

Research summary

Performance test

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*The TNO quality system is ISO 9001
certified.*

Rupes orbital sander BR 106AE in combination with Rupes dust extractor SV10

Commissioned by

Rupes SpA

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ITALY

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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/oe/_database.aspx).

Project description

For this project, TNO studied emissions of inhalable wood dust when sanding hardwood (meranti) using a Rupes orbital sander BR 106AE connected to a Rupes dust extractor SV10.

System specifications

The tested system consisted of a Rupes orbital sander BR 106AE (or equivalent*) in combination with a Rupes SV10 dust extractor (or equivalent**) with a paper dust bag. A flexible hose (length 4.5 m, diameter 29 mm) connected the orbital sander to the extractor. Figure 1 shows the complete system.

* An “equivalent” sander is one with specifications for power, rotational speed and orbit 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.



Rupes orbital sander BR 106AE



Rupes SV10 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 its equivalents are listed.

Table 1. Technical specifications of Rupes tool system.

Specification	BR 106AE	BR 65AE	ER 05
Power [W]	550	550	450
Power supply [V]	230 (AC 50/60 Hz)	230 (AC 50/60 Hz)	230 (AC 50/60 Hz)
Rotational speed [min-1]	7.000	7.000	10.000
Pad dimension [mm]	150	150	150
Orbit [mm]	6	5	5

Specification	ER 03	ER 155	ER 153
Power [W]	550	310	310
Power supply [V]	230 (AC 50/60 Hz)	230 (AC 50/60 Hz)	230 (AC 50/60 Hz)
Rotational speed [min-1]	10.000	10.000	10.000
Pad dimension [mm]	150	150	150
Orbit [mm]	3	5	3

Specification	LR 21AE	LR 21T	LR 21TE
Power [W]	200	200	200
Power supply [V]	230 (AC 50/60 Hz)	230 (AC 50/60 Hz)	230 (AC 50/60 Hz)
Rotational speed [min-1]	13.000	13.000	13.000
Pad dimension [mm]	125	125	125
Orbit [mm]	2	2	2

Specification	RH 156A	RH 153A	RA 150A
Power [W]	Pneumatic	Pneumatic	Pneumatic
Power supply [V]	Pneumatic	Pneumatic	Pneumatic
Rotational speed [min-1]	10.500	10.000	11.000
Pad dimension [mm]	150	150	150
Orbit [mm]	6	3	5

Specification	RH 126A	RH 123A	RA 75A
Power [W]	Pneumatic	Pneumatic	Pneumatic
Power supply [V]	Pneumatic	Pneumatic	Pneumatic
Rotational speed [min-1]	11.000	11.000	11.000
Pad dimension [mm]	125	125	75
Orbit [mm]	6	3	3

Specification	TA 151	TA 551A	TA 531A
Power [W]	Pneumatic	Pneumatic	Pneumatic
Power supply [V]	Pneumatic	Pneumatic	Pneumatic
Rotational speed [min-1]	11.000	10.000	10.000
Pad dimension [mm]	150	150	150
Orbit [mm]	5	5	3

Table 2. Technical specifications of Rupes dust extractors.

Specification	SV10	S130L	S130PL
Power [W]	1000	1000	1000
Power supply [V]	230 (AC 50/60 Hz)	230 (AC 50/60 Hz)	230 (AC 50/60 Hz)
Filter efficiency [%]	M	M	M
Maximum suction capacity ¹ [m ³ /h]	100	200	200
Vacuum ² [kPa]	15,69	19,61	19,61
Filter area [m ²]	1,0	1,0	1,0
Container capacity [lt]	3,5	30	30

Specification	S145L	S145PL
Power [W]	1000	1000
Power supply [V]	230 (AC 50/60 Hz)	230 (AC 50/60 Hz)
Filter efficiency [%]	M	M
Maximum suction capacity ¹ [m ³ /h]	200	200
Vacuum ² [kPa]	19,61	19,61
Filter area [m ²]	1,0	1,0
Container capacity [lt]	45	45

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)	Suction capacity (dust extractor with hose): 58 m ³ /h (initial measurement) tot 58 m ³ /h (final measurement)
Process: 60 minutes of sanding	Filter efficiency: 99.9% (M)
Productivity: permanent operation.	Dust extractor cleaning: none.
Operator exposure period: eight-hour working day.	Dust collection: in paper dust bags.
Direction of dust generation: perpendicular extractor system.	Dust filters: "open".
Extractor system compartmentalization: "semi complete".	Suction hose length: 4.5 m.
	Suction hose diameter: 29 mm.

Test results

Table 4 and Figure 2 summarize the test results.

Situation	RCS concentration (mg/m ³)
OEL, eight-hour time-weighted average	2.0
Permanent operation	0.18
"Heavy" use	0.09
"Light" use	0.02
Outdoor use	-
Practical use	-

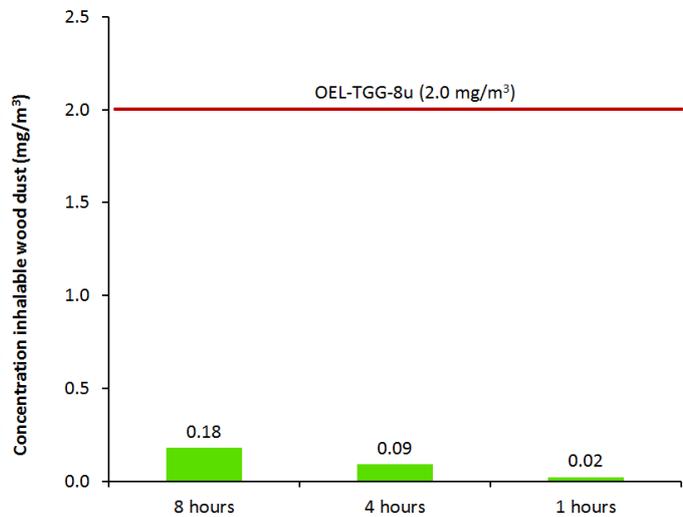


Table 4. Summary of measured data.

Figure 2. Exposure to wood dust at OEL.

Conclusion

TNO measured exposure to inhalable (hard)wood dust in the “employee inhalation zone” when sanding meranti hardwood using a Rupes orbital sander BR 106AE connected to a Rupes SV10 dust extractor.

In permanent operation (an entire eight-hour working day), average exposure was 0.18 mg/m³. This is below the statutory occupational exposure limit (OEL) of 2.0 mg/m³ (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 realistic 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 complied with the norm.

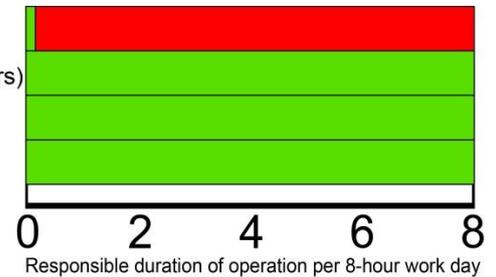
The labels below present the system’s performance in graphic form. The round label shows the total “responsible operating time” in hours per eight-hour working day. The rectangular label provides more detailed information for the situations tested, with the green bars indicating what proportion of each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

Label for sanding in (hard)wood

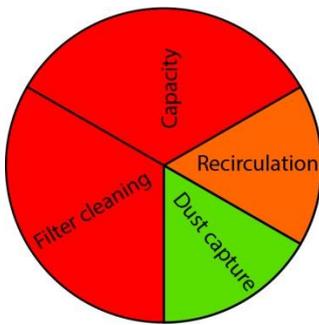
Reference: permanent operation.



- No measures
- 100% duration of operation (8 hrs sanding/8hrs)
- Heavy use (4 hrs sanding/8hrs*)
- Light use (1 hrs sanding/8hrs*)



Rupes dust extractor SV10 with 4.5 metre suction hose (diameter 29 mm), with dust collection bag



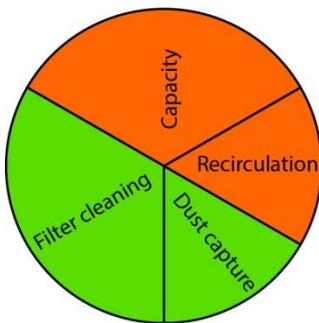
- Capacity (operational)**
- 150 - 200 m³/hour
 - 100 - 150 m³/hour
 - < 100 m³/hour

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

- 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

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

Rupes dust extractor S1 series (S130L, S130PL, S145L, S145PL) with 3.5 metre suction hose (diameter 29 mm), with dust collection bag



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

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

- 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

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

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