples a number of 3 to 5 specimens are selected, depending on the testing method for each test [3]. Specimens are acquired in both warp and weft directions. The tests may be accomplished for each lot or for every 5 lots, depending on the client requests.

Table 1. Sampling method for laboratory tests

| Number of rolls/lot | Number of samples | Number of specimens |
|---|---|---|
| less than 3 | 1 | test method conformity |
| 4 – 10 | 2 | test method conformity |
| 11 – 30 | 3 | test method conformity |
| 31 – 75 | 4 | test method conformity |
| more than 76 | 5 | test method conformity |

The diagram of the incoming inspection process is represented in figure 1.

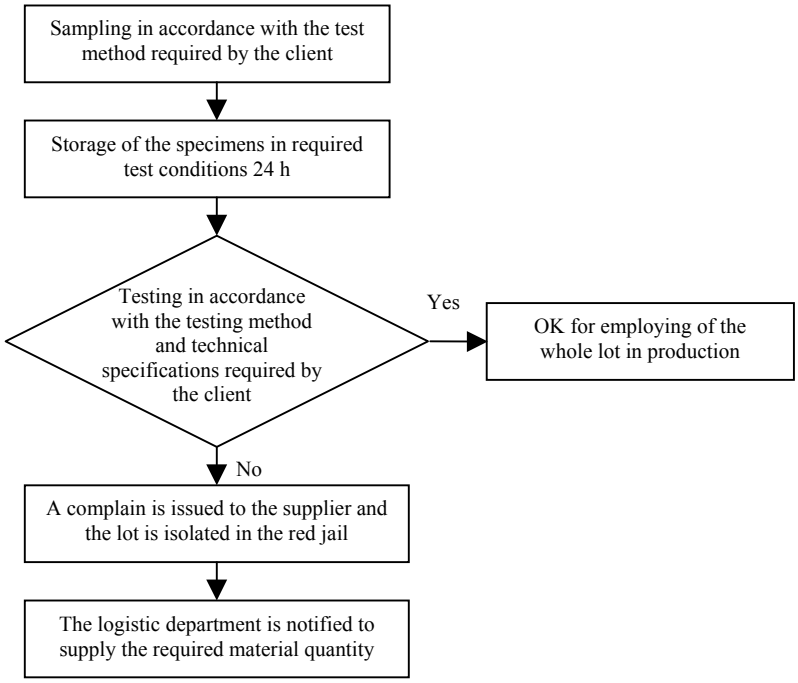


Figure 1. Incoming process diagram

## 3. Case study for laminated fabric

The most important automotive textile manufacturer in Romania is producing seat-covers, headrests and door trims using a laminated fabric complex made of polyester and polyurethane foam. The material specifications are shown in table 2.

The incoming inspection for this fabric is accomplished by following checks:

- packaging, conditioning, identification - visual inspection with the 1/10 lots frequency and the extract of the sample from 10% of the lot
- appearance (color, shade, texture) – visual inspection, comparing a A4 sample with the master sample (respecting the 1/10 frequency and the sampling method)
- width – visual inspection, with rule (respecting the 1/10 frequency and the sampling method)
- weight ($g/m^2$) – counting a circular sample of 100 $cm^2$, with balance (respecting the 1/10 frequency and the sampling method)

Table 2. Fabric specifications

| **Fabric** | |
|---|---|
| Yarn material | PET |
| Yarn count (dtex) | 360/36 |
| Dyeing method | pigment |
| Thickness | 0.50 mm. |
| Width | 185 cm. |
| Weight | 241 $g/m^2$ |
| **Foam** | |
| Type | PUR/PET |
| Density | 29 $kg/m^3$ |
| Thickness | 2 mm.(+0.5/-0.5) |
| **Laminated fabric** | |
| Thickness | 2.5 mm.(+0.5/-0.5) |

Table 3. Material test results

| Characteristics | Unit | Specification | Testing direction | Results | OK | NOK | Test Method |
|---|---|---|---|---|---|---|---|
| Weight | $g/m^2$ | 310 -340 | | 322.5 | X | | TSL2100G-4.1 |
| Thickness | mm | 2 - 3 | | 2.77 | X | | TSL2100G-4.1 |
| Tensile strength | N/50 mm. | 1922 - 2050 | L | 1833 | | X | TSL2100G-4.7.1 |
| Tensile strength | N/50 mm. | 239 - 1757 | T | 1196 | X | | TSL2100G-4.7.1 |
| Tensile elongation | % | 39 - 45 | L | 39 | X | | TSL2100G-4.7.1 |
| Tensile elongation | % | 19 - 44 | T | 41 | X | | TSL2100G-4.7.1 |
| Constant load elongation | % | 9 - 12 | L | 10.16 | X | | TSL2100G-4.9 |
| Constant load elongation | % | 11 - 13 | T | 11.9 | X | | TSL2100G-4.9 |
| Constant load set | % | 0.3 – 2 | L | 0.5 | X | | TSL2100G-4.9 |
| Constant load set | % | 0.5– 2.4 | T | 1.09 | X | | TSL2100G-4.9 |
| Seam strength with 107 tex | N | 550 - 849 | L | 900 | | X | TSL2100G-4.16.1 |
| Seam strength with 107 tex | N | 850 – 1045 | T | 920 | X | | TSL2100G-4.16.1 |
| Seam strength with 80 tex | N | 550 - 849 | L | 935.33 | | X | TSL2100G-4.16.1 |
| Seam strength with 80 tex | N | 850 – 1045 | T | 950 | | X | TSL2100G-4.16.1 |
| Tear strength | N | 230 - 280 | L | 236 | X | | TSL2100G-4.12.2 |
| Tear strength | N | 139 - 187 | T | 223.8 | | X | TSL2100G-4.12.2 |
| Peel bond | N/25mm | 3 - 5 | L | Foam breaking | X | | TSL2100G-4.39.1 |
| Peel bond | N/25mm | 3 - 5 | T | Foam breaking | X | | TSL2100G-4.39.1 |
| Flammability | mm/min | max 100 | L | 28.24 | X | | TSL 0500G |
| Flammability | mm/min | max 100 | T | 41.45 | X | | TSL 0500G |

The laboratory incoming testing for the case of a laminated weft-foam complex is performed by the following tests:

- weight
- thickness
- tensile strength in longitudinal and transversal directions
- tensile elongation in warp and weft directions
- constant load elongation and constant load set in warp and weft directions
- seam strength with 107 tex and 80 tex in warp and weft directions
- tear strength in warp and weft directions
- peel bond in warp and weft directions
- flammability in warp and weft directions

In table 3, are the results of the above tests, together with the standard test methods for an incoming lot. Due to the non-conformity of the following quality characteristics: tensile strength in the transversal direction, tear strength in the transversal direction, seam strength with 107 tex in longitudinal direction, seam strength with 80 tex in longitudinal and transversal directions, the decision is Rejected.

## 3. Conclusions

The automotive industry pioneered the modern methods of mass production, assembly line manufacturing [4] and "just-in-time" delivery. It has become a global industry and many see it as a future model for other industry. Conferences are being held periodically to inform, discuss and develop new concepts and procedures necessary to maintain the automotive industry quality. Thus, the testing and inspection methods employed become a "de facto" standard for all. As we see it, modern communications technology is can offer new possibilities to improve efficiency and reduce costs.

## 4. References


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