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## Summary

### Performance test

Report number: TNO 2018 R11182

# Husqvarna S26 dust extractor in combination with 180 mm concrete grinding machine and Holer dust shroud

#### *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/nl/taken/adviserende/grenswaarden.aspx>).

#### **Project description**

TNO has carried out research into the emission of respirable quartz during the grinding of concrete using a concrete grinding machine equipped with a Holer dust shroud, and connected to a Husqvarna S26 dust extractor.

#### **System specifications**

The tested system consisted of a Husqvarna S26 dust extractor (or equivalent\*), connected to a 180 mm concrete grinding machine equipped with a Holer MPTX-HOL-GDG180PM dust shroud. The dust shroud is connected to the dust extractor by a flexible hose (5.0 metre, diameter 50 mm). The complete system is shown in Figure 1.

\* 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.



Husqvarna S26 dust extractor with suction hose 5 metres in length, Ø 50 mm L-GDG180PM dust shroud.



180 mm concrete grinding machine Holer MPTX-HOL-GDG180PM dust shroud

Figure 1. The complete system.

Table 1 lists the key technical specifications of the system tested and its equivalents.

Table 1. Technical specifications of Husqvarna dust extractors.

Specification	S26	S36
Power consumption [W]	2.400	3.600
Voltage [V]	230 (AC 50/60 Hz)	230 (AC 50/60 Hz)
Maximum volume flow [m <sup>3</sup> /hr]	400	600
Filter efficiency [%]	99.995 (H14)	99.995 (H14)
Underpressure [kPa]	22	22
Weight (kg)	47	63

Specification	T4000	T7500	T10000
Power consumption [W]	3000	5500	11000
Voltage [V]	400 (AC 50/60 Hz)	400 (AC 50/60 Hz)	400 (50/60 Hz AC)
Maximum volume flow [m <sup>3</sup> /hr]	420	600	900
Filter efficiency [%]	99.995 (H14)	99.995 (H14)	99.995 (H14)
Underpressure [kPa]	26	28	30
Weight (kg)	95	210	336

### TNO Performance Test

Table 3 lists the key specific test conditions.

Table 3. "Worst case" test conditions.

Type of material: concrete kerb Percentage respirable quartz in concrete: 15%	Extractor system compartmentalization: "semi complete".
Source strength: continuous grinding Production: 100% duration of operation Employee exposure time: 8-hour work day	Suction capacity (dust extractor with hose): 152 m <sup>3</sup> /h (initial measurement) to 142 m <sup>3</sup> /h (final measurement).
Cup wheel diameter: 180 mm Rated revolution grinding machine: 6,600 rpm	Filter efficiency: 99.995% (H14) Dust extractor cleaning: manual.
Direction of dust dissemination: perpendicular to suction Speed of machining: maximum 63 m/s	Dust collection: in sealed plastic bags. Dust filters: "open".  Suction hose length: 5 m. Suction hose diameter: 50 mm.

**Test results**

Table 4 and Figure 2 summarize the test results.

Table 4. Summary of measured data (respirable quartz).

Situation	Concentration respirable quartz dust in mg/m <sup>3</sup>
Occupational Exposure Limit (OEL) TGG-8h	0.075
100% duration of operation	0,032 0.032 0,036
“Heavy” use	0.017
“Light” use	0.004
Outdoor use	-
Professional use	-

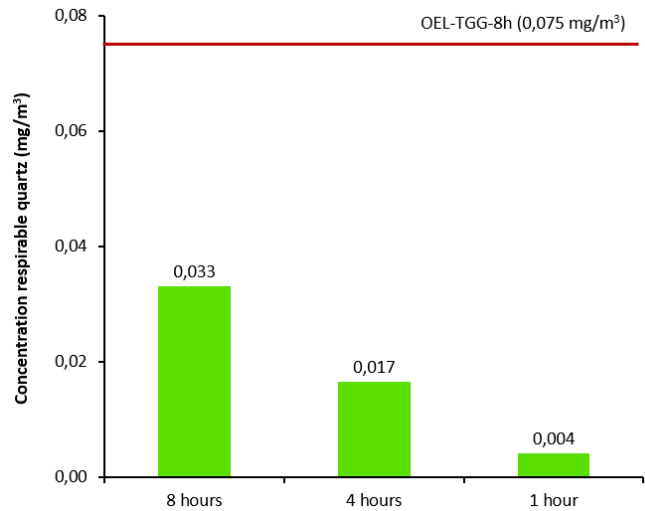


Figure 2. Test results for exposure respirable quartz relative to the OE

## Conclusion

TNO has measured the following: the exposure to respirable quartz in the breathing zone when using the Pullman-Ermator S26 dust extractor while grinding concrete with a 180 mm concrete grinding machine equipped with a Holer MPTX-HOL-GDG180PM dust shroud.

For a duration of operation of 100% (8 hours of use per 8-hour work day) the exposure to respirable quartz in the employee's breathing zone averages 0.033 mg/m<sup>3</sup>. This value is lower than the statutory threshold limit value of 0.075 mg/m<sup>3</sup> (OEL TGG-8h) and, in view of this, when used in this situation, the tool system complies with the prevailing standard for exposure to respirable quartz.

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.

Similarly, in these situations the total system complies with the standard.

TNO assumes that the mass fraction of RCS in calcium silicate is 25 per cent. For concrete and brick, that figure is 15 per cent. This means that the tested system can be used to work on those materials for longer than with calcium silicate. When grinding concrete or brick, exposure remains within the statutory OEL in all the situations described above.

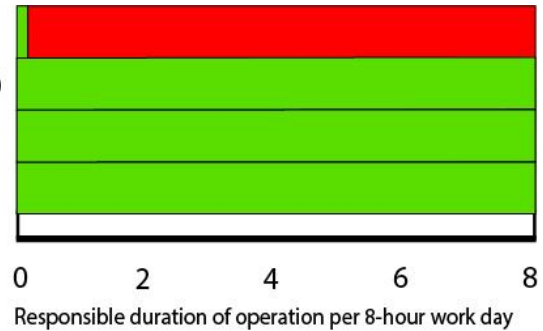
The labels below present the system's performance in graphic form. The round label shows the total "responsible operating time" in hours per eight-hour working day. The rectangular label provides more detailed information for the situations tested, with the green bars indicating what proportion of each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

**Label for calcium silicate grinding**

Reference: permanent operation.



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



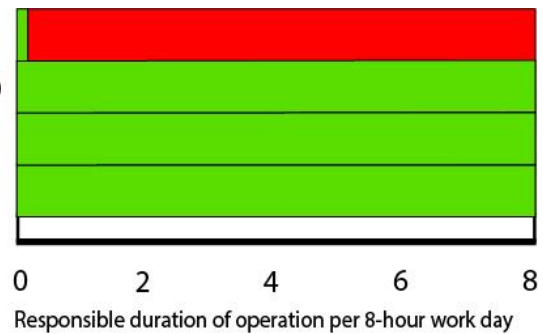
\*: given proportional operation during 8 hour work day

**Label for concrete grinding**

Reference: permanent operation.



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



\*: given proportional operation during 8 hour work day

**Dust extractor with 5-metre suction hose (diameter 50 mm), without dust collection bag**



- Capacity (operational)**
- 150 - 200 m<sup>3</sup>/hour
  - 100 - 150 m<sup>3</sup>/hour
  - < 100 m<sup>3</sup>/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.