Research summary

Performance test

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The TNO quality system is ISO 9001 certified.

DeWALT mitre saw DWS778 in combination with DeWALT dust extractor DWV901L-QS

Commissioned by
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In recent years, TNO has focused intensively upon innovative improvements to tools, processes and workplace design in the industrial environment. The main purpose of these efforts is to create low-dust production processes and tools. As well as construction, our product and process development activities have targeted the metal, aircraft and wood industries, working closely with industry organizations, trades unions, governments, employers, employees and manufacturers.

To describe innovative production processes and tools, and to assess their practical functionality, we have developed the TNO Performance Test. This checks that relevant statutory and in-house occupational exposure limits (OELs) for hazardous substances such as crystalline silica, hardwood dust and hexavalent chromium are not exceeded in areas where they may be inhaled by workers in the course of their everyday duties.

Inspectie SZW, the Dutch labour inspectorate, explicitly endorses the TNO Performance Test in its "Basic Inspection Module for Crystalline Silica" (Basisinspectiemodule Kwartsstof). That document states, "If you decide to conduct your working activities using the measures contained in a TNO Performance Test, as described on the TNO website (stofvrijwerken.tno.nl), I [the inspector] will regard exposure as being adequately managed".

This means that an employer using the test is able to communicate unambiguously with the inspectors and that no additional exposure measurements need to be agreed. Moreover, it provides both the employer and its personnel with an objective measuring tool for the accurate assessment of proposed investments. Innovative manufacturers and suppliers of production processes and tools can also highlight their quality by complying with the test criteria.

Assessment criteria

The TNO Performance Test assesses exposure to hazardous substances in the "employee inhalation zone" in the workplace. The applicable norms for each substance, both statutory and in-house, are those contained in the database of Occupational Exposure Limits (Grenswaarde Stoffen op de Werkplek, GSW) maintained by the Social and Economic Council of the Netherlands (see http://www.ser.nl/en/oel_database.aspx).

Project description

For this project, TNO studied emissions of inhalable wood dust when sawing hardwood (meranti) using a DeWALT mitre saw DWS778, connected to a DeWALT dust extractor DWV901L-QS.

System specifications

The tested system consisted of a DeWALT mitre saw DWS778 (or equivalent*) in combination with a DeWALT DWV901L-QS dust extractor (or equivalent**) with a paper dust bag DWV9402-XJ. A flexible hose (length 4.0 m, diameter 32 mm) connects the mitre saw to the extractor. Figure 1 shows the complete system.

* An "equivalent" tool system is one with specifications for power and rotational speed which are the same as or less than those of the model tested.

** An "equivalent" dust extractor is one with specifications for capacity, dust collection, filter cleaning and recirculation which are the same as or better than those of the model tested.

DeWALT mitre saw DWS778

DeWALT DWV901L-QS dust extractor

Figure 1. The complete system.

Table 1 lists the key technical specifications of the system tested and its equivalents. In Table 2 the technical specification of the dust extractor and it's equivalents are listed.

Table 1. Technical specifications of DeWALT tool system.

Specification	DWS778
Power [W]	1.850
Power supply [V]	230 (AC 50/60 Hz)
Rotational speed [min-1]	4.300
Sawing blade diameter [mm]	250
Maximum cutting depth [mm]	85
Weight [kg]	17.2

Table 2. Technical specifications of DeWALT dust extractors.

Specification	DWV901L-QS	DWV902M
Power [W]	1.400	1.400
Power supply [V]	230 (AC 50/60 Hz)	230 (AC 50/60 Hz)
Filter efficiency [%]	99.9 % (M)	99.9% (M)
Maximum suction capacity[1] [m³/h]	245	245
Vacuum[2] [kPa]	21	21
Filter area [m²]	0.3	0.3
Container capacity [lt]	30	35
Weight [kg]	9.5	15.0

[1] At ventilator.
[2] At end of hose.

TNO Performance Test

Table 3 lists the key specific test conditions.

Table 3. "Worst case" test conditions.

Material: hardwood (meranti) dimensions (155*33 mm) Process: 60 minutes of sawing TNO Productivity (60 minutes): 25 meter thickness 33 mm (permanent operation) Reference Productivity: 200 meter thickness 33 mm during 8 hour working day Operator exposure period: eight-hour working day. Sawing blade diameter: 250 mm Sawing blade thickness: 1.75 mm Number of sawing teeth: 40 Rotational speed: 17.9 m/s Direction of dust generation: in line with the extractor system.	Extractor system compartmentalization: "semi complete". Suction capacity (dust extractor with hose): 128 m³/h (initial measurement) to 104 m³/h (final measurement) Filter efficiency: 99.9% (M) Dust extractor cleaning: automatic every 30 seconds (reverse pulse system) Dust collection: in paper dust bags. Dust filters: "open". Suction hose length: 4.0 m. Suction hose diameter: 32 mm.

Test results

Table 4 and Figure 2 summarize the test results.

Situation	Inhalable wood dust concentration (mg/m^3)
OEL, eight-hour time-weighted average	2.0
Permanent operation	1.85
"Heavy" use	0.93
"Light" use	0.23
Outdoor use	-
Practical use	-

Table 4. Summary of measured data.

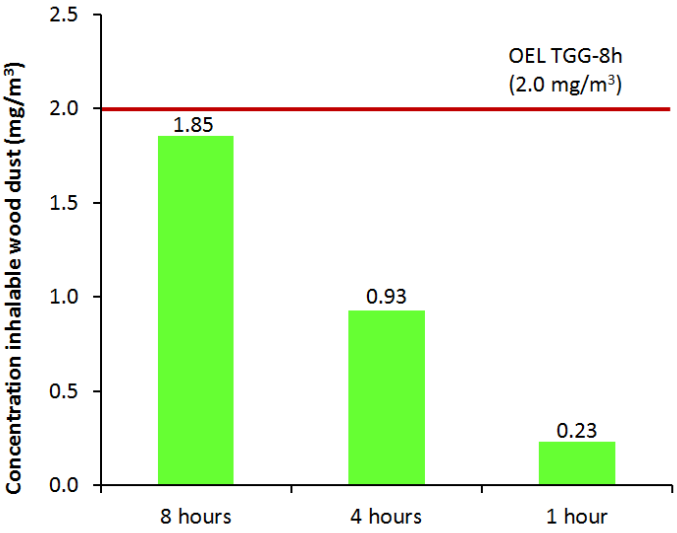


Figure 2. Exposure to wood dust at OEL.

Conclusion

TNO measured exposure to inhalable (hard)wood dust in the "employee inhalation zone" when sawing meranti hardwood using a DeWALT mitre saw DWS778 connected to a DeWALT DWV901L-QS dust extractor.

In permanent operation (an entire eight-hour working day), average exposure was 1.85 mg/m^3. This is below the statutory occupational exposure limit (OEL) of 2.0 mg/m^3 (eight-hour time-weighted average), meaning that the system tested does comply with the applicable standard for exposure to wood dust in this situation.

As well as "permanent operation" TNO has also defined two more reference situations.

- Heavy use: four hours of operation per eight-hour working day.
- Light use: one hour of operation per eight-hour working day.

In both of these situations, too, the system complies with the norm.

The inaccuracy of the exposure measurements is about 15% (5% for the analysis, 5% sampling and 5% reproducibility of the test operator). Readers are referred to the TNO measurement protocol (see TNO website www.dustfreeworking.tno.nl).

The labels below present the system's performance in graphic form. The round label shows the total "responsible operating time" in hours per eight-hour working day. The rectangular label provides more detailed information for the situations tested, with the green bars indicating what proportion of each type of use during an eight-hour working day remains within the OEL.

Label for sawing in (hard)wood

Reference: permanent operation.

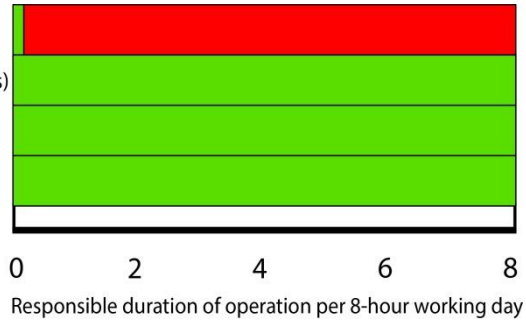
No measures

100% duration of operation (8 hrs sawing/8hrs)

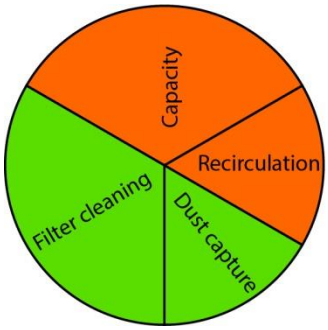
Heavy use (4 hrs sawing/8hrs*)

Light use (1 hrs sawings/8hrs*)

* Given proportional operation during an 8-hour working day



Dust extractor with 4.0 metre suction hose (diameter 32 mm), with dust collection bag



Capacity (operational)
- 150 - 200 m³/hour
- 100 - 150 m³/hour
- < 100 m³/hour

Recirculation dust extractor
- H-classification according to IEC-norm 60335-2-69
- M-classification according to IEC-norm 60335-2-69
- L-classification according to IEC-norm 60335-2-69

Filter cleaning
- Automatic cleaning (mechanic/air pulse) or filter replacement
- Manual
- None

Dust capture
- Closed system (dust bag)
- Open system (dust bag)

NB. This test says nothing about the long-term use of dust extractors.

Initials: