Determination of Organic Substances as Emitted from Automotive Interior Products Using a 1 m^3 Test Chamber VDA276

使用 1 立方米试验箱测定汽车内饰产品挥发有机物质的 VDA276 方法

Preface
前言

The present testing methods represent a possibility of quantitative determination of organic chemical substances released from the automobile interior components under described conditions.
本试验方法的内容是，在规定条件下，测定汽车内饰产品排放有机物质含量的定量方法。

The results, which can be obtained with these methods, are not suitable for:
按照本试验方法得到的测试结果不适用于下列情况：

- to effect further evaluation of health judgment of the emitted substances
- 对排放物对健康所造成影响的进一步评估；

- As a basis for the estimation of concentrations to serve, as those in the interior of a complete vehicle, in driving or in a driving-similar condition found warden can
- 作为估计行驶中或类似行驶条件下，整车内饰排放物含量浓度的依据

The available set of rules contains the following parts:
适用条件包括如下部分：

Part 1: Standard emission examination [1]
第一部分：标准挥发物检查 [1]

Part 2: Determination of the delivery of formaldehyde, ammonia and phenols according to the method of the equilibrium concentration from parts for the vehicle interior [2]
第二部分：按照平衡浓度法，测定汽车内饰部件排放的甲醛、氨气和酚类气体 [2]。

Table of contents
目录表

1. **Introduction**
简介

In this VDA recommendation an emission chamber procedure for the determination of volatile organic emissions from construction units of the vehicle interior. It contains remarks to the characteristics and general quality assurance measures for a 1-m^3 test chamber for the standard emission examination of products of the vehicle interior. Further, the general operational procedure of the standard emission examination is described by the supply of the test property to the sample delivery. For the following analysis methods should be used in the context of the FAT/BMBF - project of the technical control board, for short, (TUV) North, Hamburg and Institute for plastic examination and plastic customer (IKP), Stuttgart provided analysis methods recommended. In general, the recommended procedure should be followed and any deviations should be documented in the test report.
在本 VDA 建议文件中，介绍了汽车内饰构件所排放挥发性有机物的试验箱测定方法。本文件还评价了使用 1 立方米试验箱对汽车内饰产品排放的进行标准检测的特点和保证检测效果的方法。另外，通过提供示例，还规范了标准排放测试的一般操作流程。由于以下的分析方法用于 FAT/BMBF（德国汽车协会技术委员会/德国教育与研究部）标准—技术控制台项目，德国北部的汉堡和南部的斯图加特塑料检验和塑料客户研究院还提出了建议采取的分析方法。总之，应遵守建议的分析流程，并在测试报告中说明与建议情况的不同之处。

2. Tips to further standards, literature
其它标准和文献指引

The following are specified standards quoted for separate reference. With no data concerning date or expenditure of such a standard are made, in each case, the up-to-date valid version application should be used.
以下为所独立引用的标准。在数据没有涉及日期且不涉及费用的情况下，应使用以下标准的最新版本。

- European Collaborative Action (ECA) ”Indoor Air Quality And Its Impact on Man”, Report No.8 “Guideline for the Characterization of Volatile Organic Compounds Emitted from Indoor Materials and Products Using Small Test Chambers”
- 欧洲合作行动（ECA）标准：“室内空气质量和室内空气对人的影响”中的第 8 个报告，“使用小型试验箱测定室内材料和产品挥发有机物质的指引”

- European Collaborative Action (ECA) “Indoor Air Quality And Its Impact on Man”, Report No. 18 “Evaluation of VOC Emission from Building Products”
- 欧洲合作行动（ECA）标准：“室内空气质量和室内空气对人的影响”中的第 18 个报告，“建造制品挥发性有机物质的评价”

- DIN EN 45001, general criteria for the testing laboratories and companies
- DIN EN 45001，实验室和企业测试的总体标准

- DIN EN ISO 9001, quality management system: quality assurance model in Design development, production, assembly and maintenance

- DIN EN ISO 9001，质量管理系统：在设计、制造、组装和维护中的质量保证模式

- DIN 50011-11, climates and their technical application: Climatic testing facility; General terms and Requirements
- DIN 50011-11，环境及其技术应用：环境测试设施；总体条件和要求

- DIN 50011-13, climates and their technical application; Climatic testing facilities; Climatic conditions: Air humidity and air temperature
- DIN 50011-13，环境及其技术应用：环境测试设施；环境条件：空气湿度和温度

3. Definitions
定义

In the context of this VDA recommendation, the following definitions apply:
在本 VDA 建议文件中，使用下列定义：

Exhaust air stream: the air flow loading leaving the inspection room by a given
排出气流：在给定条件下，涌出检测空间的气流负荷

Loading: the relationship of volumes, surface, length or mass of the construction unit to the volume of the test chamber
载荷：构件容积、表面、长度或质量与试验箱容积之间的比例关系

Emissions: organic substances released from the construction unit under the described test conditions
挥发物：在规定测试条件下，构造中挥发出来的有机物质

Emission rate: emission emitted from a construction unit for each time unit: the indication effected related to mass, volume, surface, length or absolutely test part
挥发率：单位时间内单个构件挥发出来的挥发物，该指标受其质量、容积、长度或受测试部分的影响

Fogging: Precipitation from condensable volatile, usually organic substances
尘雾：可凝结挥发物（在空气中）的析出，通常是有机物质的析出

Air change: Quotient from supply air stream and test space and measure for the air interchange for each time unit air
空气交换：进气流和测试空间的空气交换，用来衡量单位时间内空气的交换

Air speed: medium speed of the air flow inside test space, measured in center, caused by the circulation
风速：测试空间内（空气循环所引起的）空气流动的速度，使用中间值

Air sample: the withdrawal of representative, quantitative volume of the test space atmosphere of ideal mixing: in an ideally mixed area a supplied material without time delay distributes itself completely and homogeneous in the entire area
空气样品：对有代表性的、一定容积的且良好混合的测定空间的取样：在理想的混合区域，立即将提供的材料迅速、完全、均匀地放入

Condensate sample: the enrichment of condensable substances (Fogging) from the test chamber atmosphere at a coolable collecting device
浓缩样品：在冷却收集设备中，将试验箱气体中的可浓缩物质（尘雾）进行浓缩后的样品

Concentration in the test chamber: the concentration of one or several chemical substances in a gaseous air sample, those in a representative place of the test space, determined by chemical or physical means
试验箱浓度：测试空间有代表性位置上，气体样品中一种或多种化学物质的浓度，用化学或物理方法测定

Surface of the construction unit: the surface inspection room passable formed by the outlines of the construction unit for organic substances
构造表面：针对有机物质，由构造外形构成的检测空间表面

Test chamber: air-tight lockable area for the determination of volatile organic emissions under defined climatic conditions
试验箱：严密密封的、用来在规定环境条件下测定挥发性有机物质的区域

Test chamber volumes: Volume of the test chamber less all volumes taking technical building and devices in the test chamber
试验箱容积：试验箱体积减去试验箱中所有技术装置和设施的体积

Recovery: proportional relationship de rim exhaust air stream intended mass of a substance for the mass loss of this substance in the inspection room, determined in the same period
回收比：一种物质在测试空间里的质量损失与其在排出气流中的质量含量的比例关系，在同一时段测定

Supply air stream: sum of all gaseous flow rates for each time unit led into the test chamber
进气流：单位时间内，进入试验箱的所有气流

4. Symbol and units
符号和单位

C [µg/m^3] Test space-concentration of a substance (at 1.013x10^5 Pa and 293K)
C [µg/m^3] 测试空间中一种物质的浓度(在 1.013x10^5Pa 气压和 293 开氏度)

R [µg/h] Emission rate

R [µg/h] 挥发率

R_A [µg/m^2h] Emission rate related to the construction unit surface
R_A [µg/m^2h] 与构造物表面有关的挥发率

R_V [µg/m^3h] Emission rate related to the construction unit volume
R_V [µg/m^3h] 与构造物体积有关的挥发率

R_m [µg/kgh] Emission rate related to the construction unit mass
R_m [µg/kgh] 与构造物质量有关的挥发率

N Air change: changes of air per hour
N 空气交换：每小时的空气交换次数

L_A [m^2/m^3] Surface loading
L_A [m^2/m^3] 表面积载荷

L_V [m^3/m^3] Volume loading
L_V [m^3/m^3] 容积载荷

L_m [kg/m^3] Mass loading
L_m [kg/m^3] 质量载荷

5. Basis of the procedure
5. 基本流程

A construction unit is put into an approximately ideally mixed 1 m^3-test chamber and stored there under given temperature, humidity and of air flow. Organic substances, which escape from the construction unit, enrich themselves in the inspection room and the air flow is delivered. At selected times air or condensate samples are taken, from which with chemical analysis, the concentrations of gaseous air contents materials in the test chamber can be determined qualitatively or quantitatively.
将构件放入大约 1 立方米的空气理想混合的试验箱中，然后在规定温度、湿度和气流下保存。从构件中溢出的有机物质充斥到检测空间，同时空气进行循环。在规定时间对空气或压缩后的空气样品进行取样，并进行化学分析，从而定性或定量地测定试验箱中气体中物质的浓度。

6. Emission tester
6. 挥发物测定设备

It is used for the determination of the gaseous emissions and contains the following functional elements:
气体挥发物测定过程使用或要求的设备和条件：

- Test chamber
- 试验箱

- Air agitator
- 空气搅拌器

- Test chamber keeping at a moderate temperature
- 保持试验箱常温

- Air humidifier
- 空气加湿器

- Pure air supply
- 使用纯净空气

- Control and regulation
- 控制和处理

- Entire-CH-monitor
- 试验箱全箱监测器

- Fogging cooling device
- 尘雾冷却装置

Concerning the design, system, combination and technical execution of these individual functional elements, there should not be binding defaults occurred. In the following sections, to the extent necessary, minimum requirements which can be fulfilled are specified. The proof is additional to furnish (e.g. by interlaboratory tests) that with the used emission chamber comparable results for the chemical substances which can be determined can warden obtained. References to continuous quality assurance measures are in chap.7.
关于这些功能设备的设计、系统配置、组合和技术性能，不得有任何系统性缺陷。以下章节对于这些设备在使用中所涉及的最低要求进行了说明。对于由不同试验人员使用挥发物试验箱测定化学物质结果的比较（如不同实验室进行测试），不予要求。测定结果保证措施见第 7 节。

6.1 Test chamber
6.1 试验箱

The test chamber is an airtight lockable space with a volume of 1 ± 0.05 m^3. Inside it, a device for air mixing and a rack which guarantee the storage of the construction unit without wall contact are required. About the attitude of the air exchange: for air sampling procedures, an inlet and an outlet pipe (Ø < 50 mm) should be diametrically arranged to avoid short-circuit flows.

试验箱是一个密闭空间，容积为 1± 0.05 m^3。试验箱内部，有一个空气混合装置和一个支架，这个支架保证了构件放入后和试验箱四壁没有接触。对于空气交换的方式：在气体取样过程中，进气管和出气管（直径小于 50 毫米）的配置应保证不产生短路气流。

Materials
材料
The wall surfaces of the test chamber and the rack for holding the construction unit must be made of high-grade steel or glass. With building or parts in the test chamber inside, for technical reasons, the two materials mentioned are preferred. Materials are to be selected based on exhibition of small emission and adsorption of organic substances and do not exceed with the test chamber wall surface.
试验箱的四壁和悬挂构件的支架必须用高等级钢或玻璃制造。对于试验箱中的部件和零件，出于技术原因，应尽量使用上述两种材料。材料选择的标准是排放和吸收有机物质尽量小，且不要接触试验箱的四壁。

Tightness
密封性
To avoid uncontrolled air exchange, it should be guaranteed that the leakage current caused by leakages in air change examinations at 1000 Pa positive pressure is less than 1% of the test chamber volume per minute and/or 1% of the total supply air stream. To prevent foreign air inflow, the emission procedure should always operate with a small positive pressure in the test chamber in related to the atmospheric pressure in the laboratory and/or a volume overcurrent. This is to be considered in particular during the air sampling.
为了避免空气的自由交换，需要保证在空气交换检查中，因缝隙产生的流出气流在 1000Pa 正向压强下小于每分钟 1%试验箱容积，或者小于该时间内 1%的进气流。为了防止外部空气进入，挥发过程中，应保证试验箱内的压强对实验室内大气压保持稍高一点，或者保持试验箱空间过流（进气大于出气）。在空气取样中更要注意这个方面。

Air mixing
空气混合
A substantial basis of this procedure is the ideal mixing of the test chamber. This must be achieved by a suitable device for air mixing and guaranteed its fulfillment of this condition even with large volume, bulky test sample. The air flow rate in the centre of the test chamber should be above 1 m/s.
进行检测的一个根本要求是试验箱内空气的理想混合。必须使用适当的设备进行空气混合，并保证空气在大容积和批量样品情况下依然可以良好混合。在试验箱中心位置的气流速度为不大于 0.3 米每秒（查德文原文）。

Note: In Report No.8 and No.18 of the European Collaborative Action (ECA) “Indoor air Quality and Its Impact on Human ", methods are described for the regulation of tightness and air mixing.
注意：在欧洲合作行动（ECA）标准“室内空气质量和室内空气对人的影响”中的第个报告 8 和 18 个报告中，对密封性和空气混合进行了规定。

Cleaning
清洁
With a suitable cleaning method e.g. the thermodesorption at high temperatures it must be guaranteed that a thorough cleaning between examinations takes place. A detailed description is given in chap.9.1. The success of the cleaning should be ensured before the start of an examination by a blank value sample.
使用适当的清洁措施，例如在高温下热脱附，以确保试验装置两次检测之间保持严格的清洁。详细的清洁规定见第 9.1 小节。进行对照检测前，必须保证彻底清洁。

6.2 Test chamber temperature
6.2 试验箱温度
Due to the strong influence of the temperature on the emission behavior, the high requirement of temperature control in the test chamber must be fulfilled. A broad temperature range is also required to suit the requirements of different test temperature. The spatial and temporal temperature derivation may not exceed $\pm$0.5 K.
由于温度对挥发过程有重要影响，对试验箱温度的严格要求必须遵守。同时，试验箱还要有较宽的温度范围，以满足不同试验温度的要求。空间温度和特定时刻的温度偏差不得超过$\pm$0.5 开氏度。

6.3 Air humidity
6.3 空气湿度
Humidification of the test chamber supply air it is to be accomplished in such a way that the formation is excluded from steam and aerosols. By the humidification unit a dew point must be able to reach 10.4 ºC to 65 ºC in the supply air stream. This corresponds to a relative humidity of 45% with 23 ºC and/or 5% with 65 ºC.
试验箱进气流的加湿通过蒸发和喷雾的方式完成。通过加湿，进气流的露点温度可以达到 10.4 ºC 至 65 ºC。具体温度根据相对湿度变化，如 45%相对湿度下为 23 ºC，5%相对湿度下为 65ºC。

6.4 Pure air supply
6.4 纯净空气供应
Examinations with air change as well as the withdrawal of air samples makes the supply of reinstall necessary. For adjustment the fixed air change of 0.5 per hour a volumetric air flow must be regulated by 6.67$\pm$0.35 l/min. under the test conditions (65 ºC, ambient pressure) with an accuracy of $\pm$3%. The sum concentrations of volatile organic hydrocarbon compounds of the supply air before the start of an examination should not be more than 50 µg/m^3 as a total and 5 ug/m^3 for individual substance. The fine dust portion must be reduced by a particle filter of 7 µm to avoid adsorption.

检测中的空气交换和空气样品的取样都要求重新填充试验箱。在调整中，必须调节为每分钟定量 6.67±0.35 升空气进行交换，以保证每小时要 0.5 次空气交换。试验条件（65 摄氏度和环境大气压）的精确度为±3%。在测试前，挥发性有机碳氢化合物在进气中的浓度总量不得大于 50 µg/m^3 且任何一种化合物的浓度不得大于 5 ug/m^3。其中的灰尘必须用一个 7µm 的过滤器进行过滤，以防止有机物被吸收。

6.5 Measurement of the sum concentration at hydrocarbon connections
6.5 碳氢化合物总浓度的测定

For the qualitative evaluation of the sum concentration of hydrocarbon compounds in the test chamber during a test cycle, an on-line analyzer with flame ionization detector (FID) is used, in which the composite signal of a broad spectrum of organic substances is seized. The calibration takes place with a test gas mixture of approx.100 ppmv propane in synthetic air. As a zero-gas, nitrogen of the purity 5.0 is used.
在一个测试循环中，使用火焰电离检测器（FID）在线分析仪对碳氢化合物在试验箱中的总浓度进行定性估计，从中用有机物质广谱复合信号进行评定。用人工空气中体积比万分之一的丙烷混合器进行校正。对于零气体，使用氮纯度为 5.0 的气体进行校正。

A conversion formula for the indication of a mass concentration is in chap.10.
物质浓度的转换公式见第 10 节。

Note: Conditions according to device for the determination of quantitative determination on the basis of a FID composite signal as indicated in "determination of the sum concentration at hydrocarbon compounds with a flame ionization detector (FID)".
注意：按照 FID 复合信号方法进行定量测定的试验条件见“使用火焰电离检测器（FID）进行碳氢化合物成分总浓度测定”。

6.6 Fogging cooling
6.6 尘雾冷却

Qualitative determination of condensable components of the organic emissions of a construction unit takes place via radiator box an attached inside the test chamber. The radiator box must be able to hold on a temperature of a 21±1 ºC in a 100 ºC test chamber. It is to be noted that the use of a radiator box can affect the recording of temperature in the test chamber. And material selection section 6.1 is to be used.
构件有机挥发物成分浓度的定性测定通过散热器罩进行，散热器罩装在试验箱中。散热器罩必须保证在 100 摄氏度的试验箱中处于 21±1 摄氏度。必须注意，散热器罩的使用会影响试验箱内的温度。采取第 6.1 小节中的材料选取方法。

Fig. 1 The assembly line of an emission test chamber
图 1：挥发物试验箱的组装

7. General quality assurance measures
7. 总体测试结果保证措施

The integration of numerous technical functions in an emission chamber creates the possibility of error, which require a regular and conscientious examination of the entire system. Since these errors can affect the part directly and hence the inspection result, the emission chamber is to be merged into an accreditable quality assurance system or a comparable continuous monitoring measure. Described below are some important testing methods for the measurement of test parameters.
挥发物试验箱整合了大量的技术功能，这也会形成误差，因此必须对整个系统定期进行严格的检查。因为这些误差会直接产生局部影响，并随之影响测试效果，所以，挥发物试验箱应当用权威的质量保证系统或连续监控比较方法进行校正。以下描述进行参数测定的重要方法。

Tightness: The tightness of the inspection room is examined with a positive pressure of 1000 Pa by measurement of the decrease of pressure with an interval of 2 hours. The sensitivity of the pressure absorbers is selected to be smaller than 100 Pa, with an accuracy of ±5%. The average leakage rate in this period is also calculated.
密封性：测试空间的密封性用 1000Pa 的正压强进行测量，测量时每 2 小时检查一次压强是否减小。压力吸收器的灵敏度应为小于 100Pa，精确度为±5%。期间的平均泄露率也要进行计算。

$$V[\%/h] = \frac{100\%}{t[h]} \times [(P_1/P_2)-1]$$

V: specific leakage rate related to the test chamber volume in parts per thousand per hour
V：以千分数表示的每小时试验箱容积内的泄漏率

P_1: absolute pressure in the test chamber at the beginning of the examination in Pa
P1：以 Pa 表示的试验开始时试验箱中的绝对压强

P_2: absolute pressure in the test chamber at the end of the examination in Pa
P2：以 Pa 表示的试验结束时试验箱中的绝对压强

t: period of the leakage rate in h
t：以小时表示的泄露时间

Alternative procedure: The tightness of the test chamber is determined with a positive pressure of 1000 Pa by measurement of the radioactive half-life $t_{1/2}$ of the pressure acceptance in the test chamber. The radioactive half-life is the period, in which the positive pressure reached half of its initial value. Thus the specific leakage rate is calculated according to the formula
其它方法：在正压力 1000Pa 的条件下，通过测量试验箱中该正压力半衰期的方法来测定试验箱的密封性。半衰期为正压力达到其初始值一半的时间。用下列公式技术泄漏率：

$$V[\%/h] = \frac{100\% \times (\Delta p/p)}{t[h]} \times (\ln 2/t_{1/2})$$

V: specific leakage rate related to the test chamber volume in per cent per hour
V：以百分数表示的每小时试验箱容积内的泄漏率

Δp/p: relative positive pressure related to ambient pressure
Δp/p：正压力和环境压强的比值

$\mathbf{t_{1/2}}$: time interval up to the reduction of the positive pressure on half of the initial value in h
$\mathbf{t_{1/2}}$：以小时表示的正压力减小到初始值 1 半的时间

In both procedures the tightness is determined at test chamber at temperature of 65 ºC.
在这两个测试密封性的方法中，试验箱的温度应保持在 65 摄氏度。

Air speed:
空气流速：
Air speed is measured in the centre of the empty test chamber. For measurement, hot wire -, film or impeller anemometers are used.
空气流速以空试验箱中心的空气流速衡量。测试应使用热线/热膜流速计或叶片流速计。

Supply air stream:
进气流：
Due to the strong influences on the test result, the supply air stream of regular intervals is examined. The inflowing volume in approximate atmospheric pressure is measured directly at the inlet of the inspection room with a gas meter, which exhibits an accuracy of ± 2%, and the range is certified as specified in section 6.4. The minimum volume which can be determined amount to the 200-times of the reading precision of the gas meter. The supply air stream can then be calculated as quotient from inlet volumes and measuring period. For the calculation of the change of air under test conditions, the determined supply air stream must be corrected according to the ideal gas law with the dominant temperature and pressure values.
由于对试验结果影响巨大，应定期检查进气流。用气量计测量由测试空间进气口进入的、压强为环境气压的气体体积，测量的精确度为± 2%，测量范围在第 6.4 节进行了规定。最小的测量体积应达到气量计读数精确度的 200 倍。用进入的体积和测量时间，进气流可以计算为气体交换比例。测试条件下气体交换率的计算中，应按照理想气体定律以及温度、压力值对进气流的数值进行修正。

Control values:
控制值：
Control values in supply air and room air, as well as other sources of emission, which stand with the test chamber atmosphere, are used for assistance of regular examinations. With control substance, its quantitative methods of analysis are proceeded with specific

procedure and measurement. For the half-quantitative control value monitoring, a screening procedure e.g. Tenax/ Thermodesorption is consulted, which exhibits a sensitivity or single substances. The sum concentration of VOC, determined with this procedure, should be below 50 µg/m^3, whereby the concentrations of single substances are not to exceed 5 µg/m^3.
与试验箱内气体相关的进气流、室内空气和其它来源的挥发物应当用定期检查和控制值的办法控制。对于受控的物质，其定量分析应按照规定流程和测量方法进行。对于半定量控制值监控，可使用过滤方法，如 Tenax 热脱附方法，这种方法对单种物质的灵敏度为< 2 µg/m^3。用这种方法测定的挥发性物质总浓度应小于 50 µg/m^3，而单种物质的浓度应小于 5 µg/m^3。

Temperature and humidity:
温度和湿度：
The adherence to the tolerances for temperature and relative humidity is determined with a combined temperature moisture meter on ±0.5K and/or ±5% exactly. If sufficient experiences are present over possible condensation effects of the moistened supply air, the humidity can also used in the supply air stream measurement.
用组合型的温度湿度计来测量温度和相对湿度，其误差必须分别小于±0.5K and/or ±5%。如果对于克服潮湿进气对浓度产生的影响有足够的经验，可以在进气流测量中使用潮湿的气体。

8. Construction unit
8. 构件
Before the determination of volatile organic emissions, the construction unit was exposed to condition which can affect the quantitative investigation and hence the results substantially. It is necessary to standardize the pre-examination of construction unit as far as possible.
在进行挥发性有机物质测定前，构件会暴露于影响定量检查并对测量结果产生重大影响的环境中。因此，必须尽量在测试前对构件进行标准化。

8.1 Withdrawal of the construction unit
8.1 构件的取样
For standardized examinations, in which the emission behavior of a new part is to be seized, the construction units in the delivering condition are to be examined with incoming goods. The possible adsorption of substances from the environment which were not originally in contained in the construction unit also counts. The pre-examination of the construction unit should be documented as complete as possible. If it is necessary to dismantle the parts for inspection purposes, the separation of the construction unit or any changes, those procedures should be documented. Anschmutzungen are to be avoided.
在标准化的测定中，要获取新部件的挥发性质，必须将交货条件下的构件进行验收检验。同时还要计算非原始环境对物质的吸收。构件的试验前检查应当用书面方式尽量完整地记录。如果因为测试而必须拆卸构件，构件的分拆或其它改变应当用文件记录。期间要避免构件受到损污。

8.2 Packing, transport, storage of the construction unit
8.2 构件的包装、运输和存放
The construction unit should be packed after withdrawal until the start of the examination that the contamination of the construction unit by chemical substances from the environment is prevented, the emission potential of the test sample is conserved and material changes by radiation (e.g. sun exposure) to be excluded.
构件应当在取样后包装，直至测试时再打开，应当避免环境中的化学物质污染构件，保存试样的潜在挥发物，同时要排除辐射（例如，暴露于太阳光下）造成的重大变化。

Note: For this purpose a weldable sandwich foil with an intermediate layer of aluminum is suitable, concerning gas and diffusion tightness. It also protects against transportation damages offers (e.g. company Flöter, 71735 Eberdingen nut village). During the temporary storage and transport of the construction unit, the temperature of 23 ºC should not be exceeded.
注意：为了保证存放和气密性，可以使用带有中心层为铝箔的、可焊接的、三明治式的箔。这种三明治箔还防止运输途中的损坏（例如：勃兰登堡的 Flöter 公司的事例）。在构件的临时存放和运输中，不得超过 23 摄氏度。

9. Procedure of the standard emission examination
9. 挥发物标准测试流程
In this section, the proceedings, definitions and requirements of the standard emission examination in the chamber are described. This examination gives a broad overview of the intensified emission conditions for the construction units.
在本节中，将描述用试验箱进行挥发物标准测试的流程、过程和要求。测试对构件的强化挥发条件进行了综述。

The test temperature amounts to the first conditioning phase 65 ºC with a supply air humidity of approx. 5% R.H. (45% correspond R.H. at 23 ºC). The change of air amounts to 0,4 /h.
在第一个处理阶段，测试温度为 65 摄氏度，进气流相对湿度为大约 5%（在 23 摄氏度下，相对湿度相应为 45%）。空气交换为 0.4 次每小时。

The method determines the air concentration of BTXE/S: aromatics, aldehydes and ketone by GC-MS analysis. When necessary, further analytic procedures can be used for air determination e.g. amines, glykolethern, phthalate or n-nitrosamine can within 2.5 the hour sampling window beprobt.
空气中苯、甲苯、二甲苯、乙苯浓度的测量方法：用气相色谱－质谱联用方法分析芳香烃、乙醛和甲酮的方法测定。如果需要，还可以测定空气中的其它物质，如：胺类、乙二醇醚、邻苯二甲酸盐或亚硝胺，通过抽样窗在 2.5 小时内取样。

In a second conditioning phase, the test chamber is raised to a temperature of 100 ºC is raised (without supply air humidification), while at the same time, the cooling device of the fogging condensate sample is kept at a moderate temperature of 21 ºC. The test sequence is in minutes form to document (for example see appendix 1). During the entire

test period, the temperature, humidity and total concentration of organic compounds in the test chamber is monitored by mean of FID.
在第二次处理阶段，试验箱的温度提高到 100 摄氏度（不得进入湿气），同时尘雾浓缩样品冷却装置应保持在 21 摄氏度的适度温度下。测试顺序应记录为文件（见附件 1 的示例）。在整个测试过程中，试验箱中的温度、湿度和有机物质总浓度用 FID 进行监控。

9.1 Cleaning
9.1 清洁
Before the start of a construction unit investigation, all pollutant-liable surfaces of the test chamber must be in cleaned condition. If necessary, existing background concentrations must be so small that the quality of the results from air-analytic regulation methods remains uninfluenced.
在构件检测前，试验箱中所有可能受到污染的表面必须保持清洁。如果无法根除污染，则污染的本底浓度必须足够小，使得空气分析方法的结果不受影响。

Test chamber
试验箱
The test chamber should be first freed of particles or the like. Mechanical cleaning methods are used to remove the remains of the construction unit (e.g. industrial vacuum cleaner). Drying up of condensate arising in the edges may be removed by steel wool or volatile solvents. In the case of a thermal cleaning, the test chamber are baked under scavenging air at a temperature > 200 ºC which can reach all surfaces and in contact with the test chamber atmosphere. The cleaning procedure is terminated after 10 changes of air starting from reaching the baking temperature. If the cleaning of the test chamber surfaces takes place via washing with alkaline cleaning agents, it should be accomplished with two washing processes of demineralized water. Afterwards the test chamber is dried with rinsing air flow at test temperature.
试验箱中的微粒物或类似物体应当首先清除。可以使用机械式的清除方法移除构件的附带物（例如，使用工业真空吸尘器）。干燥构件边缘的凝结物可以用钢刷或挥发性溶剂清除。如果是加热清洁，试验箱可用 200 摄氏度以上的清洁空气干燥，清洁空气可以到达试验箱内空气接触的任何表面。在达到 200 摄氏度以上干燥温度后，进行 10 次空气交换，然后结束清洁过程。如果用酒精清洁剂进行刷洗来清洁试验箱表面，应使用除盐水进行 2 次清洁。然后，用测试温度下的清洁空气干燥试验箱。

Others
其它方面
All parts in contact with the test chamber atmosphere, which are not directly included in the cleaning procedure of the test chamber, must be supplied to a separate purification process comparable from the technical view.
所有和试验箱内空气接触的部件，如果没有在试验箱清洁过程中进行清洁，就必须按照技术要求进行独立的清洁。

Note: With the test chamber outfits parts, the maximum temperature of the drying process is 200 ºC with120 ºC over 2-3 hours is considered sufficiently.
注意：试验箱附件在干燥过程中的最高温度为 200 摄氏度，同时，120 摄氏度下干燥 2~3 个小时就已经完全满足试验要求。

9.2 Examination
9.2 检查

The actual examination extends from inserting the construction units into the emission test chamber to the withdrawal after conclusion of all conditioning and sampling procedures.
从将构件放入挥发物试验箱到所有处理和取样过程结束后的取出，都要进行检查。

9.2.1 Preconditioning
9.2.1 预先处理

The test chamber is conditioned before inserting the construction unit at a temperature of 70±1 ºC and a relative humidity from 5±2%.
在将构件放入试验箱前，需要将温度和相对湿度分别调节到 70±1 摄氏度和 5±2%。

9.2.2 Preparation
9.2.2 试验准备

The entire emission chamber should be examined carefully for all necessary functions before the start of a test, so that the test can be completed with high security. For that, the pure air production, the test chamber, the climatic regulation, the entire CH monitor, data recording and all other necessary accessory equipment are to be included in the functional check.
测试前，挥发物试验箱应仔细地整体对所有必备的功能进行检查，保证试验可以在高度可靠地完成。因此，纯净空气的产生、试验箱、环境调节、试验箱整体监测器、数据记录和所有必备的附属设备都必须进行功能检查。
Note: Appendix 2 contains an example checklist of the activities before the test start.
注意：附录 2 包含了测试前的检查项目示例。

9.2.3 Inserting the construction unit
9.2.3 放入构件

The construction unit is put in the test chamber concentrically and avoids wall contact by the rack. A sentence from several construction units is to be arranged in such a way that the all-round surge that result in the best possible way which can be reached by the circulation. It is to be made sure that the construction units cannot shift over the entire testing period. The test chamber is to be locked immediately after inserting the construction units.
构件应放入试验箱中心位置，利用支架避免和四壁接触。多个构件放入的原则是能够使其各个方面和空气环流以最佳方式接触。这可以保证构件在整个测试中不会发生移位。在放入构件后，试验箱应当立即锁闭。

9.2.4 Conditioning phase

9.2.4 处理阶段

Immediately after locking the emission chamber, the examination is started by selection of an automated test program or by manual control of the test conditions. In the following table the climatic parameters and sampling procedures of the individual test phases are summarized. Fig. 2 Plot of temperature gradient and the sampling windows:

在立即关上试验箱后，选用自动测试程序或以人工控制方式开始试验。下表总结并列出了每个测试阶段的环境参数和取样过程。图 2：温度梯度和取样窗草图：

Tabular operational sequence of the standard emission examination

标准挥发物试验操作流程表

Row	Time [h:min]	Temperature [ºC]	Air change [l/h]	Incoming air humidity [ºC/%R.H.][1)]	Process
Conditioning					
1		70	maximal	10.4/4.0	
2	-0:30	70	maximal	10.4/4.0	If necessary, prepare the test chamber
Testing					
3	0:00	65	0.40	10.4/5.0	1. Conditioning phase
4	2:00	65	0.40	10.4/5.0	Start testing -BTXE/S-Aromatic -Aldehyde and ketone -Clearanalysis -If necessary, further testing
5	4:30	100	0.44	out	2. Conditioning phase -Fogging test start -Fogging test end
6	8:00	100	0.44	out	

[1)] Dew point temperature e.g relative humidity at 65/ºC u.1.013x10^5 Pa

[1)] 露点温度：例如，在 65/ºC 和 1.013x10^5 Pa 气压下的相对湿度

行	时间[小时：分钟]	温度[ºC]	空气交换速率[升/小时]	进气流湿度[ºC/%R.H.][1)]	过程
处理					
1		70	最大值	10.4/4.0	
2	-0:30	70	最大值	10.4/4.0	如果需要，处理试验箱
Testing					
3	0:00	65	0.40	10.4/5.0	第一个处理阶段
4	2:00	65	0.40	10.4/5.0	开始测试 -苯、甲苯、二甲苯、乙苯-芳香烃

					-乙醛和甲酮 -清洁度分析 -如果需要，进行其它试验
5	4:30	100	0.44	已取出	第二个处理阶段 -开始尘雾测试 -结束尘雾测试
6	8:00	100	0.44	已取出	

Supplementing notes:
其它注意事项：

Note 1: In the test chamber before beginning of the examination, the demanded humidity prevails, must be begun with the humidification of the supply air in time.
注意 1：在开始测试前，试验箱中的湿度必须在规定时间内达到进气流的湿度，然后开始测试。

Note 2: The preparation of the test chamber must take place so promptly that at the latest to test beginning the conditions of the conditioning are again fulfilled within the accuracy borders.
注意 2：试验箱的准备应当立即进行，在环境条件的处理再次符合其上下限要求时，试验箱应可以投入试验。

Note 3: It is to be guaranteed that the inspection temperature of 65±0.5 ºC in the test chamber is again reached at the latest after 30 min.
注意 3：应在最晚 30 分钟后保证试验箱中的试验温度再次达到 65±0.5 ºC 范围。

Note 4: The given air sampling phase is laid out that after conclusion of the prescribed air sampling procedures, there is still time for supplementing air sampling remains for the testing of e.g. amines, glykolethern, phthalate or n-Nitrosamine.
注意 4：进行规定物质的空气取样，同时，在规定的空气取样过程结束后，还有时间对其它物质进行抽样，例如：胺类、乙二醇醚、邻苯二甲酸盐或亚硝胺。

Fig. 2 test cycle of the standard emission examination for regulation easily and heavy volatile substances from construction units with a 1 m^3 emission test chamber
图 2：使用 1 立方米试验箱对构件发出强挥发和易挥发物质进行标准挥发物试验的测试流程

Air sampling
空气取样

The withdrawal of air samples is to take place with standardized emission examinations at a given time. Therefore the duration and sequence of the air sampling procedures are constantly bleached to hold during an air sampling phase of several analysis. The

execution of the air sampling is described in the respective air-analytic testing methods. Note: The number of air sampling procedures running off at the same time is limited by the adjusted change of air on maximum 61/min (65 ºC, ambient pressure).
在规定时间，按照标准化的挥发物试验规定对空气样品进行取样。因此，空气取样的过程和流程在多个分析取样过程中要经常进行。空气取样按照不同的空气分析方法进行了规定。注意：每次完成的空气取样流程次数受到空气交换调节的最长时间 61 分钟（65 摄氏度和环境大气压条件下）的限制。

Condensate sampling
浓缩取样
The condensate sampling begins with the supply of radiator box kept at a moderate temperature on 21 ºC. Since the test chamber must be open in order to withdraw the condensate sample, the examination has to be terminated.
The execution of the condensate sampling is operated as described in a standard working instruction.
浓缩取样应在保持散热器罩处于正常温度 21 摄氏度下。为了取出浓缩样品，试验箱必须打开，所以，这时测试必须已经完成。
必须按照标准化要求的规定进行浓缩取样。

9.2.5 Completion of the examination
9.2.5 试验的完成
An emission examination is completed with the switching off of the climatic regulation and/or the opening of the emission chamber. A cleaning procedure is required right after the emission examination (see chap. 9.1).
关闭环境调节或打开挥发物试验箱，完成挥发物试验。在挥发物试验完成后，立即进行清洁（见第 9.1 小节）。

10 Calculation and presentation of the inspection results
10. 测试结果的计算和表达
Upon completion of the test, one receives quantitative statements of air concentration in the test chamber and from this emission rate or qualitative statements about the presence of chemical substances in the test chamber atmosphere can be calculated.
在试验完成后，可以通过计算得到试验箱中的挥发物定量数据或试验箱空气中存在的化学物质的定性结论。

The determination and calculation of these inspection results are a component of the respective chemical analysis procedure according to the respective standard working instruction. As reference volumes, the volume of the test chamber in the **normal state** [1] (standard temperature and pressure) is used, which can leads to a lower, calculated concentration value than the actual one.
试验结果的判定和计算是化学分析过程的组成部分，并应按照相关的规定进行。关于参考容积，应使用正常状态 [1]（标准温度和气压）下的试验箱容积，这会使得浓度值的计算结果小于实际值。

Test chamber concentration
试验箱浓度

Standard emission test	65ºC	Toluene (108-88-3)	10µg/m^3
Test		*Phase*	*Substance (CAS-Nr) Concentration [µg/m^3]*
标准挥发物试验	65ºC	甲苯 (108-88-3)	10µg/m^3
试验		*相*	*物质 (正十四碳酸) 浓度[µg/m^3]*

Qualitative substance verification
定性的物质鉴定

Standard emission test	65ºC	Toluene (108-88-3)	Identification
Test		*Phase*	*Substance (CAS-Nr) Verification*
标准挥发物试验	65ºC	甲苯 (108-88-3)	鉴定
测试		*相*	*物质 (正十四碳酸) 鉴定*

Total carbon emission-mass concentration with FID
使用 FID 方法测定的含碳挥发物总浓度

Standard emission test	180 min	Total-CH	10mg $_{CH}$/m^3
Test	*Time*	*Substance*	*Concentration [mg_{CH}/m^3]*
标准挥发物测试	180 分钟	全箱	10mg $_{CH}$/m^3
测试	*时间*	*物质*	*浓度 [mg_{CH}/m^3]*

Since the recording takes place continuously, the concentration profile in the test chamber is shown by a concentration-time diagram. Time t =0 min is to set as the time locking the test chamber after inserting the construction unit. The total carbon concentration is calculated from the volume concentration of a FID reading according to the formula (calibration with a propane gas mixture).
由于持续记录数据，试验箱中的浓度数据以浓度-时间表格形式显示。时间 t=0 为放入构件并锁闭试验箱的时间。按照下列公式，使用 FID 方法的浓度读数计算总的碳浓度。

$$\text{Mass concentration} = \frac{\text{Mol mass}_{\text{Propane}}}{\text{Mol volume}_{\text{Propane}}} \times \text{Volume concentration}$$

$$\text{物质浓度} = \frac{\text{丙烷的摩尔浓度}}{\text{丙烷的摩尔体积}} \times \text{体积浓度}$$

m_{CH} [mg/Nm^3] = $\frac{44.094\ [kg/kmol]}{24.055\ [m^3/kmol]}$ x C_{FID} [ppmv]

=1.833 x C_{FID} [ppmv]

1) as a normal state a pressure is based by 1.013x10^5 Pa and a temperature of 293 K for the gas volume

1）标准状态的压强为 1.013x10^5 Pa，温度为 293 K。

Emission rate

挥发率

With the mass concentration, the emission rate can be calculated for the time of the sampling in the test chamber. This reads:

使用物质浓度，根据试验箱的取样时间，可以计算出挥发率。即：

Emission rate = Air stream volume x Concentration

挥发率=气流体积 x 浓度

m_{CH} [mg/h]= V [m^3/h] x C_{CH}[mg/m^3]

Area-related emission rate

与空间有关的挥发率

Emission rate $_A$ = $\frac{\text{Air stream volume x Concentration}}{\text{Surface of the test material}}$

挥发率 A= $\frac{\text{气流体积 x 浓度}}{\text{试验材料表面积}}$

$m_{CH;A}$ [mg/m^{2}h]= $\frac{V[m^3/h] \text{ x } C_{CH}\ [mg/m^3]}{A[m^3]}$

Mass-related emission rate

与质量有关的挥发率

Emission rate $_m$ = $\frac{\text{Air stream volume x Concentration}}{\text{Mass of the test material}}$

挥发率 M= $\frac{\text{气流体积 x 浓度}}{\text{试验材料质量}}$

m_{CH} [mg/kgh] = $\frac{V[m^3/h] \text{x } C_{CH}\ [mg/m^3]}{m[kg]}$

11 Test report

11. 试验报告

It should be in compliance with DIN ISO 9001 and/or the following data are given according to DIN EN 45001 in a test report:

试验报告应符合 DIN ISO 9001 标准的要求，并按照标准 DIN EN 45001 的要求提供下列数据：

- Name and address of the test laboratory
- 进行试验的实验室名称和地址

- Name and address of the client
- 客户的名称和地址

- Input information of the construction unit and kind of the packing during delivery
- 接收构件时，收到的构件信息和包装类型

- Clear notation(s) for the identification of the construction unit
- 构件类别的清晰记录

- Detailed description of the construction unit
- 构件的详细描述

- Production date
- 生产日期

- Storage and climate of entrance of the construction unit before the test start
- 在开始试验时，构件的包装和所处的环境条件

- Changes made in the construction unit (e.g. disassembly, surface sealing...)
- 构件发生的变化（例如：分解、密封等）

- Test parameters temperature, humidity and change of air during the entire test period
- 测试参数，整个测试期间的温度、湿度和空气变化

- Time, nature and duration of the sample/sampling
- 取样或样品的时间、状态和持续时间

- Method of analysis and working instruction
- 分析方法和工作指引

- Short description of the analysis procedure
- 分析过程简述

- Precision and correctness of the analysis procedure
- 分析过程的精度和正确性

- Recovery of the determined substance
- 测定物质的回收比

- Reference to the available standards
- 相关参考标准的索引

- Deviations from the testing method and characteristics during the examination
- 测试期间分析方法和特性的偏差

- Date and signature
- 日期和签名

Appendix 1 **Lab. Protocol** Page 1 of 1	**Determination of Organic Substance as Emitted from Automotive Interior Products Using a 1 m^3 test cabinet** **Part 1: Standard Emission Test**	**VDA 276-1**
Order No.	Name of construction unit	
Processor, Department	Pretreatment See section B	
Date	Test condition See section C	
Test No.		

附录 1 **实验室规定流程** 第 1 页，共 1 页	使用 1 立方米试验箱测定汽车内饰产品挥发有机物质 **第一部分：标准挥发物测试**	**VDA 276-1**
订单号	构件名称	
试验部门和试验者	预处理 见 B 部分	
日期	测试条件	

	见 C 部分
试验编号	

A. Characteristics
Manufacturer: Manufacturing date:
A. 构件性质
制造商: 制造日期

B. Storage
B. 存放

Store in: Place:
Temperature: ºC Packaging: PE
PE-Al
Openly

存放于： 地点：
温度： ºC 包装： PE
PE-Al
无包装

C. Measurement
C. 测量
Measurement beginning: End:
EPS: Total-CH-File:

测量开始： 结束
EPS: 全程记录文件

C1.Conditioning
C1. 处理
Automatic: Manual:
Program No.: Temperature: ºC
Dew point bath: ºC
Incoming air: NI/min

自动： 人工：
程序编号： 温度： ºC
露点温度： ºC
进气量： NI/min

C2.Test
C2. 测试

Date/ Test name
_____
_____
_____

Substances
1 2 3 4 5 6 7 8 9

测试日期和名称
_____
_____
_____

测定物质
1 2 3 4 5 6 7 8 9

D. Relocation/ outsourcing
D. 外部服务

Evacuated in:
服务地点：

Place:
位置：

Date:_____
日期：_____

Signature:_____
签名：_____

	Determination of Organic Substance as Emitted from Automotive Interior Products Using a 1 m^3 test cabinet Part 1: Standard Emission Test	**VDA 276-1**

	使用 1 立方米试验箱测定汽车内饰产品挥发有机物质 **第一部分：标准挥发物测试**	**VDA 276-1**

Appendix 2: Check list of emission examination (example)
附录 2：测试前检查项目表（示例）

Regular check	i.o.
Air-filter for carrier gas supply (function, loading)	
Water stock for sufficient air humidification	
Berstsicherung (function, density)	
Visual check of the inspection room, air agitation	
Function of the Fogging cooling (circulation, tightness, temperature)	

Before insertion of construction unit	
Supply air stream (actual value) correctly adjusted	
Fogging cooling connected, discs put on	
Test chamber inserted and intact	
Total-CH-Analysis and fogging cooling attached	
At test beginning	
Necessary test chamber openings	
Activate data recording	
Keep test parameter	

常规检查	i.o.
进气部分的空气过滤部分（包括功能和流量）	
水储存量，以保证足够的空气湿度	
安全阀（功能和紧密度）	
检测空间和空气搅拌的目视检查	
尘雾冷却功能检查（循环、紧密度和温度）	
放入构件前	
进气流（实际值）可否正常调整	
是否连接尘雾冷却装置，阀盘是否已安装	
试验箱是否完好、未动	
全箱体分析和尘雾冷却是否已启动	
测试开始时	
必须打开试验箱的次数	
启动数据记录	
保持测试参数	

Determination of Organic Substances as Emitted from Automotive Interior Products Using a 1 m^3 Test Chamber VDA276-2
使用 1 立方米试验箱测定汽车内饰产品挥发有机物质的 VDA276-2 方法

Part 2: Determination of the release of formaldehyde, ammonia and phenol-measurement by method of steady-state concentration.
第二部分：按照平衡浓度法，测定汽车内饰部件排放的甲醛、氨气和酚类气体。

1. Purpose 目的

The available VDA recommendation describes a measuring procedure for the determination of the release of formaldehyde, ammonia and phenol from shaped parts of the vehicle interior.
本 VDA 建议文件描述了测定汽车内饰构件排放甲醛、氨气和酚类气体的方法。

2. Range of application 应用范围

The measuring procedure applied for the emission examination of shaped parts under extreme climatic conditions.
本测定过程应用于极端环境条件下构件挥发物的排放。

3. Reference to other testing methods 其它测试方法

ENV 717-1 timber material determination of the formaldehyde discharge Part 1: Determination of the formaldehyde discharge according to the test chamber method
木制材料排放甲醛测定标准 ENV 717-1 的第一部分：按照试验箱法测定甲醛排放物

4. Principle 原则

The determination of the release of air-contaminating pollutants such as formaldehyde, ammonia and phenol from shaped parts of automotive interior made of textile and wood fiber, using 1 m^3-Chamber-Method. Practical condition as in the automotive interior under unfavorable conditions is considered.
关于织物和木质纤维汽车内饰构件排放的空气污染物如甲醛、氨气和酚类气体等的测定，使用 1 立方米试验箱法。采取极端条件下的汽车内饰工作状态。

For the simulation of conditions, which can occur in motor vehicle interiors during sun exposure, the test chamber temperature was specified at 65ºC. Based on different preliminary investigations over the figure determination of air changes with closed ventilation flaps in automobiles as well as regarding the average more highly lying portion of the blocked textile fleeces in the vehicle interior, the space loading figure of air changes of 4 was selected for the test. Relative humidity is fixed at approx. 11%, i.e. it introduces air saturated with water vapor at ambient temperature in the test chamber kept a moderate temperature on 65ºC. The construction unit is generally air-retune inserted.
对于汽车内饰在阳光暴晒条件下的模拟，规定试验箱温度为 65 摄氏度。基于汽车通风窗页关闭下空气交换值的各种初步测定和汽车内饰中含有高比例织物羊毛条件下的不同测试目的，测试空间中的空气交换值设定为 4。相对湿度固定为固定值，

如 11%。对试验箱中的空气湿度，使用环境温度下的饱和湿度，试验箱保持中等温度 65 摄氏度。构件放入时，试验箱的空气应重新调节。

5. Sampling 取样

The construction unit is to have total surfaces of 2 m^3. The construction unit is a larger shaped representative part taken from the complete part. The construction unit is to be packed immediately after the production or after the withdrawal, e.g. stored in polyethylene foil at a temperature of max.25 ºC until the examination. In order to avoid condensation on the surfaces, the sample material must exhibit a temperature > 20 ºC when bringing into the chamber.

构件的总表面积须达到 $2m^2$。构件样品应为完整部件中取出的有代表性的构件。构件应在生产或取出后立即包装，如：在试验前，包装在聚乙烯箔中，保持最高 25 摄氏度的温度。为了避免表面凝结，在放入试验箱时，样品材料应暴露在大于 20 摄氏度的环境中。

6. Testing method 测试方法

6,1 Test parameters

6.1 测试参数

The sample material is stored in a chamber with a total volume of 1 m^3 under defined climate conditions:

样品材料放在总容积为 1 立方米的试验箱中，并符合以下试验条件：

Test temperature	(65±1)ºC
Relative humidity	(11±5)%
Change of air	0.5 h^{-1}
Space loading	$2m^2/m^{3*}$
试验温度	(65±1)ºC
相对湿度	(11±5)%
空气交换	0.5 h^{-1}
空间载荷	$2m^2/m^{3*}$

* A smaller space loading is just as possible, if the figure of air changes is reduced, to reach the relationship of space loading/figure of air changes to 4.

* 如果空气交换值较小，为了达到空气交换值为 4 的空间载荷关系，可以选用更小的空间载荷。

Description of a 1 m^3 chamber

6.2 1 立方米试验箱的规格

6.2.1 Glass chamber (example)

6.2.1 玻璃箱（示例）

The inside dimensions of the chamber amounts to 1.00m x 0.80m x 1.25m (fig. 1). The outside walls are manufactured from 8 mm thick glass. The setting of the temperature occurs with the help of a heating thermostat manufactured from high-grade steel, the circulation achieved through two ventilating fans right in the thermostat.

试验箱的内部尺寸为 1.00m x 0.80m x 1.25m（如图 1 所示）。外壁用 8 毫米厚的玻璃制作。使用以高等级钢材制作的加热恒温器进行温度设置，气流循环由安装在恒温器内的 2 个通风扇提供。

By introduction of air into the test chamber, kept at a moderate temperature of 23 ºC, saturated with water, on 65 ºC the test chamber air with relative of (11±5)%.
通过进入试验箱的空气，保持中等温度 23 摄氏度，用水进行饱和，在 65 摄氏度下，将试验箱中空气相对湿度保持在(11±5)%。

Fig.1 Schematic construction of a 1 m3 chamber (e.g. Glass with external thermal insulation)
图 1：1 立方米试验箱的结构图示（例如带外部绝热层的玻璃箱）

6.2.2 High-grade steel chamber
6.2.2 高等级钢制试验箱

The test cabinet consisted of a conditioning area and the actual emission chamber (1.78m x 0.75m x 0.75m). The test chamber is a gas-tight welded adjustment tank with smooth surfaces made of high-grade steel with small roughness depth. The attitude of the humidity takes place in the air inlet stream according to the dew point principle. An accurate description of the high-grade steel test chamber is contained in VDA recommendation Part 1, Section 6.
试验箱中包括调节区和实际挥发腔（1.78m x 0.75m x 0.75m）。试验箱为焊接密闭的箱体，以高等级钢制作，表面光滑，内部粗糙度低。按照露点方法，设定进气流中的空气湿度。高等级钢制试验箱的精确描述见 VDA 建议文件第一部分第 6 节。

Note: Other $1m^3$-chamber test checking facility is permissible, if it is proven to agree with available described measuring procedures.
注意：可使用其它的 1 立方米试验箱测试检查设施，如果该设施证明符合规定的测试方法。

6.3 Devices for the set up of the test chamber 配置试验箱的设备

- 1 m^3 chamber
- 1 立方米试验箱
- 1 air measurer, 50 to 300l/h
- 1 个空气流量计，50 至 300 升每小时量程
- Gas sampling equipments
- 气体取样设备
- Thermal hydraulic graph
- 热水力记录仪
- Barograph
- 自动记录式气压计
- 3 air washer compressor
- 3 个空气清洁压缩机
- Air bleed port or pump compressor

- 空气流出口或泵抽空压力机
- Activated charcoal tower
- 处于启动状态的炭塔
- Purifying oil separator
- 纯精油分离器
- Insulating material (only glass chamber)
- 绝热材料（仅适用于玻璃试验箱）

7. Execution of the test
7. 进行测试
7.1 Preparation of the test equipments
7.1 测试设备的准备

The chamber is to be adjusted in such a manner that a test temperature is reached by (65±1) ºC. Fresh air can enter e.g. over an air supply line. For air pre-purification, a activated charcoal tower is used. Before the start of an examination the concentrations of the following single materials in test chamber air should not be exceeded:
试验箱应调整到测试温度(65±1) ºC。通过进气管道，新鲜空气可以进入试验箱。在空气预净化过程中，使用已经启动的炭塔。在进行测试前，试验箱中以下单个物质的浓度不得超过：

	ppm	µg/m^3
Formaldehyde	<0.005	6.3
Phenol	<0.003	11.4
Ammonia	<0.01	13.9

	ppm	µg/m^3
甲醛	<0.005	6.3
酚类	<0.003	11.4
氨气	<0.01	13.9

7,2 Test
7.2 测试

The construction units is removed from the packing and inserted into the chamber kept at a moderate temperature. Once the sample inserted in the chamber and during the test, the temperature and the relative humidity is documented by the thermal hydraulic graph. Two air washers switched into row for the humidity adjustment. The air volume in the closed chamber is regulated by transformer and throttle valve e.g. with a figure of air changes of 0.5 h^{-1} to (500± 5) l/h.
从包装物中取出构件，并放入试验箱中，将试验箱保持在中等温度。一旦样品放入试验箱，测试过程中的温度和相对湿度应使用热水力记录仪进行记录。打开空气清洁开关，进行湿度调节。密闭箱体中的空气容积用压力调节器和节流阀进行调节，例如：从 0.5 h^{-1} 变化到(500± 5) l/h 的图表。

7.3 Sampling for the regulation contents of formaldehyde, ammonia and phenol
7.3 对含有甲醛、氨气和酚类气体样品的取样

The measurements of the concentrations of formaldehyde, ammonia and phenol takes place daily up to reach the respective balance concentrations.
对于甲醛、氨气和酚类浓度的测量要经常进行，并达到相应的平衡浓度。

Note: At the beginning of the investigation, it is necessarily to accomplish 3 successive working-days 2x daily sampling. The loading of the chamber with the test samples should be according to the scheduled. For this masses of gas, in each case, 0.1m^3 is taken (fig. 2), with liquid-filled absorption and by means of different analytic methods with assistance of gas sampling equipments of the room air.
注意：在测试开始时，必须在 3 个工作日内，每天进行 2 次取样。试验箱中样品的载荷应符合规定。对于气体物质，在每次取样中，取 0.1 立方米（图 2 所示），并进行充液吸收，同时，取样应针对不同分析方法，并通过室内条件下的取样设备进行取样。

7.3.1 Assigned methods of analysis
7.3.1 针对性的分析方法

7.3.1.1 Formaldehyde
7.3.1.1 甲醛

For the determination of the formaldehyde concentration, test chamber air is passed through the gas wash bottle filled with distilled water at a sampling speed of 2 l/min. The formaldehyde content of the absorber solution is determined by photometry and/or fluorimetry using the acetyl acetone method (VDI recommendation 3484 sheets 2, draft 1999). The detection limit for the applied method is 0.005ppm formaldehyde (1ppm~ 1.25 mg HCHO/m^3).
对于测定甲醛浓度，试验箱中的空气要通过充满蒸馏水的洗气瓶，取样时通过的速度为 2 升每分钟。吸收液中的甲醛含量以光度测定法或丙酮乙酰荧光测定法（见 VDI 建议文件第 3484 号中的表 2，1999 年）。所使用方法的检测限制为 0.005ppm 的甲醛含量（1ppm 相当于 1.25 mg HCHO/m^3）。

Alternatively, formaldehyde content can be determined by the DNPH method according to the VDI recommendation 3862 sheets 3, draft October 1999.
另外，按照 VDI 建议文件第 3862 号（草案，1999 年 10 月）中表 3 的规定，甲醛含量还可以用二硝基苯腙（DNPH）法进行测定。

7.3.1.2 Phenol
7.3.1.2 酚类

The phenol content can be determined with the help of the p-Nitranilin-method (VDI recommendation 3485, December 1988). With absorber solution of 0.1 Mol caustic soda solution, which at a sampling speed of 1 l/Minute. The detection limit of this analysis method for phenol under these sampling conditions is approximately 0,003 ppm. (1 ppm~ 3.8mg/m^3).

酚类含量的测定使用硝基苯胺法（VDI 建议文件第 3485 号，1988 年 12 月）进行测定。使用 0.1 摩尔的烧碱溶液，按照 1 升每分钟的速率取样。在这些取样条件下，使用该方法的检测限制大约为 0.003ppm 的酚类含量(1 ppm 相当于 3.8mg/m^3)。

7.3.1.3 Ammonia

7.3.1.3 氨气

0.1M sulfuric acid at the speed of l/Minute serves as the absorber solution for the ammonia in the room air for the photometric test. In each case, 1 ml of the absorber solution react with 5 ml solution A (25mg sodium nitroprusside and 9.975g phenol dissolve in water and fill up to 500ml) and solution B (2.5g sodium hydroxide and 2.5ml sodium hypochlorite solution dissolved and make up to 500ml with water). It is transferred to the thermostatic water bath at 40ºC for 30 min. Subsequently, the extinction of the developing chromocomplexes Indophenol is determined photometrically at the wave-lengthen of 580nm. (detection limit: 0,01 ppm ammonia; 1 ppm~1.39 mg/m^3). Note: Other methods of analysis are permissible, if it is proven to agree with the results of the specified procedures.

在光度测定中，使用浓度为 0.1M 的硫酸溶液作为氨气吸收液，以 1 升每分钟的速率进行取样。在每次取样中，1 毫升吸收液可以和 5 毫升 A 溶液（25mg 硝普化钠和 9.975g 酚类溶解于水中，至 500 毫升）和 B 溶液（2.5g 氢氧化钠和 2.5 毫升次氯酸钠溶液，加水至 500 毫升）进行反应。这个数值可以转换为 40 摄氏度下 30 分钟的恒温水浴。然后，用 580 纳米波长光对靛粉复合颜色变化的光度进行测度，至该颜色消失。（检测限制：0.01ppm 氨气；1ppm 相当于 1.39 mg/m^3）。注意：如果其它方法符合规定的测试效果，其它分析方法也可以采用。

8. Calculation of the results

8. 测试结果的计算

Calculation of the corrected sampling volume (20C, 1013 hPa):

以校正的取样体积计算（20 摄氏度，1013 hPa）：

$$V_{korr} = \frac{V_P \times P_L \times 293}{(273 + t_G) \times 1013} \quad [m3]$$

V_{korr}: corrected sampling volume (20ºC, 1013 hPa) [m^3]

V_{korr}: 校正的取样体积 (20ºC, 1013 hPa) [以 m^3 表示]

V_p: sampling volume, read off [m^3]

V_p: 所记录的取样体积[以 m^3 表示]

P_L: medium air pressure during the measurement [hPa]

P_L: 测量期间的中等气压[以 hPa 表示]

t_G: middle air temperature in the mass of gas counter during the measurement [ºC]

t_G: 测量期间的气体计数器中物质的中等气体温度[以 ºC 表示]

Calculation of the formaldehyde concentration:
甲醛浓度的计算

$$K_{CH2O} = (Ex - Ex_{BW}) \times A \times 3 \qquad [\mu g/30ml]$$

$$K'_{CH2O} = \frac{K_{CH2O}}{1000 \times V_{korr}} \qquad [mg/m^3]$$

$$K''_{CH2O} = \frac{K_{CH2O}}{1.248} \qquad [ml/m^3] \text{ and/ or } [ppm]$$

K_{CH2O} : formaldehyde content of the sample [µg]
K_{CH2O} : 样品中的甲醛含量[以 µg 表示]

Ex : extinction of the absorption solution
Ex : 吸收溶液的消光

Ex_{BW} : extinction of the comparison solution
Ex_{BW} : 对比溶液的消光

A : upward gradient factor of the calibration function [µg/10ml]
A : 刻度上的上升梯度因子[以 µg/10ml 表示]

K'_{CH2O} : formaldehyde concentration [mg/m^3]
K'_{CH2O} : 甲醛浓度 [以 mg/m^3 表示]

K''_{CH2O} : formaldehyde concentration [ppm] and/or [ml/m^3]
K''_{CH2O} : 甲醛浓度 [以 ppm 表示]或[以 ml/m^3 表示]

Calculation of the ammonia concentration:
氨气浓度的计算

$$(Ex_{St} - Ex_{BW}) \sim C_{St}$$

$$(Ex_{NH3} - Ex_{BW}) \sim K_{NH3}$$

$$K'_{NH3} = \frac{K_{NH3} \times 30}{V_{korr}} \qquad [mg/m^3]$$

$$K''_{NH3} = \frac{K_{NH3}}{1.39} \qquad [ppm] \text{ and/ or } [ml/m^3]$$

Ex_{St} : extinction of the standard solution
Ex_{St} : 标准溶液的消光

Ex_{NH3} : extinction of the analysis solution
Ex_{NH3} : 分析溶液的消光

Ex_{BW} : extinction of the comparison solution
Ex_{BW} : 对比溶液的消光

K_{St} : concentration of the standard solution [mg/ml]
K_{St} : 标准溶液的浓度[以 mg/ml 表示]

K_{NH3} : concentration of the analysis solution [mg/ml]
K_{NH3} : 分析溶液的浓度 [以 mg/ml 表示]

K'_{NH3} : ammonia concentration [mg/m^3]
K'_{NH3} : 氨气浓度[以 mg/m^3 表示]

K''_{NH3} : ammonia concentration [ppm] and/or [ml/m^3]
K''_{NH3} : 氨气浓度 [以 ppm 表示] 或 [以 ml/m^3 表示]

Calculation of the concentration of phenol
酚类浓度的计算
$$K_{Ph} = (Ex - Ex_{BW}) \times B3 \qquad [mg/30ml]$$

$$K'_{Ph} = \frac{K_{Ph}}{V_{korr}} \qquad [mg/m3]$$

$$K''_{Ph} = \frac{K'_{Ph}}{3.8}$$

Ex: extinction of the analysis solution
Ex: 分析溶液的消光

Ex_{BW} : extinction of the comparison solution
Ex_{BW} : 对比溶液的消光

B: upward gradient factor of the calibration function [mg/10ml]
B: 刻度上的上升梯度因子[以 mg/10ml 表示]

K_{Ph}: concentration of phenol [mg]
K_{Ph}: 酚类浓度[以 mg 表示]

K'_{Ph}: concentration of phenol [mg/m^3]
K'_{Ph}: 酚类浓度[以 mg/m^3 表示]

K''_{Ph}: concentration of phenol [ppm] and/or [ml/m^3]
K''_{Ph}: 酚类浓度[以 ppm 表示] 或 [以 ml/m^3 表示]

9. Test report
9. 试验报告

In the test report the following information should be given under reference to this VDA recommendation:
按照本 VDA 建议文件的要求，试验报告应提供下列信息：

- Origin of the construction unit
- 构件产地
- place, situation and condition of the material at the time of the sampling, humidity in particular
- 取样时样品材料的地点、条件和环境，尤其是湿度
- date and production of the material
- 材料的生产日期
- date of the sampling
- 取样日期
- date of the test
- 试验日期
- test condition
- 试验条件
- space loading
- 空间载荷
- determined concentrations of formaldehyde, ammonia and phenol (e.g. in ppm)
- 所测定的甲醛、氨气和酚类的浓度（例如，以 ppm 表示）
- description of further details [1)]
- 其它细节的描述

[1)] Report all procedures that are not in agreement with this VDA recommendation (withdrawal of the construction unit, conditioning etc..)
[1)] 报告所有流程不是 VDA 建议文件的要求（例如构件的取回和处理等）。