



Drywall sanding: Dust exposure and ergonomics

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Health

Almost every construction project involves installation of drywall for interior walls. One way in drywall building is sanding the drywall compound.

Generally workers sand the compound manually using a hand-held block or a long-handled pole (Figure 1) with a piece of sandpaper or the end of a sanding plate.



Stress

To create sufficient friction for sanding, the worker applies pressure to the manual sander. This results in stress on the back, arms, and neck.

Dust

Sanding also generates high levels of dust including respirable silica. Inhaling this dust causes eye, nose, throat, and respiratory tract irritation, coughing, phlegm production, and breathing difficulties. Worse, it increases the risk of silicosis and lung cancer.

Sander

One way to control these health hazards is to use an electric shrouded sandhead rotary sander (YVES).

The Yves sander collects particulates by drawing air through the space between a) the outer circumference of the rotating abrasive pad and b) the inner surface of the shroud covering the abrasive pad. The dust then passes into a vacuum collection system equipped with a high-efficiency filter.



Study

Three partners undertook a study to document the potential ergonomic and hygiene benefits of using an Yves to prevent musculoskeletal injuries and dust-related illness. The partners were the International Brotherhood of Plumbers and Allied Trades, District Council 46, the Interior Systems Contractors Association, and the Construction Safety Association of Ontario.

The study took place in a newly constructed home at the Interior Finishing Systems Training Centre in Toronto. We selected two very similar rooms—A and B—to compare dust concentrations generated by conventional pole sanding with those generated by an Yves. The total sanding area for room A was 796 ft², and for room B, 384 ft².

Eleven subjects participated in the study seven journeymen and four apprentices from the Plumbers' Union. While all participants in the dust measurement portion of the study only one participated in the ergonomic portion.

Each subject participated in two scenarios for the dust measurements:

- 1) using the pole sander in one room
- 2) using the Yves in the other room.

Rooms and method of sanding were randomly selected.

To measure respirable dust concentrations, we used a TSI, model 85304, SidePak[®] in conjunction with a DustCatcher cyclone. The aerosol monitor is a small, direct-reading, dust logging unit.

While measuring respirable dust, we also measured muscle activity using electromyography (EMG). EMG signals were recorded by attaching surface electrodes to the skin above the following four muscles, selected to estimate muscle loads on the shoulders and forearms:

- ➔ left upper trapezius
- ➔ right upper trapezius
- ➔ left flexor digitorum superficialis
- ➔ right flexor digitorum superficialis



Results: respirable dust

The results demonstrate that the Yves is very effective in capturing most of the respirable airborne dust.

Pole sanding exposures ranged from 0.774 to 1.737 mg/m³ with a mean value of 1.080 mg/m³. Yves exposures ranged from below background levels to 0.478 mg/m³ with a mean of 0.077 mg/m³. The difference between the two sanding methods was found to be highly significant (p<0.05) and represents a 90% reduction in respirable dust exposure.



This finding is consistent with other studies involving similar sanders.

Using bulk samples, we detected an average concentration of 7% silica in the drywall compound used in this study—demonstrating that dust control is a continuing concern for drywall finishes.

Results: ergonomics

Despite the large differences in weight between the Yves (8 lbs) and the pole sander (2 lbs), working with the Yves required significantly (p<0.05) less static load levels in the left and right supinator muscles and the right flexor flexor. The maximum load level (dynamic work) involved significantly less muscle activity in the left and right supinator muscles and in the right forearm flexor than a worker used the Yves.

With the Yves, there was significantly higher muscular use duration for the right and left supinator muscles and the left forearm flexor muscles than with the manual sander. Only the right supinator muscle was found to have a significantly higher use frequency with the Yves.

With a manual pole sander, workers reported greater muscular effort to create a high friction force between the sanding paper and the wall. Using the Yves, however, requires comparatively little muscular effort because most of the sanding force is generated by the machine. In this case, the muscular effort observed in workers' upper extremities served to support and guide the EMG along the wall.

Comparing muscle use

Amplitude domain analysis summaries of sanding using manual and machine methods

	Static	Dynamic	EMG
Left upper trapezius	0.000	0.000	0.000
Right upper trapezius	0.000	0.000	0.000
Left flexor digitorum superficialis	0.000	0.000	0.000
Right flexor digitorum superficialis	0.000	0.000	0.000
Left forearm flexor	0.000	0.000	0.000
Right forearm flexor	0.000	0.000	0.000
Left supinator	0.000	0.000	0.000
Right supinator	0.000	0.000	0.000
Left shoulder	0.000	0.000	0.000
Right shoulder	0.000	0.000	0.000
Left neck	0.000	0.000	0.000
Right neck	0.000	0.000	0.000
Left back	0.000	0.000	0.000
Right back	0.000	0.000	0.000
Left wrist	0.000	0.000	0.000
Right wrist	0.000	0.000	0.000
Left hand	0.000	0.000	0.000
Right hand	0.000	0.000	0.000

Conclusions

Based on the ergonomic and hygiene measures, we conclude that the Yves is an effective method for drywall sanding and demonstrated that the Yves is used to control drywall dust. The Yves has many advantages over pole sanding.

Some advantages of the Yves:

- ➔ It significantly reduces exposure to drywall dust. Workers are much less likely to suffer adverse health effects.
- ➔ It greatly reduces the need for respiratory protection.
- ➔ It can significantly reduce cleanup time because it contains drywall dust so well.
- ➔ It is easy to use and unlikely to cause musculoskeletal problems.
- ➔ It is ideal for situations where creating dust is a problem—for example, renovations in occupied buildings, new construction where other trades are in the area, work in hospitals or medical facilities where patients must be protected, or work around dust-sensitive electronic equipment.

Some disadvantages of the Yves:

- ➔ The vacuum is not powerful enough to be used in some circumstances—e.g., on a wall.
- ➔ The vacuum hose can create a tripping hazard.
- ➔ The round shape of the sanding head means it cannot fully sand corners.
- ➔ The vacuum and sander require electrical power that is not always available, especially on new construction sites.

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