



Assessment of dust extraction system solutions on hand-held electric diamond cutters to BS EN 50632:

Summary Report

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Summary Report

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Disclaimer:

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EXECUTIVE SUMMARY

Aim

The aim of this project was to determine the effectiveness of three manufacturers' dust extraction system solutions for hand-held electric diamond cutters.

Objectives

The objective was to test three manufacturers diamond cutter and vacuum unit systems following the methods described in the European standards BS EN 50632-1:2015 and BS EN 50632-2-22:2015.

Method

Tests were performed at the Health and Safety Laboratory from 25th February to 15th March 2019 by trained and experienced operators who were independent of the three tool manufacturers.

Inhalable and respirable dust concentrations were measured in the breathing zone of the operator whilst they performed a standardised task with one of the tools using the recommended dust control. The task involved using the diamond cutter to make a minimum of 13.2 m long, 40 mm deep cuts into concrete slabs.

- Inhalable dust is the fraction that is inhaled through the nose and mouth.
- Respirable dust is the fraction of inhaled particles that can penetrate into the deepest parts of the lung and can cause diseases like lung cancer, asthma, chronic obstructive pulmonary disease (COPD – which includes emphysema and other breathing difficulties) and silicosis.

There is a legal duty for employers to prevent or adequately control worker exposure to construction dust. On-tool extraction is an effective control for this dust and will reduce the risk of ill health.

The systems tested were:

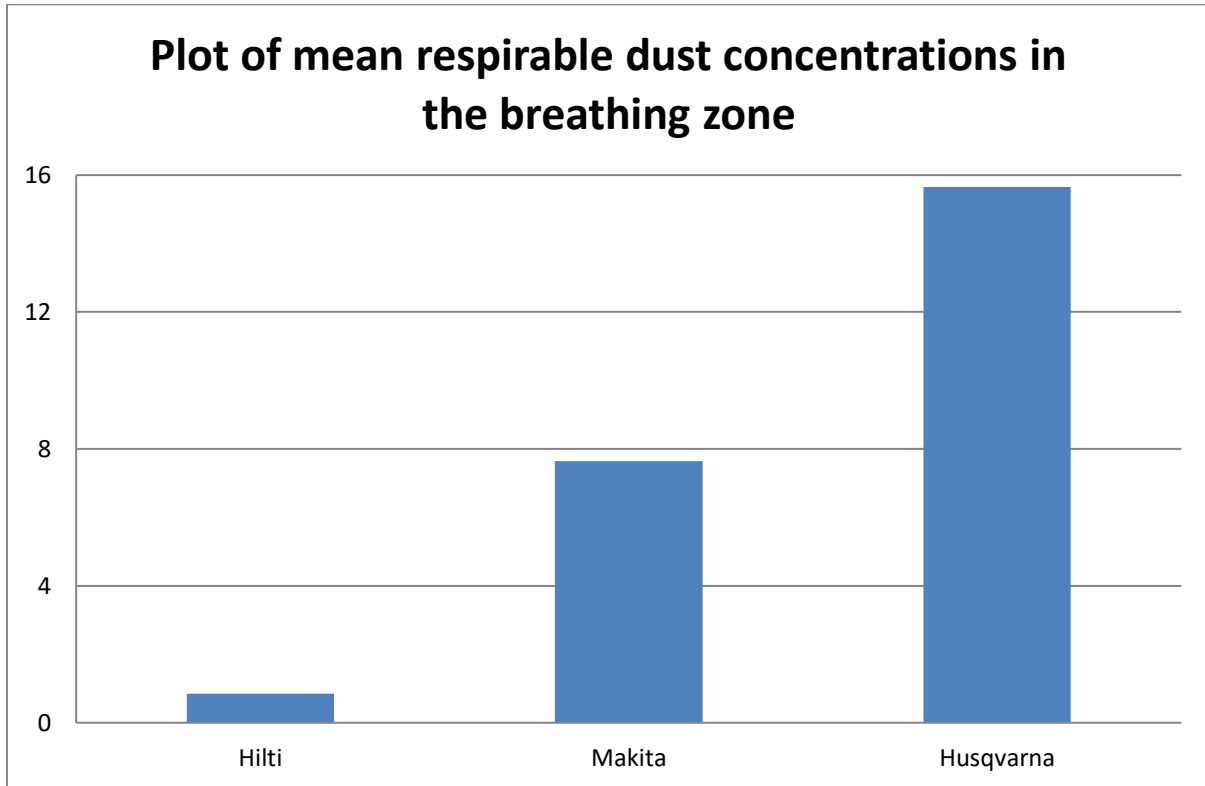
- Hilti DCH 300-X saw fitted with a 305 mm diameter SP-S 305/22 Univ blade with extraction provided by a Hilti VC 40-UM vacuum unit;
- Makita 4112 HS saw fitted with a 300 mm diameter Comet Rapide blade with extraction provided by a Makita VC4210M vacuum unit;
- Husqvarna K4000 fitted with a 350 mm diameter Vari-cut Electric blade using a Husqvarna S13 vacuum unit.

Findings

The mean dust concentrations when using the Hilti dust extraction system solution were 0.85 mg.m⁻³ and 2.45 mg.m⁻³ for respirable and inhalable dust respectively.

The mean dust concentrations when using the Makita dust extraction system solution were 7.65 mg.m⁻³ and 16.55 mg.m⁻³ for respirable and inhalable dust respectively.

The mean dust concentrations when using the Husqvarna dust extraction system solution were 15.65 mg.m⁻³ and 38.90 mg.m⁻³ for respirable and inhalable dust respectively.



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1 INTRODUCTION

The Health and Safety Laboratory (HSL) were contracted to carry out testing of the effectiveness of integral dust controls fitted to three diamond cutters according to the European Standard BS EN 50632-1 (BSI, 2015a) and BS EN 50632-2-22 (BSI, 2015b). Testing was carried out at HSL from 25th February to 15th March 2019.

Diamond cutters are often used to cut concrete and natural stone, both of which can contain high levels of crystalline silica, in the case of concrete up to 70% (HSE, 2013). Using power tools to abrade silica containing materials can release dust that contains respirable crystalline silica (RCS). RCS has been classified as carcinogenic to humans; specifically it can cause lung cancer (IARC, 2012). This is not a legally binding classification for EU regulatory purposes but RCS is now within scope of the EU carcinogens and mutagens directive (EU-OSHA, 2019). The control of substances hazardous to health (COSHH) regulations, Schedule 2A (COSHH, 2015) state:

“Control exposure by measures that are proportionate to the health risk.”

As there is a high health risk it means that a high level of exposure control should be applied to processes that can cause exposure to RCS. There is a legal duty for employers to prevent or adequately control worker exposure to construction dust. On-tool extraction is an effective control for this dust and will reduce the risk of ill health.

2 METHODS

2.1 TOOLS AND DUST EXTRACTION SYSTEM SOLUTIONS TESTED

Three systems were tested, each consisting of a circular saw and a matching vacuum unit as recommended by the manufacturer. The systems tested are shown in **Table 1**, **Figure 1**, **Figure 2**, and **Figure 3**. All tools were operated as per the manufacturers' guidance and using the manufacturers' recommended blades. Three repeat tests were performed with each system and changing operator each test in order to minimise the effects of operator behaviour.

Table 1 Systems tested

Manufacturer	Saw	Blade (diameter in mm)	Vacuum Unit
Hilti	DCH 300-X	SP-S 305/22 Univ (305)	VC 40-UM
Makita	4112 HS	Comet Rapide (300)	VC4210M
Husqvarna	K4000	Vari-cut Electric (350)	S13



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Figure 1 Hilti DCH 300-X diamond cutter (Top left), Hilti VC 40-UM vacuum unit (top right), and Hilti SP-S 305/22 Univ 305 mm diameter diamond blade (bottom)



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Figure 2 Makita 4112 HS diamond cutter (top left), Makita VC4210M vacuum unit (top right), and Makita Comet Rapide 300 mm diameter diamond blade (bottom)



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Figure 3 Husqvarna K4000 diamond cutter, Husqvarna S13 vacuum unit, and Husqvarna Vari-cut Electric 350 mm diameter diamond blade

2.2 ASSESSMENT OF DUST CONTROL SYSTEM SOLUTIONS EFFICACY

The efficacy of the dust control system solutions were assessed by measuring the concentration of respirable and inhalable dust in the breathing zone of the operator whilst using the tools to make cuts to a depth of 40 mm in concrete paving slabs meeting the requirements as specified in BS EN 50632-2-22.

- Inhalable dust is the fraction that is inhaled through the nose and mouth.
- Respirable dust is the fraction of inhaled particles that can penetrate into the deepest parts of the lung and can cause diseases like lung cancer, asthma, chronic obstructive pulmonary disease (COPD – which includes emphysema and other breathing difficulties) and silicosis.

The respirable fraction is the key value because this is the fraction that can penetrate to the deep lung. The quantity of RCS depends on the material, therefore RCS was not measured directly but the mean concentration of respirable dust is given as required by BS EN 50632-2-22.

3 RESULTS

The mean respirable and inhalable dust concentrations for the three diamond cutter and vacuum unit systems are shown in **Table 2**. Each value is the mean of three repeat tests as required by BS EN 50632. The respirable dust concentrations are also plotted in **Figure 4**.

Table 2 Mean respirable and inhalable dust concentrations in the breathing zone

Manufacturer	Dust Concentration (mg.m ⁻³)	
Hilti	Respirable	0.85
	Inhalable	2.45
Makita	Respirable	7.65
	Inhalable	16.55
Husqvarna	Respirable	15.65
	Inhalable	38.90

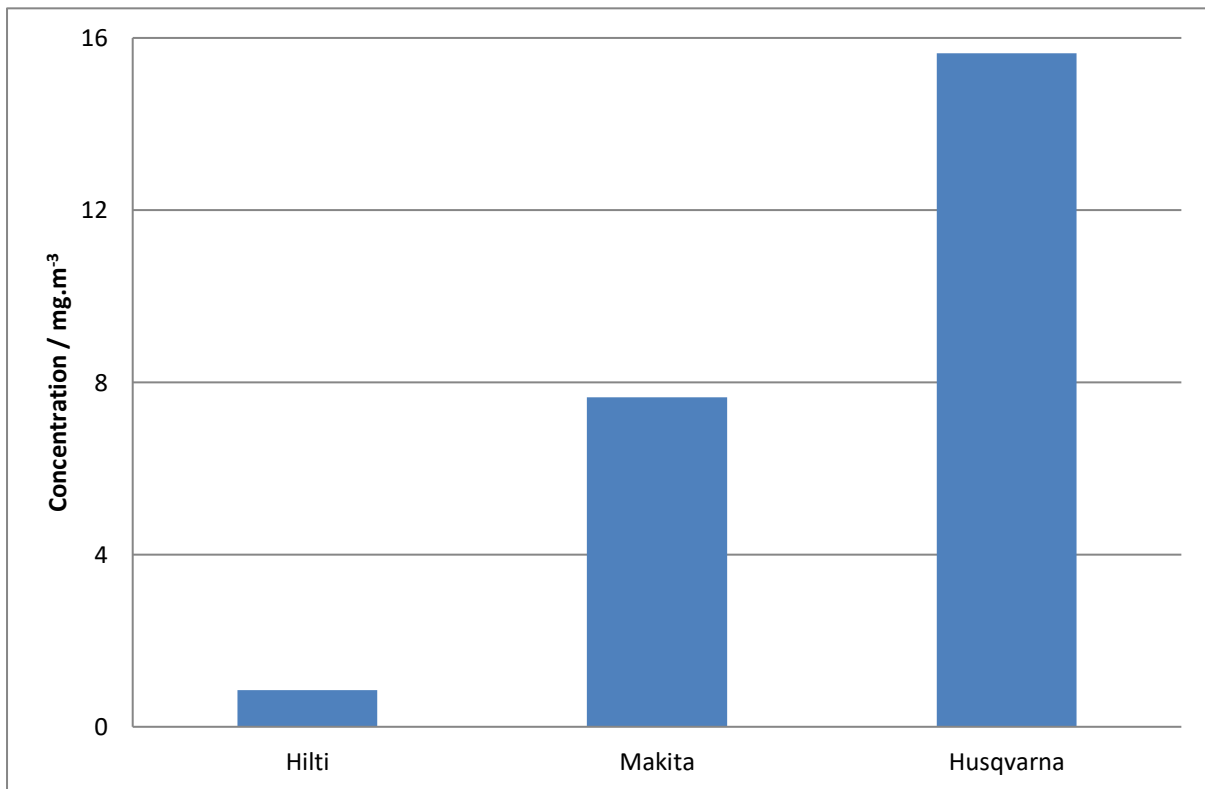


Figure 4 Plot of mean respirable dust concentrations in the breathing zone

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