# Commercial Vacuum Cleaner Time and Motion Study

10-20-16

Electrolux

*This AICS time study was sponsored by Electrolux Home Care Products, Inc.*

aics.com

**TABLE OF CONTENTS**

## 1. Introduction

The American Institute for Cleaning Sciences (AICS) is pleased to submit this report detailing the results of a time-and-motion study using commercial vacuums. The research was conducted in a large class A office building in Charlotte, NC. BOMA defines class A office buildings as the most prestigious buildings competing for premier office users with rents above average for the area. These are buildings that have high quality standard finishes, state of the art systems, exceptional accessibility and a definite market presence.

The American Institute for Cleaning Sciences (AICS) is the cleaning industry's preeminent consulting firm in the commercial cleaning industry serving property managers, building service contractors, in-house service providers, manufacturers and distributors. AICS is the architect of the comprehensive Cleaning Industry Management Standard Green Building (CIMS-GB) and acts as the registrar for the ISSA certification program.

AICS is focused exclusively on the commercial cleaning industry. Our involvement with hundreds of industry firms expands our expertise and knowledge to bring you the most comprehensive information and business solutions available.

## 2. Scope of the Study

This study focuses on vacuuming obstructed and unobstructed vacuuming in a class A office building to verify the practical cleaning times of commercial upright and backpack vacuums. The principles of a time-and-motion study can be applied in any building type to verify the production rates of vacuuming and other cleaning tasks.

## 3. Purpose

The purpose of this study is to verify average practical production rates for vacuuming in a commercial building.

## 4. Current State of Vacuuming

Vacuuming is one of the core cleaning tasks in commercial cleaning industry. It represents a large financial commitment when establishing labor budgets, performing job costing, determining staffing standards and applying computerized workloading principles. The purpose of vacuuming is to enhance the appearance of an area, extend the life cycle of the carpet, improve indoor air quality and comply with the carpet mill's warranty specifications.

Commercial cleaning workers use a vacuum between 1-3 hours per day. Part time and full time workers' daily vacuuming hours may vary. There are numerous variables that impact production rates. The building classification, age of the building, soil loads, carpet construction, building occupants, weather, obstructions, density, square foot of carpet, work interruptions and other factors can increase or decrease the hours needed to vacuum.

## 5. Time-and-Motion Study Method

A time-and-motion study defines the task and work performed in a given period of time. The workers should perform the work according to standard operating procedures (SOP), under average conditions, and at a pace which will produce an average production rate. All of the working conditions should be carefully considered for the time-and-motion study to be practical.

### 5.1. History of Time-and-Motion Studies

AICS uses a methodology founded on Scientific Management principles practiced by Frederick Winslow Taylor. The key element in Taylor's technology of work, to which he gave the name "scientific management," was the time-and-motion study. This was, and is, a technique for determining how fast a job can reasonably be performed, and for identifying, and eliminating, inefficient and time-wasting practices.

### 5.2. Practical versus Theoretical Time Studies

The cleaning industry recognizes two types of time studies conducted by manufacturers, service providers and third party-firms. AICS used practical cleaning time practices for the time-and-motion study.

**(1) Theoretical Cleaning Times**

Theoretical times are calculated based on the cleaning width of a machine or tool and the forward walking pace of the cleaning worker. The average walking speed of a cleaning worker may be 1-2 miles per hour (mph). This number is then multiplied by 5280 (feet in a mile) and then divided by 12 inches. The final calculation is sq. ft. per hour that the cleaning equipment or machine will yield. Theoretical numbers do not represent the numerous variables of real world production rates.

**(2) Practical Cleaning Times**

Practical times account for real world conditions and a consistent set of variables that can be defined by managers or supervisors in the building. These variables may include area type, soil conditions, floor surfaces, building type, travel time, setup time, equipment and worker skill levels. Many operations managers make an attempt to "guesstimate" these times. For accurate job costing and budgeting, it is considered a best practice for managers to conduct a time-and-motion study of common tasks such as restroom cleaning, vacuuming, pulling trash and floor cleaning.

## 6. Time-and Motion Study Protocol

Although the conditions of the obstructed and unobstructed area types were different, workers used the same protocol for the time study.

6.1. Three males and three female workers were asked to participated in the study. All of the workers had experience in the commercial cleaning industry. Their ages and physical abilities of the test subjects were diverse. The workers did not have any special needs or learning disabilities.

6.2. The substrate for the unobstructed hallway was dense, low profile, standard carpet roll construction. The substrate for the office cubicle area was dense, low profile commercial carpet tile construction.

6.3. There were 12 cubicles in the 1,000 sq. ft obstructed area with modular desks, chairs and trash cans in each cubicle.

6.4. 1,000 sq. ft. areas were measured using a Disto 330 Laser measuring device, and then the distances were reconfirmed using a commercial walk wheel and tape measure.

6.5. The 1,000 sq. ft area was framed using blue masking tape. Start and stop points for the workers were marked as indicators.

6.6. The workers were not trained on any specific vacuuming technique to simulate practical or real world cleaning times.

6.7. Confetti was dispersed on the carpet to simulate "traffic vacuuming". Traffic vacuuming is a practical or real world method commonly used by cleaning workers. The worker identifies soil visually and then they move the vacuum wand or upright vacuum from soiled area to soiled area to vacuum the debris. This encouraged the workers to vacuum under desks, move chairs and remove debris from traffic patterns at each cycle of the time study. Edge vacuuming and wall-to-wall vacuuming were not part of this time study.

6.8. The workers each took turns with different vacuums in obstructed and unobstructed area types.

6.9. The obstructed and unobstructed areas required the workers to change power outlets for the corded vacuums. It took the worker 30-45 seconds to locate and change outlets. This time was calculated into the total vacuuming time of the corded vacuums. All corded vacuums were equipped with 50' electrical cables.

6.10. Cleaning time was recorded for each worker at the end of the 1,000 sq. ft. area using a stop watch, clip board and time sheet.

6.11. Travel time from the closet to the work area was not measured.

6.12. Cleaning times and worker vacuuming techniques were videotaped.

6.13. After all data was collected, the production rates, data and videos were thoroughly reviewed by AICS.

## 7. Published Production Rates

Industry published rates are measured in minutes per thousand sq. ft. These times are then translated into sq. ft. per hour. The ISSA 612 Cleaning Times table below demonstrates published times for vacuuming.

Table 1. ISSA 612 Published Vacuum Cleaning Times Example

| ISSA 612 Cleaning Times - Carpet Care | | Sq. Ft | Minutes | Sq. Ft. Hr. |
|---|---|---|---|---|
| 296 | Vacuum w/ 12" Upright Vacuum w/ automatic brush adjustment & bag fill control | 1,000 | 24.60 | 2,439 |
| 299 | Vacuum w/ 15" Upright Vacuum | 1,000 | 19.53 | 2,657 |
| 313 | Vacuum w/ Back-Pack Vacuum & 14" Orifice Carpet Tool | 1,000 | 8.10 | 7,407 |
| 576 | Vacuum Specialist office building | 1,000 | 6.00 | 10,000 |
| 577 | Vacuum Routine Speed (Low) | 1,000 | 4.61 | 13,015 |
| 578 | Vacuum Routine Speed (High) | 1,000 | 3.62 | 16,575 |
| 598 | Vacuum Specialist with Battery Powered Backpack with 14" tool (routine speed) | — | — | 14,286 |

## 8. Electrolux Practical Time-and Motion Study

The production rates of the vacuums below are an average of the workers' practical cleaning times obtained as a result of a practical time and motion study. Users may experience site-specific variables that can increase or decrease the production rates and annual labor cost. The time-and-motion test protocol can be replicated using similar vacuums to establish a practical production rate in schools, universities, manufacturing, healthcare or any building type.

**Table 2. AICS Time-and-Motion Study Findings**

| Vacuum Type | Area Type | Sq. Ft. | Minutes | Sq. Ft. Hr. |
|---|---|---|---|---|
| 15" Two Motor Upright Vacuum | Cubicle (Obstructed) | 1,000 | 4.77 | 12,580 |
| 12" Corded Upright Top Fill HEPA Vacuum with sensor | Cubicle (Obstructed) | 1,000 | 4.94 | 12,207 |
| 14" Battery Backpack Vacuum 6 qt. - 14' Head / 1.5" Aluminum Wand | Cubicle (Obstructed) | 1,000 | 2.71 | 23,056 |
| 14" Corded Backpack Vacuum 10 qt. - 14' Head / 1.5" Aluminum Wand | Cubicle (Obstructed) | 1,000 | 3.43 | 17,775 |
| 12" Corded Upright Top Fill HEPA Vacuum with sensor | Hallway - (Unobstructed) | 1,000 | 2.83 | 22,935 |
| 14" Battery Backpack Vacuum 6 qt. - 14' Head / 1.5" Aluminum Wand | Hallway - (Unobstructed) | 1,000 | 2.18 | 27,679 |
| 14" Corded Backpack Vacuum 10 qt. - 14' Head / 1.5" Aluminum Wand | Hallway - (Unobstructed) | 1,000 | 2.67 | 22,929 |
| 15" Two Motor Upright Vacuum | Hallway - (Unobstructed) | 1,000 | 2.41 | 25,268 |

## 9. Observations

AICS observations are as follows:

(a) The cleaning workers in the time study increased their production rates as they became more familiar with the area they were cleaning. Once the power outlet was identified, the time to vacuum a 1,000 sq. ft. area decreased. Power outlets could be identified with colored sticker dots, and workers could be trained to be more efficient with corded vacuums.

(b) The cleaning workers preferred the battery backpack vacuum for cleaning obstructed areas (office cubicles). Power cord management, outlet discovery and untangling the cord from door jams and partitions can consume additional time and worker effort. Power cords may also cause asset damage in buildings and require replacement as they become cut or worn.

(c) The corded upright vacuums in unobstructed areas had an increased production rate similar to a backpack vacuum. The worker movement of the backpack wand was similar to the cleaning path of the brush propelled upright (back and forth) cleaning path to remove the soil. A large area vacuum or battery-powered rider sweeper vacuum may be better suited for large unobstructed hallways or an airport concourse. Managers should determine the best vacuum for the diverse area types of their buildings.

(d) The workers were not trained on a specific vacuuming technique to simulate practical cleaning times. Using an articulating motion of a backpack wand or walking an upright vacuum in a figure-eight pattern in an unobstructed area may reduce worker fatigue, reduce repetitive motion injuries, and increase productivity.

(e) The workers in the study preferred a vacuum with a lower handle weight that was easy to maneuver.

(f) The upright vacuums tested that were brush propelled were preferred by the workers in the study. The brush strip or roller bar may be replaced on a preventative maintenance schedule to reduce worker fatigue, increase productivity and improve vacuum performance.

## 10. Conclusions

Practical production rates for vacuuming are essential to determine accurate staffing levels in all types commercial buildings. Vacuuming can represent 15-25% of the total cost of cleaning a building when analyzing the scope of work, cleaning frequencies, square feet of carpet and the practical production rates.

Standard operating procedures, worker training, work flow design and utilizing specialists may generate additional efficiencies beyond a practical production rate. The elimination of non-productive time and defining production rates will assist service providers who are seeking labor efficiencies that can reduce hours or dollars from the bottom line.