HARTER
drying solutions

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Sources and literature notes:

All details of the trial set-up and procedure can be read about in Michael Knoedl's thesis. The study can be obtained through the library of the technical college of Deggendorf or from HARTER GmbH.

资料来源和文献摘录：

所有关于试验设置和步骤的详情都可以在Michael Knoedl的论文中查到。该课题可以从德国代根多夫工学院图书馆或哈特有限公司（HARTER GmbH）处获得。

› German Federal Environmental Agency 2007
› BMU: National 8-point plan for minus 40 percent CO_2, Environment 6/2007. Federal environmental agency: Climate protection in Germany: 40% reduction in CO_2 emissions by 2020 compared to 1990, 2007. Federal government: Cornerstones for an integrated energy and climate program. Decided by the federal cabinet at its conference in Meseberg on August 23, 2007
› 596 g CO_2/kWh (el.), Federal environmental agency 2006
› www.porsche.com, Carrera 911 (997), 345 Ps, Annual driving performance 15000 km, 242 g CO_2/km
› Diploma Thesis Michael Knödl 2009

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75 % CO_2 reduction
by means of Airgenex® condensation drying

Against the background of increasing energy prices and the problems of global warming, politics, society and industry carry the responsibility of protecting our resources and using them in a sustainable manner. In this process, industry is faced with a great task. The goal of the federal government is to reduce the CO_2 emissions to 40 % by 2020 in comparison to 1990.

To a large degree, this also affects the industry. As part of these goals, the federal government envisions a reduction of CO_2 emissions by 40 million tons of CO_2/year by 2020 by means of increased energy efficiency in power consumption.
For this purpose, the Airgenex® condensation process from HARTER offers a product for the highly energy-intensive sector of the industrial parts drying, which not only offers an ecological benefit, but also a decisive economical advantage:
- lower operating costs
- decreased resource consumption
- independence from fossil fuels
- more stable process conditions
- a large CO_2 reduction potential

75 % CO_2 减排量
通过 Airgenex ®除湿干燥系统可以实现

在能源价格不断上涨和全球气候变暖的背景下，我们的社会和企业有责任去保护和合理利用有限的资源。
在这个过程中，工业生产将会面临比较大的挑战。政府的目标是到2020年CO_2排放量比1990年减少40%

这在很大程度上影响到了生产工业，因为政府的目标中提到，联邦政府预期，到2020年，通过提高能源效利过程中的利用效率，实现每年减少CO2排放量4千万吨。
为响应这一目标，HARTER公司研发了一款专为能源高度密集型工业使用的设备，Airgenex® 除湿干燥设备，用于部件干燥，这款设备不仅可以产生生态效益，还具有决定性的经济优势：
- 节省运行成本
- 减少资源损耗
- 不同于矿物燃料燃烧
- 更稳定的工艺条件
- 具有更多的CO_2减排潜力

As part of a diploma thesis...
The energy efficiency and thus the reduction of CO_2 emissions by means of Airgenex® condensation driers was investigated

The goal of the measurements was a comparison of conventional exhaust air drying systems, which dry parts by means of hot air circulation in open drying chambers and the HARTER Airgenex® system, which purposefully demoisturizes the drying chamber by means of closed circulation and a heat pump. It was intened to assure the comparability of the results in order to obtain a result which is as objective as possible in regard to energy consumption.
Here, the progress of the relative and absolute humidity as well as the temperature were considered. These values are decisive for the drying. The retained water of the non-hygroscopic materials was investigated during rack drying and drum drying. Both of these applications differ in construction as well as air flow routing.

The following data were recorded during the comparison measurements:
- *Temperature in the drying chamber*
- *Relative/absolute humidity in the drying chamber*
- *Power consumption*

The air speed in the drying chamber was not considered in the evaluation since no changes were made to the fans in the course of the trials. Thus, these parameters have no influence on the comparability of the results. By reason of the same argumentation, the power consumption of the fans was also not considered.
For both trial set-ups, efforts were made to achieve a temperature in the drying chamber for both systems which was as constant and uniform as possible in order to be able to compare the measurement results.

Low electrical power consumption
The measurements showed that the investigated systems under equal conditions exhibit highly differing power requirements. For operation with the conventional exhaust air dryer a power consumption of 20 kW (el.) was determined.
In contrast, with the Airgenex® condensation dryer a power consumption of 4.6 kW (el.) was determined.

The basis for a comparison of the CO_2 emissions is the power requirement of both systems. The data found may infer to the CO_2 emissions in the operation of the dryers. Other values (peripheral processes) were not considered.
On the one hand, an annual loading of 6.200 hours for both installations was taken as a basis. Furthermore the CO_2 emissions are determined on the basis of the German power mix. For this installation size the following results:

Reduction for operation with Airgenex®: up to 57 tons CO_2/year!

学位论文内容摘要...
利用 Airgenex®除湿干燥系统进行了能源利用效率和CO2排放量的调研考察

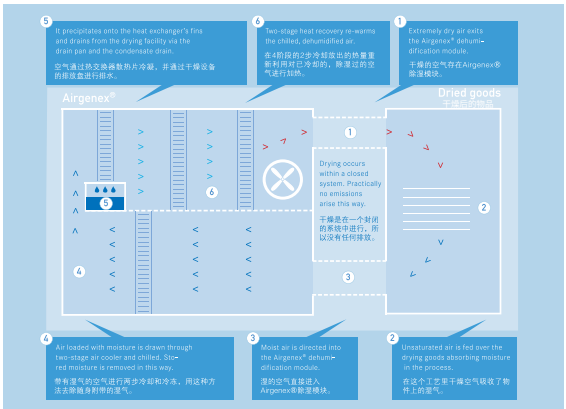
本次量化测试的目的在于对两种干燥系统进行对比，一种是传统排气式干燥系统，利用敞开式干燥箱内的热空气循环进行干燥，另一种则是哈特Airgenex®干燥系统，该系统利用密闭循环空气和热泵，有目的性的除湿干燥。为了获得关于能源消耗方面尽可能客观的数据结果，确保结果的可比性是非常重要的。
这次试验考虑了相对湿度、绝对湿度以及温度的发展变化因素。这些数据对于干燥过程至关重要。同时针对挂钩干燥和滚镀干燥，对不吸水材料的残留水分含量进行了研究。这两种干燥系统无论是结构还是空气流通路径都是不一样的。
对比量化测试过程中记录下了如下数据：
—干燥箱的温度
—干燥箱的相对/绝对湿度
—能源消耗

本次测试并未考虑干燥箱内风速因素，因试验中并未调整风扇。因此这些参数对于试验结果是否具有可比性并无影响。同理，风扇的能耗也未考虑。
两个干燥系统测试设置时，我们都尽力保持干燥箱内获得尽可能稳定、均匀的温度，从而获得可比性的测量结果。

电能消耗低
测试结果显示，同等条件下，两种干燥系统电能需求差异非常大。操作传统排气式干燥系统，需要20千瓦(el.)；而操作 Airgenex® 除湿干燥系统，只需要4.6千瓦（el.）。

对 CO_2 排放量进行对比的基础是两种干燥系统的能量需求。测试中所得数据可以推断出干燥系统运行过程中产生的 CO_2 排放量。其他数值（外围工艺）未予考虑。
假设两种系统各使用6200小时，且使用德国混合动力能源，则这种干燥系统 CO_2 排放量结果如下：

使用 Airgenex®干燥系统，
CO_2年减排量可达57吨！



For comparison:
The annually saved CO_2 emissions correspond to the emissions of

> 15 Porsche 911!

High CO_2 reductions
Through the usage of Airgenex® condensation dryers, approx. 75 % of the CO_2 emissions can be conserved in the electrical operation of drying installations in comparison with installations with conventional exhaust systems. Furthermore the operation allows the process parameters to be kept constant, which has a very positive effect on process security.

Dehumidification in the closed circuit
The HARTER Airgenex® condensation drying is based on the system of a heat pump, which heats and dehumidifies the air in the drying chamber. In contrast to conventional systems, the air is fed in a closed circuit. This has the advantage that on the one hand almost all the energy remains in the system and on the other hand, independent of the environmental conditions, the climate in the drying chamber can be influenced in almost every way.

作为比较：
CO_2年减排量

>15辆保时捷911排放量 ！

CO_2高效减排
与传统排气式干燥系统装置相比，Airgenex®干燥系统的使用能够减少75%的CO2排放量。此外，该系统保证了工艺参数的稳定性，对于工艺安全性有着积极的影响。

封闭循环式除湿
HARTER Airgenex®干燥系统基于一个热泵系统，它可以对干燥箱内的空气进行加热和除湿。不同于传统系统，空气循环系统是封闭的。这带来了许多好处，一方面，几乎所有能源都保留在系统中；另一方面，由于不受环境条件限制，干燥系统内的温湿度可灵活控制。

Percentile CO_2 emission in comparison
预期CO2减排百分比对比图

Conventional exhaust dryer
传统排气式干燥器

Airgenex® condensation drying
HARTER Airgenex®除湿干燥系统

SAVE CO_2
with HARTER **Airgenex** ®
使用哈特**Airgenex** ® 产品，
高效减排 CO_2