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Foreword

This VDA Guideline has been prepared by the VDA Working Group "Material Laboratory Assessment" on behalf of the VDA Material Steering Committee to provide a tool for the standardization of the assessment and for the improvement of the quality of material laboratory services in the automotive industry.

The objective is the assessment of material laboratories within the companies of the automotive industry within the framework of system auditing using a list of requirements (Annex A). The application of this Guideline is intended to save time and money and, in particular, to prevent multiple audits by different clients.

This material laboratory assessment - which is an assessment of material laboratories according to ISO/TS 16949 with increased depth - is intended as a basic validation. This is why suitable elements from ISO/IEC 17025 are used in the list of requirements without however applying this standard fully in order to keep the time and effort required reasonable. This is possible because there is no requirement for in-house material laboratories within the automotive industry to be accredited. Figure 1 visualizes these correlations.
This procedure ensures that the assessment of material laboratories when audited according to ISO/TS 16949 becomes significantly more meaningful.

Figure 1

1. **Scope**

Material laboratories are part of the laboratories which are referenced in ISO/TS 16949. This VDA Guideline applies to material laboratories in the narrower sense, i.e. laboratories which are primarily concerned with material tests on raw materials, test specimens and components. It is not intended for laboratories dedicated to durability, dimensions, acoustics etc.

2. **References**


ISO/IEC 17025: General Requirements for the Competence of Testing and Calibration Laboratories

3. **Brief description**

Material laboratories are part of an overall organization with in-house clients. This Guideline and the list of requirements contained therein (Annex A) therefore presume that general processes which are not specific to the material laboratory are considered and reviewed as part of the audit of the overall organization.
The assessment of the material laboratory services should be performed throughout the entire automotive industry. The list of requirements to be applied has therefore been designed such that even auditors without background in materials engineering are able to execute the material laboratory assessment and are therefore able to prove that basic processes specific to material laboratories have been implemented and are applied successfully. Assessment in line with this Guideline therefore allows a basic validation of the material laboratory services.

Special emphasis is nevertheless given to the correctness of the tests which is why procedures are described explaining how the material laboratories must validate their test methods. Detailed explanations are given in Annex B to facilitate the auditability of these procedures.

In special cases (e.g. development projects, complex failure analyses, launches, insufficiently standardized test methods) it may become necessary to perform an additional, more in-depth examination by experts - usually from other material laboratories - of the material laboratory competence than the basic validation described in this Guideline.

The inclusion of this basic validation into an overall system of possible methods of material laboratory assessment is shown in Figure 2.

---

**Figure 2**

4. **Terms and definitions**

**Automotive industry:** Automotive manufacturers and suppliers

**List of requirements:** Requirements for a material laboratory (Annex A of this Guideline)

**Organization:** The entity to which the international set of rules ISO/TS 16949 are to be applied.

**Factory material laboratory:** Normally laboratory with primarily production-related test functions.

**Development material laboratory:** Normally laboratory with test functions relating to development technology or failure analysis

---

1 "Insufficiently standardized test methods" include, for example, non-standardized in-house tests, strength tests on components or component-specific non-destructive test methods.
5. Execution

The material laboratory assessment in accordance with this VDA Guideline may be performed as a self-assessment and/or as an assessment by ISO/TS 16949 auditors. It shall be carried out by auditing compliance with the requirements contained in the first column of the list of requirements (Annex A). Comments further explaining these requirements are contained in the second column, while concrete examples for implementation are listed in the third column. The fourth column refers to the relevant clause of ISO/TS 16949.

The description of process flows for the validation of test methods by the material laboratories is an important part of the list of requirements (Item 12 of the requirements column). This description is included as a separate document in Annex B.

6. Assessment

The implementation of the list of requirements (Annex A) shall be assessed in accordance with the method specified in ISO/TS 16949.

7. Documentation

The audit results of the material laboratory shall be documented in the ISO/TS 16949 audit report with special consideration of the assessment characteristics from the list of requirements. The application of this VDA Guideline shall be indicated explicitly in the report.

To avoid multiple audits by different clients, the material laboratories which have been subject to a material laboratory assessment according to this Guideline shall be documented. The Audit Info Sheet (Annex C) shall be completed for this purpose with information on the auditing body, the audit time and the audited material laboratory units. This Audit Info Sheet is intended for the exchange of information between different partners within the automotive industry.

Annex

A - List of requirements
B - Guidance on the validation of material test methods
C - Audit Info Sheet
<table>
<thead>
<tr>
<th>Requirement</th>
<th>Comments</th>
<th>Examples</th>
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<tbody>
<tr>
<td><strong>1. Quality management</strong></td>
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<tr>
<td><strong>1.1</strong> The laboratory shall provide evidence of a quality management system complying with the requirements of ISO/TS 16949.</td>
<td>The quality management system of a laboratory is often documented in the form of a manual (hard copy or electronic). The description of the laboratory scope (&quot;lab scope&quot;) often forms a constituent part of the manual. In comparison with development or production units, material laboratories are often small units (e.g. smaller factory material laboratories with fewer than 5 employees). It is therefore not necessary to establish written procedures for all processes (e.g. determination of customer requirements for resource planning). In such cases, evidence of implementation is sufficient.</td>
<td></td>
<td>5.1</td>
</tr>
<tr>
<td><strong>1.2</strong> The scope of the laboratory shall be clearly defined.</td>
<td>The scope (and therefore the list of services/tests) depends on the products manufactured at the site. The laboratory must be capable of testing – externally, if necessary - specified material properties which are influenced by the manufacturing process.</td>
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</table>
| **1.3** The tasks to be performed shall be described in procedures and work instructions. | Problem-related test methods:  
- analysis of micrographs for welding companies,  
- coating thickness test for surface treatment companies | | |
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<tr>
<th>Requirement</th>
<th>Comments</th>
<th>Examples</th>
<th>ISO/TS 16949</th>
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</thead>
<tbody>
<tr>
<td>1.4 Regular internal laboratory checks (audits) shall be made to ensure that defined procedures and processes specific to the laboratory are maintained.</td>
<td>During such checks, issues such as the following must also be assessed • personnel safety • orderliness • cleanliness • environmental protection</td>
<td></td>
<td>5.4.2</td>
</tr>
<tr>
<td>1.5 Complaints resulting from internal/external checks and audits shall be processed according to plan.</td>
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</table>

2. Control of documents

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<th>Requirement</th>
<th>Comments</th>
<th>Examples</th>
<th>ISO/TS 16949</th>
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<tbody>
<tr>
<td>2.1 The laboratory shall establish and maintain procedures for the control of all documents (internal/external) belonging to its scope.</td>
<td>Laboratories which form part of larger organisations often use the in-house documentation management system; however, the laboratory staff must be explicitly instructed only to use current specification documents.</td>
<td>Specification documents for the laboratory include, among others • test specifications • customer specifications • standards • drawings</td>
<td>4.2.3</td>
</tr>
<tr>
<td></td>
<td>It is a requirement for the system audit in accordance with ISO/TS 16 949 that current drawings and standards shall be used. During the laboratory audit, the resulting test specifications are therefore only subjected to some exemplary checks. Note: the laboratories are often not in direct contact with the external customers of the organisation.</td>
<td></td>
<td>5.5.3</td>
</tr>
<tr>
<td></td>
<td>The work results of a laboratory are normally documented in the form of laboratory reports which also need to be con-</td>
<td>Changes to the originals of reports must be traceable and archived.</td>
<td></td>
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</table>
### 3. Process efficiency

#### 3.1 The laboratory shall have a process in place to measure and continuously improve the efficiency of its work.

For this purpose, the laboratory shall regularly determine meaningful performance indicators which are appropriate for the relevant laboratory scope.

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<th>Requirement</th>
<th>Comments</th>
<th>Examples</th>
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</table>
|             | The examination of the efficiency of the work refers in this context to the process from initial job request until release of the report. Performance indicators for the quantity of the laboratory work are relatively easy to determine (see examples), while the determination of quality performance indicators is significantly more difficult. Customer surveys may be used for this purpose, for example (see 4. Customer focus). | Meaningful performance indicators may include the following, among others:  
- quantity  
- throughput time  
- adherence to deadline of the reports considering the capacity of the laboratory. | 5.1.1 |

### 4. Customer focus

#### 4.1 The laboratory shall determine and evaluate the customer requirements (normally internal clients) regularly and include them in a resource plan.

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<th>Requirement</th>
<th>Comments</th>
<th>Examples</th>
<th>ISO/TS 16949</th>
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</table>
|             | The frequency depends on the structure of customers and tasks of the laboratory. | Among the questions asked must be which new test methods/services will be required in future in view of  
- new products  
- new production processes  
- new customer or legal requirements. | 5.2 |

#### 4.2 Customer satisfaction shall be determined regularly to allow the quality of the laboratory’s own work to be assessed.

<table>
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<tr>
<th>Requirement</th>
<th>Comments</th>
<th>Examples</th>
<th>ISO/TS 16949</th>
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</thead>
</table>
|             | Customer satisfaction is normally determined by means of a questionnaire or in a workshop. | Typical points in a customer survey using a questionnaire may include the  
- throughput time  
- adherence to deadline | |
### 5. Control of nonconforming product
(Also refer to Annex A Item 12 and Annex B)

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Comments</th>
<th>Examples</th>
<th>ISO/TS 16949</th>
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</table>
| 5.1 The laboratory shall have a policy and subsequent procedures to be able to react on recognised nonconforming test results or to withdraw the results, to minimise the negative impact, and to inform the customer as soon as possible. This also applies to tests carried out externally. | The products of laboratories are normally laboratory reports or services. | • the rejection of nonconforming test equipment  
• the containment / traceability of nonconforming laboratory reports  
• the information of the customer  
• the information of the laboratory management. | 5.2 and 8.3 |
| 5.2 Corrective actions which have been carried out shall be communicated and documented.  
5.3 Actions to prevent a repeat shall be defined. | Management of test equipment problems should be reported and documented using a standard format. |  |  |
### 6. Responsibility and authority

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<tr>
<th>Requirement</th>
<th>Comments</th>
<th>Examples</th>
<th>ISO/TS 16949</th>
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<tbody>
<tr>
<td><strong>6.1</strong> The structure of the laboratory both internally and with respect to the organisation shall be documented within an organisation chart</td>
<td>Laboratories normally have a certain share of quality assurance tasks. Laboratories are nevertheless quite often attached to higher-level non-QA functions such as production units. How is independence assured in case of conflict of interests, in particular?</td>
<td></td>
<td>5.5.1</td>
</tr>
<tr>
<td><strong>6.2</strong> In addition, deputies shall be defined to ensure continued operation of the laboratory.</td>
<td>This is not always possible in the case of specialist functions and in smaller laboratories.</td>
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<tr>
<td><strong>6.3</strong> The responsibilities and authorities of employees shall be unambiguously described.</td>
<td>Specialist’s competence areas must also be defined, although its review poses problems for system auditors. The following are commonly used to describe responsibility:  - job descriptions  - process descriptions  - work instructions  Major fields of authority of the laboratory employees include, among others:  - test activities and approval of reports  - preparation of expert reports  - initiating of rejections</td>
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</table>
## Annex A: List of Requirements

### 7. Internal communication

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<thead>
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<th>Requirement</th>
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<th>Examples</th>
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<tbody>
<tr>
<td>7.1 Laboratory reports of suppliers and external customers shall be available to the laboratory even where such reports/information are administered in other departments of the organisation</td>
<td>Without feedback from external customers and suppliers, no comparison is possible.</td>
<td>Feedback sheet, evaluation</td>
<td>5.5.3</td>
</tr>
<tr>
<td>7.2 The consistency of the use of customer specifications for test methods (e.g. where deviating in-house standards exist) shall be ensured, even if direct customer contact is in the responsibility of other organisational units</td>
<td>Comparison of customer specification and in-house standard; in case of deviating company standards, evidence of their equivalence to customer specifications must be provided.</td>
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<tr>
<td>7.3 The laboratory shall collect its experiences from the laboratory work in searchable lists or databases and make them available.</td>
<td></td>
<td>• material databases&lt;br&gt;• results databases&lt;br&gt;• know-how lists&lt;br&gt;• list of suitable external service providers</td>
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### 8. Management and provision of resources

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<th>Requirement</th>
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<th>Examples</th>
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<tr>
<td>8.1 The laboratory shall have the necessary equipment and personnel for its functions which allow job requests to be processed within an appropriate time scale and with appropriate quality</td>
<td>Determination of the necessary equipment and personnel capacity.</td>
<td>Derived, for example, from &lt;br&gt;• customer requirements (e.g. drawings, specifications)&lt;br&gt;• adherence to deadline</td>
<td>6&lt;br&gt;6.1</td>
</tr>
</tbody>
</table>
### 9. Competence, awareness and training

**9.1** The laboratory shall ensure and document that the qualification of its personnel is continuously adapted to the requirements of the specified laboratory scope by means of selection, education and training as well as know-how transfer. The laboratory must establish plans for the familiarisation, training and development of personnel. Even where the national language is not German or English, it must be ensured that laboratory personnel understand the technical contents of customer specifications.

- Training matrix
- Seminar planning and participation

 ISO/TS 16949

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### 10. Customer-related processes

- The laboratory shall:
  - 10.1 have an agreed procedure in place for the processing of laboratory requests
  - 10.2 maintain an appropriate system for the tracking of laboratory requests
  - 10.3 agree with customers which tests should be performed and what the objective of the tests is.

- Processing of laboratory requests
  - Date of receipt
  - Problem identification
  - Scope of job request
  - Estimated date of completion
  - Date of completion

- Agreement of test requests
  - Request form
  - Type and number of tests and completion date
  - Data sheets

 ISO/TS 16949

<table>
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<tr>
<td><strong>10.4</strong> agree changes to the laboratory requests with the customer and document them.</td>
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<tr>
<td><strong>10.5</strong> collect all information necessary for testing and evaluation.</td>
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<td>7.2 7.2.1 7.2.1.1</td>
</tr>
<tr>
<td><strong>10.6</strong> notify the customer when an external laboratory will be involved in the testing of specific aspects</td>
<td>Test results of external suppliers must also be identified.</td>
<td></td>
<td>7.2 7.2.2 7.2.2.1</td>
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<tr>
<td><strong>10.7</strong> agree the disposal of the samples following testing with the customer.</td>
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</table>

### 11. Identification and traceability

<table>
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<tr>
<th>Requirement</th>
<th>Comments</th>
<th>Examples</th>
<th>ISO/TS 16949</th>
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<tbody>
<tr>
<td><strong>11.1</strong> Clear procedures shall exist for obtaining and handling of test samples.</td>
<td>Obtaining and handling of samples according to • drawing • specification • test plan • problem-oriented specifications</td>
<td></td>
<td>7.5.3.1</td>
</tr>
<tr>
<td><strong>11.2</strong> Therefore pertinent specifications of the external customer shall be applied. Where prepared samples are received, the laboratory shall request the documentation from the customer.</td>
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<td><strong>11.3</strong> The samples shall be provided with a unique marking.</td>
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### Annex A: List of Requirements

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<th>Requirement</th>
<th>Comments</th>
<th>Examples</th>
<th>ISO/TS 16949</th>
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<tbody>
<tr>
<td><strong>11.4</strong> The sample properties shall not be influenced by their marking or storage.</td>
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<tr>
<td><strong>11.5</strong> From receipt until testing, the laboratory shall ensure by appropriate storage/conditioning that the sample properties remain unchanged. If the storage of retained samples has been agreed with the laboratory, this requirement shall also apply to the retained samples in association with an agreed storage period.</td>
<td>Material specific storage conditions must be defined for the samples.</td>
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</table>

**12. Validation of material test methods**

<table>
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<th>Requirement</th>
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<th>Examples</th>
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<tbody>
<tr>
<td><strong>12.1</strong> For the validation of material test methods, refer to Annex B.</td>
<td>• monitoring of test equipment&lt;br&gt;• evaluation of test methods&lt;br&gt;• calibration and verification</td>
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**13. Documentation of laboratory examination**

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<th>Requirement</th>
<th>Comments</th>
<th>Examples</th>
<th>ISO/TS 16949</th>
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<tbody>
<tr>
<td><strong>13.1</strong> The laboratory shall document the performed tests using a defined reporting structure.</td>
<td>Reporting structure:&lt;br&gt;• task&lt;br&gt;• execution&lt;br&gt;• result&lt;br&gt;• evaluation&lt;br&gt;• recommendations, if applicable&lt;br&gt;• contact person</td>
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</table>
### Annex A: List of Requirements

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<th>Requirement</th>
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<th>Examples</th>
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<tr>
<td>13.2 Reports shall be clearly phrased.</td>
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</table>
| 13.3 Raw data shall be available in the laboratory and assignable to the reports. | The traceability of the test instruments used must be ensured. | • Identification number or inventory number on laboratory report (direct)  
• Assignment via work instruction (indirect) |
| 13.4 Deviations from test specifications (e.g. climate) shall be recorded. |  |  |
| 13.5 The test equipment used shall be unambiguously documented in the report. |  |  |

### 14. Requirements for external laboratories

The laboratory shall:

14.1 select and assess its externally commissioned laboratories according to appropriate criteria.

14.2 maintain a list of its external laboratories

14.3 highlight the cited results of external laboratories in its reports

14.4 evaluate the test results of its external laboratories.

14.5 An equivalent procedure shall also be used for the validation of test results of suppliers.

Selection criteria for external laboratories include, among others:

- specification of external customer
- accreditation for the relevant test method
- comparison with customer or other reference laboratory
- audit

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<td>7.6.3.2</td>
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</table>
Preliminary remark:

Auditors without background in materials engineering usually find it difficult to evaluate the technical items of the material tests. They are however able to examine the basic working principles of the material laboratory in particular with regard to its core activity, as a basic validation, by checking whether the process flowchart shown in this document has been adhered to, and by analyzing the comparative results determined in this way. In this context, the process flowchart represents the minimum requirement for the validation of the material test methods. For the convenience of the reader, this document uses the terms “test methods” and “test equipment” instead of “measuring and test methods” and “measuring and test equipment” commonly used in other sets of standards.

The testing of material properties using special material test methods is one focus of material laboratory work. The fundamental difference between material test methods and dimensional or function tests is that material test methods are predominantly destructive tests. This fact and some other special characteristics of materials testing technology such as

- certified reference materials (CRM) are often missing ¹,
- test methods represent special cases compared with the pertinent standards,
- indirect test methods are often used,

mean that “evidence of capability” as defined by ISO/TS 16949 and MSA² or more importantly evaluations according to GUM³ or VDA 5 are not practicable for material test methods in most cases.

Material test methods nevertheless allow reliable results to be achieved, provided that the material laboratory adheres to some established fundamental rules for the validation of material test methods. These are summarized in the following process flowchart. The validation process usually is a comparative process with several stages.

---

¹ CRM: Material / object with one / several defined (known) properties, produced by public authorities or internationally recognized institutes
Annex B: Guidance on the validation of material test methods

Process flowchart

Start

Validation during commissioning of equipment (1)

Official, regular test equipment monitoring (lab-internal) (2)  Voluntary, event-related test equipment monitoring (lab-internal) (3)

Doubts regarding test results? (4)

Yes

Internal validation possible? (5)

Yes

Deviations? (6)

No

Comparison of the method (8)

Deviations? (9)

No

Evidence of comparability of test results provided: re-release of test method (11)

Yes

Analysis of causes and measures (7)

Yes

No

Analysis of causes and measures (10)

Archiving (12)

Notes
(also refer to additional notes on the flowchart on the following page)

1) e.g. acc. to standard, by manufacturer
2, 3) examination according to standard or by calibration service provider or testing against certified reference materials (e.g. hardness reference blocks) or against own validated standards. Continuous use of control charts.

4) e.g. abnormalities during test equipment monitoring, deviating results of customer/supplier or from round robin tests, launch/modification of method or changed ambient conditions or change of test personnel, implausible test results, i.e. test values do not match material data from literature

5) Review of test method by using a different method

8) Participation in a proficiency test organized externally or comparison with a customer/supplier or with an accepted third party laboratory
Annex B: Guidance on the validation of material test methods

Additional explanations on the process flowchart

Re (1) to (3): in-house verification methods include, for example:

- **Monitoring of test equipment**
  Monitoring of test equipment can be performed according to the standard on which the test method is based (if specified). It can be carried out by the equipment manufacturer or an accredited external calibration service provider or by means of self-inspection against validated standard or reference materials.
  Test equipment shall be monitored regularly at intervals appropriate to the test method and frequency of use. The calibration intervals may be redefined based on the results of trend analyses.

- **Comparison with other test methods**
  By means of other test methods which determine the same material properties as the method to be validated, the results of the latter can be verified.

- Internally developed test methods shall be validated by separate measures.

Re (8): External verification methods usually include comparisons with other laboratories (including those within the same group), e.g.

- **Bilateral comparison of two** laboratories:
  A successfully passed bilateral comparison requires acceptance by the customer laboratory and can be carried out, for example, within the context of initial sample inspection. Detailed documentation is required.

- **Participation in a proficiency test** (e.g. round robin test):
  Successful participation in a proficiency test (e.g. round robin test) requires that no negative assessment is notified by the organizing institution.

  Note: Internal supplier test instructions do not need to be adjusted, provided that these are not used as evidence of compliance with customer specifications.

Re (7, 10): If during test equipment monitoring, for example, or after comparisons with other laboratories deviating results are determined, the impact of incorrect test results on products and customers shall be traced and contained (refer to Guideline / ISO/TS 16949 clauses 5.2 and 8.3).

These are the usual steps for analyzing and remedying the causes:

- In the case of internal deviations, comparative tests according to a different method or against reference materials may be performed, where possible.

- In the case of deviations compared to customers or suppliers, these should be involved in the root cause analysis.

- If the deviations are confirmed, the causes shall be determined. The storage and preparation of samples, the test environment and the qualification of the test personnel shall, for example, be included in such an analysis.

- Once the causes of the deviations have been removed, the effectiveness of the measures shall be validated.
Annex B: Guidance on the validation of material test methods

- If the causes were merely due to the characteristics of the test equipment (calibration, software), validation by using a different method or testing against reference material is sufficient.

- If other factors such as operator or environmental factors have been determined as cause, validation can be achieved, for example, by comparison with a different member of the test personnel or an external laboratory.

- Only when evidence has been provided of the elimination of the deviations, may routine surveillance be resumed.

- If comparable test methods with similar influencing variables are used in the laboratory, these should also be tested for the error sources determined.
Material Laboratory Assessment

Annex C: Audit Info Sheet

Overview of audits executed in material laboratory
Intended for the exchange of information within the automotive industry
May be used for self-auditing

Date of audit:

Audited supplier
Company name/site
DUNS no.
Product range
Address
Contact
Telephone
E-mail

Auditor(s)
Name(s)
Address
Company
Telephone
E-mail

Audited laboratory areas

<table>
<thead>
<tr>
<th>Laboratory areas</th>
<th>Remarks *</th>
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* Further explanations for a more detailed indication of laboratory area, product group and audit type (e.g. plastics laboratory elastomers – product group coolant hoses and charge air hoses – audit type: self-audit).