

## The Modern Way of Cleaning on Board

– Why is central vacuum cleaning system so much greener, safer and more efficient on cruise ships



The Modern Way of Cleaning on Board is now available!

We have gathered all the information in this booklet to tell you more about the benefits of using a central vacuum cleaning system. Why is it so much better than traditional systems? What kind of a process it is to have a central vacuum cleaning system installed on board? What is the payback time? First and foremost, we listen to our customers. We hope you will enjoy this booklet!

# Table of Contents

---

3

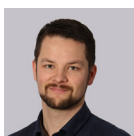


## **The benefits of using a central vacuum cleaning (CVC) on board**

By Sami Piirainen - Director, Halton Marine

“Real-life conditions show that CVC is 20-55% faster to use compared to traditional vacuum cleaners. Central vacuum cleaning systems also radically reduce the amount of waste compared to traditional systems.” Read more about the benefits of using CVC on board.

6



## **Calculation example - CVC vs. traditional systems**

By Ilmari Kirjalainen - CVC System Specialist, Halton Marine

“How is it possible to save hundreds of thousands of dollars by using a central vacuum cleaning system?” See how we calculated the savings and compare the figures to your own potential project.

9



## **Learnings after 2500 CVC installations**

By Janne Tulivuori - CVC Sales Manager, Halton Marine

“How does a typical project proceed? How long does a project take? What is the main reason that CVC is not already widely used on board ships?” Read more about Janne’s thoughts and learnings.

13



## **The voice of the customer**

Interview with Hendrik Väli, M/S Megastar

“Why was the Halton central vacuum cleaning system chosen to be installed on board Megastar? What are the main advantages of the Halton central vacuum cleaning system?” Read about the Intendent’s experience with CVC.

16



## **Central vacuum cleaning system specification**

By Halton Marine

The purpose of this document is to define the minimum requirements for the design, construction and supply of complete central vacuum cleaning systems. Feel free to copy the specification.

# Benefits of using central vacuum cleaning on board

## Interview with Sami Piirainen

Why would a ship owner choose a central vacuum cleaning system over traditional vacuum cleaners that are so easy to purchase?

What would you say to a ship owner who is considering his options for cleaning?



**Sami Piirainen**  
Director, Halton Marine

### Halton's mission is to enable people's wellbeing. What do central vacuum cleaning systems have to do with wellbeing?

Everything. CVC is a key part of a good indoor environment, which is one of the main factors affecting wellbeing. As you know, people spend most of their time indoors. Our mission is to enable wellbeing by providing the best possible indoor environment, including the air that we breathe. Providing high indoor air quality also involves the removal of odors, dust and airborne bacteria.

With traditional vacuum cleaners, which are used several times a day on board, you circulate air through filters which still allow small particles to return to the same space. With a CVC system, the vacuumed air is filtered and removed from the building/ship –the result is that all those vacuumed small particles are not circulating indoors any longer.

You can test this at home if you have a traditional vacuum cleaner. Before vacuuming, wipe your coffee table clean. 10–15 minutes after vacuum cleaning, have a look at the surface of the table. It is full of micro dust, which can cause e.g. breathing problems for people with allergy and asthma. In fact, central vacuum cleaning systems are clearly a better choice for people suffering from allergies and asthma.

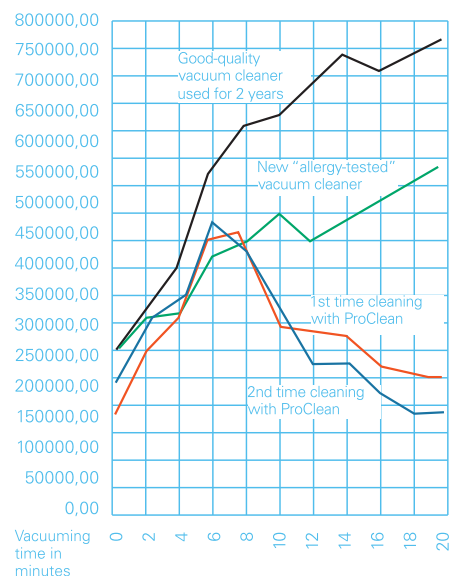
### Do you have any proof of the better indoor air quality?

Yes, certainly. An independent study by Dr. Ilmari Lindgren from Helsinki University Hospital / Allergy Hospital shows that traditional vacuum cleaners are not optimal for human health. According to the study, when used regularly, a central vacuum cleaning system achieves indoor air that is nearly as clean as outdoor air. See the graphics displaying different options.

And it is not just for the sake of better passenger comfort – but also for the crew. Cleaning with central vacuum cleaning

Quantity of harmful dust particles (<0,5 microns) per sq.m. air

### Halton ProClean system effects in practice



systems is healthier for the staff, as the system does not create dust-raising swirls filled with hazardous micro-dust. Preventing this micro-dust from circulating in the indoor spaces also reduces the need to change your normal ventilation filters, as the majority of particles are vacuumed out for good.

**Halton is saying that central vacuum cleaning is 20–55% faster to use. What is this claim based on?**

This claim is based purely on real operational tests which were done by two of our customers, one in Sweden and another one in Finland. They performed the tests for their own purposes, we didn't ask them to do it – but naturally we were delighted to see the results afterwards!

Hotel Management timed a vacuum cleaning operation covering all rooms. The first round was done using conventional vacuum cleaners. The average result was that they were able to vacuum clean 2.2 rooms per hour. The next step was cleaning with our central vacuum cleaning system. Our Swedish customer got a result of 3.4 rooms per hour, while the Finnish customer got a result of 3.3 rooms per hour. This study showed us that the average cleaning efficiency of the chambermaids had improved by almost 55 %.

This efficiency comes from the fact that unlike the portable or conventional vacuum cleaner, the central vacuum cleaning system only requires the user to carry the hose around, which makes moving around easier and less demanding. With a traditional vacuum cleaner, you really need to be careful around both walls and furniture, as well. In the end this means several lost hours per day.



**Why would a ship owner choose a central vacuum cleaning system over traditional vacuum cleaners that are so easy to purchase?**

There are several significant reasons. Let me highlight two of them.

Space saving. Compared to traditional vacuum cleaners – there can be several hundreds of units on board – a central vacuum cleaning system saves space. There is no need for a space to store all the units. This can free space for designing one or more cabins on board. Each extra cabin means more revenue.

Sustainability. And it is not all about saving money, it is also about protecting environment. Several hundreds of traditional vacuum cleaners a year create a massive amount of waste even if you only consider the units themselves. We estimated that if a major cruise ship needs up to 500 traditional vacuum cleaners a year (average lifetime 6 months), that would mean approx. 50 m<sup>3</sup> of waste just from the units themselves. And that waste consists of plastics and electronics. If the same cruise ship had chosen a central vacuum cleaning system, there would not be any yearly waste on the units. The central unit, which powers the whole system, is designed to last the ship's entire life time. I think it is brilliant. Imagine how many big cruise ships there are, and how many times over we could save that 50 m<sup>3</sup> of yearly waste! I believe greener values have definitely become more important for the owners and the passengers, who are nowadays more aware of their choices.

**If a central vacuum cleaning system is powered by a central unit, it must consume much more energy than traditional vacuum cleaners?**

In fact, it does not. According to calculations, using CVC instead of traditional vacuum cleaners leads to approx. 30% energy savings. The central unit adapts its power consumption based on actual demand and it is still much more efficient with its vacuum power than traditional cleaners.

**What would you say to a ship owner who is considering his options for cleaning?**

A central vacuum cleaning system is a rational choice. Having it on board pretty much only brings benefits. It is greener, safer and more efficient – and it really contributes to better indoor air quality. It does not disturb passengers with noise, which traditional vacuum cleaners often tend to do. And it does not hurt that it really brings a return on investment. The design and installation phase for new building is not that challenging when the work is left to professionals. Our people have completed over 2,500 installations with great customer satisfaction. It does not cost anything to ask for their opinion.

# Calculation example – CVC vs. a traditional system

By Ilmari Kirjalainen

How is it possible to save hundreds of thousands of dollars by using a central vacuum cleaning system?

See how we calculated the savings and compare the figures to your own potential project.



**Ilmari Kirjalainen**  
CVC System Specialist, Halton Marine

	<p>VS.</p>	
<p>Halton ProClean CVC system</p>		<p>Multiple traditional vacuum cleaners</p>

The calculation is indicative and based on Halton’s best knowledge and experience. The numbers change depending on the project. Halton can provide indicative calculations for specific projects on request.

## BASE DATA

Type of the vessel:	<b>Cruise ship</b>
Number of cabins:	<b>1750</b>
Average size of the cabin:	<b>20 m2</b>
Public areas in need of vacuum cleaning:	<b>22 000 m2</b>
Number of hoovers used simultaneously:	<b>120</b>
Number of hoovers needed in total:	<b>180 (+50% needed for reserve)</b>
Number of CVC systems needed in total:	<b>10 (12 users/system)</b>

## HARDWARE COSTS

The Lifetime of a single vacuum cleaner is 6 months. The dust bag is changed once a week (EUR 2,04/pcs). The filter is replaced every two weeks (EUR 5,00/pcs). The cost of a traditional vacuum cleaner is EUR 80,00.

A CVC system is designed to last for the entire life time of the vessel. The dust bag is changed every two weeks (EUR 0,20/pcs). The filter is replaced twice a year (EUR 80,00/pcs).

	<b>Traditional vacuum cleaners</b>	<b>Halton ProClean CVC</b>
Annual cost of new vacuum cleaners	EUR 19 200,00	none
Annual cost of dust bags	EUR 17 625,60	EUR 48,00
Annual cost of filters	EUR 21 600,00	EUR 1 632,00
Total annual hardware cost	EUR 58 425,60	EUR 1 680,00

**Annual savings achieved with the Halton central vacuum cleaner: [EUR 56 745,60](#)**

## MAINTENANCE LABOR COSTS

Labor cost for maintenance work was calculated using an hourly cost of EUR 25.00.

Traditional vacuum cleaners require maintenance work every two weeks. This maintenance work includes the replacement of filters, general cleaning and small-scale general repairs. This service work takes, on average, 15 minutes per vacuum cleaner.

The Halton ProClean central vacuum cleaner requires maintenance work twice a year. This maintenance work includes replacement of the fine filter and going through a checklist. These tasks take 30 minutes. Additionally, the whole system requires approximately 30 minutes of general upkeep work each month.

	<b>Traditional vacuum cleaners</b>	<b>Halton ProClean CVC</b>
Total maintenance time a year	1 080 hours	70 hours
Total annual labor cost	EUR 27 000,00	EUR 1 750,00

**Annual savings achieved with the Halton central vacuum cleaner: [EUR 25 250,00](#)**

## CLEANING LABOR COSTS

Labor cost for vacuum cleaning work was calculated using an hourly cost of EUR 20.00. Work times presented are based on Finnish cleaning standards. These standards also state that vacuuming with a central vacuum cleaner is 15% faster. Please note that real operational tests have shown that CVC is 20-55% faster to use.

The vacuuming speed with a traditional vacuum cleaner is 0.17 min/m<sup>2</sup>. Additional time spent with a traditional vacuum cleaner machine is 0.00595 min/m<sup>2</sup>. All cabins and public areas are vacuum cleaned once a day. The weekly labor time spent on vacuum cleaning is 1,169 hours using traditional vacuum cleaners or 959 hours using the Halton CVC system.

	<b>Traditional vacuum cleaners</b>	<b>Halton ProClean CVC</b>
Total vacuuming time a year	61 010 hours	50 105 hours
Total annual labor cost	EUR 1 220 200,00	EUR 1 002 100,00

**Annual savings achieved with the Halton central vacuum cleaner: [EUR 218 100,00](#)**

## OTHER COSTS

Due to the vast number of traditional vacuum cleaners needed and their short life time, passenger cabin space often ends up being reserved for the storing of vacuum cleaners in need of repairs. Alternatively, this storage space is reserved in place of additional cabins in the initial shipbuilding design.

The use of traditional vacuum cleaners increases the amount of small dust particles in the indoor air, as the air is circulated back to the cleaning area. This causes more strain for the cabin air circulation filters. The use of a central vacuum cleaner reduces the amount of these small dust particles, as the vacuumed air is not circulated back to indoor air. We moderately estimate that the use of CVC will extend cabin air filter life time by 10%. Cabin air filters are generally replaced once a week, causing 5 minutes of maintenance work and costing EUR 3.00/pcs.

### Note

Choosing the central vacuum cleaning system on board substantially reduces the number of electric wall sockets required. This cost has not been taken into consideration in the calculations.

According to calculations, using CVC instead of traditional vacuum cleaners leads to approx. 30% energy savings. The central unit adapts its power consumption based on actual demand and it is still much more efficient with its vacuum power than traditional cleaners. This has not been taken into consideration in the calculations.

	<b>Traditional vacuum cleaners</b>	<b>Halton ProClean CVC</b>
Annual cost of single cabin lost for storage	EUR 300 000,00	none
Annual cost of cabin air filter replacement	EUR 424 666,67	EUR 382 200,00
Total annual cost	EUR 724 666,67	EUR 382 200,00

**Annual savings achieved with the Halton central vacuum cleaner: [EUR 342 466,67](#)**

---

---

## TOTAL ANNUAL SAVINGS ACHIEVED WITH THE HALTON CENTRAL VACUUM CLEANING SYSTEM (exchange rate 1 EUR = 1.14 USD)

**[EUR 642 562,27](#)**

**[USD 732 520,99](#)**

## ESTIMATED RETURN ON INVESTMENT

**[Appr. 2 YEARS](#)**

Please note that return on investment depends on the project and the scope. It can easily be even less than 2 years.



# Learnings after 2500 CVC installations

## Interview with Janne Tulivuori

---

How does Halton support the customer during and after the project? Describe a successful CVC project? What does it take?

What do you think is the main reason that CVC is not already widely used on board ships?



**Janne Tulivuori**  
CVC Sales Manager, Halton Marine

**True or false? For the customer, a central vacuum cleaning system is more difficult to choose?**

False. The central vacuum cleaning system is thought of as difficult to acquire. Our scope of supply, however, is very wide and ranges from draft layout pipe design and material deliveries to turnkey deliveries. For our customers, turnkey delivery is always an easy and safe way to purchase a system, allowing customers to concentrate on their businesses and earning more money while we take care of the central vacuum cleaning installation.

**True or false? A central vacuum cleaning system is much more expensive than using traditional vacuum cleaners?**

Sorry, false again. As a single purchase, a central vacuum cleaning system can seem expensive at first, but ultimately, comparing the benefits of a central vacuum cleaning system to traditional vacuum cleaners, the price that appears expensive in the beginning is not expensive in the end. In fact, it is usually the opposite. But of course, one must consider the size of the installation and the installation environment when making calculations.

**How does a typical project proceed?**

Once we receive, for example, GA drawings, we can already map the customer's needs quite well. But in order to get maximum accuracy already in the first draft layout design, we might ask for additional information, such as details from the Owner and their Hotel Management side regarding the way they have intended to arrange cleaning in practice. This is especially important when designing a central vacuum cleaning system for a big cruise ship.

Next, we'll give you our quotation based on the information.

After the order, and depending on our contract with the customer, we will produce 2D drawings of our system for the shipyard, which can then be added to the final 3D drawings.

Then, depending on the contract, we will deliver the materials, perform the installation on board,

and carry out all system function tests and commissioning. Finally, we train the end users on how to use and maintain our central vacuum cleaning system.

### **If we talk about a ferry, for example, how long does a typical project take?**

It is difficult to specify the exact duration, as it depends on so many factors. Every project is different from the next one. In an ideal situation, the installation work would be uninterrupted, so that we could get tens, even hundreds of meters a day completed. But it is not possible in real life.

We jump on board when the vessel is in the outfitting stage. Based on our experience, we should not start working before AC, drainage and sprinkler pipes are installed. Because our piping is more flexible to install than the others, it is best for us to come just after them: that way work on board will be much faster and more convenient to do, not only for us at Halton Marine, but for all of us on board. Our inlet valves are the last and only visible pipe components in our system. We will have to wait until all walls are ready, which might take some time after our pipes are already installed. We do this final installation at the same time with electricians.

So, the straight and short answer to the question is several months. But there are always periods where we are doing something else, instead of just waiting on board for others to finalize their work. It means both timing and communication are extremely important key factors in every project.

### **How does Halton support the customer during and after the project?**

We have technical support always available at our factory, and our customers are more than welcome to contact us for any reason.

During the project's installation, if there is something our technicians or our customer's own installation team cannot do or decide themselves on board, our designer and systems specialist will help and support them. This also applies to the shipyard, there might always be questions during the process which need to be solved right away.

After the commissioning is done and when the central vacuum cleaning system is finally in use on board, we keep providing our customers with all the support they need. Normally this support mainly concerns the maintenance services and spare parts, such as filters, cleaning tools, vacuum hoses etc.

But there can be other requests as well, like for example, a while ago our customer wanted to add some inlet valves in the central vacuum cleaning system which is close to 20 years old. They needed a type of pipe we last used about 12–13 years ago. Another type of pipe was not acceptable, because it would have caused too much additional work on board. It took some extra time for us to find the exact same pipe, but it was a normal support request for us and we managed to sort out the problem.

If it is considered necessary to come on board, it is not a problem either. We have the whole team from design to commissioning available if needed.

For us at Halton Marine, the age of the system does not matter. Our customer support principle is that all central vacuum cleaning systems supplied by us must work perfectly for the entire lifetime of the ship.

### **About delivery reliability – how well is Halton able to keep the delivery schedules?**

Our delivery reliability is top class. Of course, it is important to take into account the manufacturing time, as the systems are always manufactured project by project. Some projects might take more time than others.

And before we can start manufacturing, we need to have all issues (final design, final materials, final technical details etc.) approved by the owner and shipyard.

Once the preliminary plans have been made, we will make a timeline for the project. We follow the timeline and provide the customer with progress reports, for example on a weekly or biweekly basis, depending on what they need. However, there may always be something, even last-minute changes, but any potential deviation is reported to the customer as well.

When we are installing the system on board, we have a supervisor leading our installation team. The supervisor monitors the progress of the work of other suppliers and if necessary, our supervisor discusses scheduling with them to ensure our installation work can be performed as planned. Of course, with the shipyard, time schedules are regularly reviewed throughout the different areas of the ship, as well.

The supervisor also relays information to our in-house project team at the factory, so they are aware of the installation situation and potential needs on-site.

This is how we can anticipate any additional needs and react quickly.

### **How long is the life time of central unit? How often do you need to replace them?**

Our central vacuum cleaning system is designed to last as long as the vessel itself, up to 25–30 years. So, my answer is zero times, no replacements are needed at all. The oldest systems I have seen were delivered back in the mid 90s – more than 23 years ago – and these central units still looked great and ran perfectly.

But of course, it's like with a car, our vacuum unit will need some maintenance during its operation years to be able to run this long. Let me explain in more detail.

Our central unit is made of sturdy components designed for heavy use. The body of the central unit is made of metal, it does not bend, crack or weaken during the years. Our turbine motors can run non-stop 24/7 for about 6–7 years without any special need for maintenance, meaning close to 60,000 hours. After 60,000 hours, it is time to check and maybe even replace the bearings and silencer materials inside the turbine motor. Our controls are manufactured by using only marine approved professional components etc. Our central units are very reliable, long-life devices.

The one maintenance operation usually required on a regular basis is changing the filter cartridge. Depending on the use and environment, it should be done 2–4 times a year. This takes about 5-10 minutes for each filter change, less than 1 hour per year per central unit. It is nothing compared to the conventional devices' maintenance and repair needs.



### **Describe a successful CVC project? What does it take?**

A happy smiling customer after the new central vacuum cleaning system has been commissioned is the picture of a successful central vacuum cleaning project. In the end, it is that simple.

But how to get there is another thing, as every project is unique and comes with its own demanding challenges. Let me give you an example. Oftentimes, there is very little space left for our pipes, and although our pipes are more flexible than others, sometimes there may be a feeling that "this is it, cannot do anything". A few years back on board of Tallink's Megastar we had a very tight place in a cabin corridor, directly below the emergency power room. There was a huge amount of cables, and all other pipes crossing the roof, and we had about 10–12 meters where we could not find a route for the pipe. At the time, we had delivered almost 2,500 systems, and each system had been completed. This vessel was not going to be the first one we could not finish, not on my watch, and though it might sound silly, I sat there for hours just looking at the roof, cables

and other pipes just to find a solution. And we did find it.

A successful central vacuum cleaning project is a combination of lot of sweat, challenges and successes during the whole process – and as said earlier, the happy smiling customer.

### **What kind of CVC projects have you and your team been involved with?**

If we talk about marine and land-based projects, playfully put “you name it, we’ve already done it”. In the marine sector, we have supplied central vacuum cleaning systems for Coast Guard vessels, Army vessels, High-Speed Crafts, Multi-Purpose vessels, Jack-Up Vessels, Oil & Gas Platforms, Ice Breakers, Oil Tankers, Ro-Ro/Passenger Ships and Cruise Ships. And there have also been some Yachts as well. The most memorable one for me was a huge Nautor Swan sailing boat.

### **What do you think is the main reason that CVC is not already widely used on board ships?**

Unfortunately, lack of information is the main reason.

Central vacuum cleaning systems are widely known and used in Scandinavia and Canada, where they are known especially as vacuum systems for home use. For example, only some years ago in Finland, approx. 20,000 new private homes were built in a year, and almost 19,000 of those were equipped with a central vacuum cleaning system instead of a conventional vacuum cleaner for the same reasons that have been described above.

So, the main reason is that people don’t know this kind of system exists, and even the people who already know of the idea of central vacuum cleaning systems do not necessarily know that the system could also be scaled for professional use in ships, on platforms, in hotels, in offices etc. There we have a lot work to do, and it will be done for sure. We just have to be the messengers for the central vacuum cleaning systems!

## **Janne’s top benefits of having CVC on board based on experience**

- 1. Saves space.** Can even free space for adding extra cabin/s on board.
- 2. A green choice.** Enables savings in energy consumption and less waste. The Halton central vacuum cleaning central unit is designed to serve as long as the vessel.
- 3. Faster and easier to use.** Enables less staff for cleaning and faster cleaning.
- 4. Creates a healthier environment.** As opposed to traditional vacuum cleaners that just circulate (dirty) air, the CVC filters the air and removes it from the building/ vessel. This contributes to better indoor air quality, which is particularly helpful for people suffering from allergies and asthma. At the same time, the fancoil filters stay cleaner for a longer period.
- 5. Silent operation.** Vacuuming noise does not disturb passengers nor business. No need to close spaces because of cleaning.
- 6. Low maintenance needs and costs.** Regular central unit maintenance approx. 1 hour per year.
- 7. Safety.** No need for unsafe electrical cord extensions. No need to carry a vacuum cleaner in stairs.
- 8. All from one supplier.** Halton offers a complete turn-key delivery – everything from design to after sales services.
- 9. Offers a real return on investment** on top of benefits that you cannot put a price tag on.

# The voice of the customer – on board Megastar

## Interview with Hendrik Väli

---

Why was the Halton central vacuum cleaning system chosen to be installed on board Megastar?

How care-free is the central vacuum cleaning system compared to traditional vacuum cleaners?



**Hendrik Väli**  
Intendent, Megastar

### About Megastar

Megastar is a fast ferry built by the Meyer Turku shipyard in Turku, Finland, for the Estonian shipping company Tallink. The ship made its maiden voyage in the end of January 2017 and is operating on a Tallinn–Helsinki route, accommodating 2800 passengers at a time. The ship carried a record number of over 2 million passengers during its first year of operation. Megastar uses LNG as her fuel and she complies with the new and stricter emission regulations for the ECA areas, including the Baltic Sea. The ship is also equipped with other environmentally friendly solutions.



Photo courtesy of Tallink Silja

**Do you know why the Halton central vacuum cleaning system was chosen to be installed on board Megastar?**

Halton's systems have been successfully used for many years on board of our company's other ships. By now, we cannot imagine making our personnel carry around the traditional heavy vacuum cleaners. Therefore, the decision to use the solution offered by Halton on board this ship was an easy one.

**According to your experience – what are the main advantages of the Halton central vacuum cleaning system?**

It makes the cleaning process quick and is easy to use, making it possible to clean large areas quickly, efficiently and quietly. You do not need to change the dust bag. The hoses can be conveniently stored in each area (they do not take up a lot of space) and can be easily transported (they are not heavy). The hoses, tubes, and brushes are reasonably priced and quickly shipped on board. The system is reliable, and regular maintenance expenses are low.

**Has your staff commented on the difference between a central vacuum cleaning system and traditional vacuum cleaners – which do they prefer and why? Does your staff find the system faster to use?**

They prefer the central vacuum cleaning system. It makes cleaning quicker and is easier to use. It can be conveniently adjusted to your height and work methods. Also, the vacuum is more powerful, making it physically less demanding. Carrying traditional vacuum cleaners up and down the ship's stairs and from one deck to another can be exhausting as well as dangerous. With the Halton system, the chances of work accidents are much lower.



**Have you had any complaints of the noise levels of central vacuum cleaning on board? Do you need to close spaces due to cleaning because of noise?**

No, I do not recall receiving any complaints over the years, neither from the crew nor the passengers. The system works very quietly, and we have not had to close doors or isolate any areas during cleaning.

Occasionally, a few of the vacuum cleaner's power sockets have made whistling sounds, but then we have just had to replace the seal, which is quick, easy, and cheap.

**How care-free is the central vacuum cleaning system compared to traditional vacuum cleaners?**

During 2 years of use, the Halton system has just needed regular maintenance and filter changes a couple of times a year. The traditional electric vacuum cleaners go through a lot of filters, and their service life is not long when they are intensively used on the ships.

**What about maintenance? How easy is it to maintain the system?**

There are 3 central vacuum cleaner stations on the ship that are located on the 7th vehicle deck. These can be easily accessed for maintenance. The system has worked well for two years now. We have a mechanic on board, and one of their tasks is to maintain the system and monitor its performance. So far, we have only had to perform regular maintenance (filter changes, cleaning, etc.).

**What would you say about the co-operation with Halton – all the way from installation to after sales?**

Co-operation with Halton has worked well, the ordering and delivery process of accessories has always been timely and quick.

Our technical questions have been answered quickly and constructively.



**Any other comments?**

The planning and installation process on board the Megastar went smoothly and was managed flexibly for us – the client. They took the small changes we wanted to make into account. The co-operation was smooth throughout the process.

# Specification for a central vacuum cleaning system

By Halton Marine

---

## 1. SCOPE

The purpose of this document is to define the minimum requirements for the design, construction and supply of complete central vacuum cleaning systems.

Within HVAC documents, expressions in CAPITAL CHARACTERS AND *ITALIC* are defined within the "Terminology, definitions and abbreviations" specification.

When other words require a definition only for use within that document, the definition is given in a paragraph of that document and the defined word is marked in small and *italic* letters.

## 2. REFERENCE DOCUMENTS

Equipment and installations must be in accordance with (in order of precedence):  
The local regulations of the country where the equipment and/or installations will be used.

### 2.1 Standards

Reference	Title
NORSOK C-001 : Sc.7.29 (edition 5. March 2015)	Living quarters area (offshore petroleum industry)

### 2.2 Other documents

Reference	Title
SI	International System of Units
ASTM F2647-07	Standard guide for approved methods of installing a CVS (Central Vacuum System)

### 2.3 Project Specifications

Reference	Title

## 3. DEFINITIONS

- CVC: Central vacuum cleaning system.
- Central unit: Main unit with vacuum blower and control cabinet. With or without *filter unit*.
- Filter unit: Dust separation unit with pre-separation and fine filter (99.9% separation of >5µm particles). Can be merged on same frame with the central unit or as a divided stand-alone unit.
- Out blow piping: Positive pressure piping from *central unit* to outside. Discharges vacuumed



and filtered air to outside (filtered but considered as dirty air). Air speed max. 10 m/s.

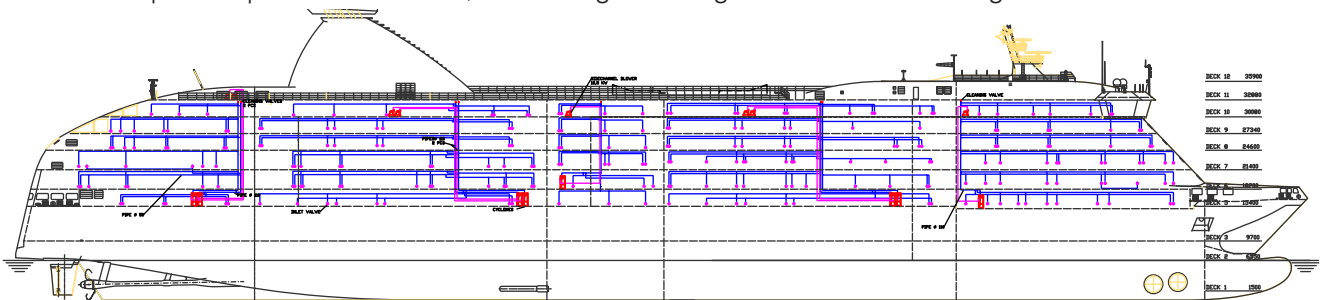
- Vacuum piping: Negative pressure piping from the *central unit* through the *filter unit* to the *inlet valves*. Transports vacuumed particles to the *filter unit* (dirty air) and the filtered air (filtered but considered as dirty air) to the *central unit*. Air speed 15-30 m/s.
- Trunk pipe: *Vacuum piping* that collects *branch pipes* together. Pipe diameter minimum Ø65mm.
- Branch pipe: *Vacuum piping* from the *branch pipe* to the *inlet valves*. Pipe diameter Ø50mm.
- Inlet valve: Vacuum cleaning hose connection point at the end of each *branch pipe*.
- Pipe flushing valve: Pneumatic sliding damper at the end of each horizontal *trunk pipe*. Controlled with low voltage wiring from the *central unit*. Opens in turns during the pipe flushing sequence to enable maximum air speed for each horizontal *trunk pipe*, thus cleaning the inside of the piping.
- Cleaning area: Specified area where the number of maximum simultaneous users is pre-determined and restricted by that area's *trunk pipe* sizing.

#### 4. OPERATION

The CVC system's intended use is the vacuum cleaning of all pre-determined dry areas. Water may not be vacuumed into the CVC piping to prevent pipe clogging. The use of a mobile water separator connected to the vacuum cleaning hose will enable the vacuuming of water and the repeated vacuuming of moist particles (e.g. in the galley area).

#### 5. SYSTEM CONSTRUCTION

As the foundation for CVC system design, the COMPANY must determine the mode of operation for it. The mode of operation is based on the planned user type (professional cleaning personnel, vessel operator personnel or both). This will generate guidelines for the design.



CVC system for professional cleaning personnel: *inlet valve* locations are chosen to minimize disturbance for vessel users/passengers. This guides the designer to avoid connection to *inlet valves* behind doors or across walk ways. Results in more than the minimum amount of *inlet valves*.

CVC system for vessel operator personnel: *inlet valve* locations are chosen to minimize the amount of *inlet valves* needed to be able to vacuum of all necessary areas. Vacuuming will not cause disturbance as the users are the vessel's operators.

CVC system for both professional cleaning personnel and vessel operator personnel: general passenger areas are designed to minimize disturbance and vessel operator personnel areas

are designed to minimize the amount of *inlet valves* needed.

When a *CVC* system is needed in more than one fire zone, it is advised to design a separate system for each fire zone. The *vacuum piping* cannot be equipped with fire dampers to isolate fire zones. The inside of the piping needs to be without any collision surfaces to avoid pipe clogging. One *CVC* system can only be used to serve two zones when the fire zone can be penetrated without the use of a fire damper.

The desired number of simultaneous users for a *CVC* system will affect both the piping design and the *central unit* selection. Each user requires a certain amount of air flow and vacuum pressure. Regardless of the selected *central unit*, the piping designed will also create *cleaning areas* with a maximum number of simultaneous users restricted by that area's *trunk pipe* size.

The system starts up when a vacuuming hose is connected to an *inlet valve*. An alternative control method is a run timer located e.g. inside the catering manager's office.

## 5.1 Vacuum piping

*Vacuum piping* design is tree-like, its diameter decreases when branching from the main *trunk pipe*. The main *trunk pipe* is a straight vertical riser pipe with branches on each deck. The horizontal *trunk pipe* collects pipes from a single deck's *inlet valves*.

The pipe type needs to be designed for vacuum use, with smooth inside walls and pressure resistance of up to negative 40 kPa pressure. Options for marine approved vacuum pipe materials are at least AISI 304 (EN 1.4301), AISI 316 (EN 1.4432) and PVC-C. Other pipe materials may be considered in cooperation with the COMPANY.

Pipe sizing is chosen to allow an estimated number of simultaneous users in each *cleaning area*. A single user requires approx. 115 m<sup>3</sup>/h air flow and the maximum air speed inside the pipe should always be designed to be below 25 m/s, otherwise a pressure drop will occur.

Pressure drop calculations with maximum pipe lengths for each pipe size used shall be presented as the basis of *vacuum piping* design.

*Vacuum pipe* sizing creates cleaning areas:

Ø160 mm	=	14 simultaneous users
Ø110 mm	=	6 simultaneous users
Ø75 mm	=	3 simultaneous users
Ø50 mm	=	1 simultaneous users

Bends and branches are designed to enable smooth air flow to avoid pipe clogging and minimize the pressure drop. The radius of bends shall allow the passage of a pencil. Bends should be done using only 45-degree angles. All branches need to be at 45-degree angles, straight T-branches are not allowed. Branches will be installed to simplify flow direction and the connection side must always be horizontally or upright.

Piping shall be air tight for a negative pressure of 40 kPa and withstand vessel vibrations.

Pipes must be secured by vibration insulated clamps at changes of direction, next to an *inlet valve* connection and in accordance to the pipe manufacturer's specifications for straight horizontal and vertical pipes. The free movement range of any point should not be more than 10 mm from normal when tested with reasonable force.

Fire proof penetration methods shall be locally approved.

All metal *vacuum piping*, *central units* and *filter units* shall be earthed to prevent static electricity build-up.

## 5.2 Pipe flushing valve / rodding points

To prevent pipe clogging, an automatic pipe flushing sequence shall be used. A *pipe flushing valve* is placed at the end of each *trunk pipe* with horizontal routing. Valves are controlled with a 24VDC signal wire from the *central unit* and operated with pressure air (yard supply).

The use of pipe flushing sequence eliminates the need for rodding points. If the pipe flushing sequence is not used, rodding points need to be added next to every direction change.

## 5.3 Out blow piping

Discharge air from the *central unit* shall be routed to external areas with sufficient sound attenuation. *CVC* discharge air is comparable to AC exhaust, in terms of being dirty air with positive pressure. The design of the *out blow pipe* needs to take the following into account: air speed shall be below 10 m/s, air temperature may reach 100 C°, the material is steel, air tight for positive pressure, if a fire damper is needed then it needs to be equipped with a 120 C° fuse.

## 5.4 Inlet valve

The number of *inlet valves* shall be sufficient to allow all pre-determined areas to be reached with a maximum 10 m hose. The maximum number of *inlet valves* is not restricted.

*Inlet valve* (hose connection point) material is stainless steel. Opening the lid requires the use of a special opening tool (key or key hook) to restrict unintentional use. The lid is self-closing. The *inlet valve* consists of the valve and a pipe connection piece, with a tight 90-degree bend for clog prevention.

*Inlet valve* installation height shall be pre-determined. The suggested installation height from the floor is 800-1000 mm, for best ergonomics.

## 5.5 Central unit

The *central unit* consists of a vacuum pump(s) with electric motor, control panel and pressure transmitter. The electric motor(s) shall be controlled by variable speed drive for energy efficiency. Control panels shall include a test button, a service reset button, light information (ready, running, service need, general fault) and status connection readiness to the vessel's central automation system (IAS / SAS)

*Central unit* selection is based on the pre-determined number of simultaneous users for the system. Rough vacuum unit calculations can be made using the following values: 32 l/s (115 m<sup>3</sup>/h) per user @ vacuum pressure 180-200 mbar (18-20 kPa).

The *central unit* can be on the same frame with the *filter unit* (located on the lowest deck) or separately located on the top deck, inside the HVAC room. It requires a ventilated room for motor heat dissipation.

## 5.6 Filter unit

Each *CVC* system has one *filter unit* with pre-separation and a fine filter (99.9% separation of >5 µm particles). These can be merged on the same frame with the *central unit* or as a divided stand-alone unit. They are to be equipped with automatic filter cleaning to ensure long lifespan for the fine filter. Dust is collected in an easily changeable plastic bag (80 l).

The location of the *filter unit* must be on the lowest deck to ensure smooth passage for heavier particles.

## 5.7 Cleaning tools

A cleaning set consists of:

- Ø32 mm vacuum hose (10 m) with connector & handle
- telescopic suction pipe
- nozzles: hard floor / carpet / furniture / brush / narrow
- optional nozzle: rotating brush for carpet deep cleaning
- hose hanger with nozzle basket

The number of sets needed depends on the requested number of simultaneous users, or one set for each deck. A wet vacuuming set consists of:

- mobile water separator (30 l tank with wheels)
- Ø32 mm wet vacuuming hose (3 m) with handle
- plastic suction pipe
- floor nozzle with rubber wiper blade

The number of sets needed depends on the number of cleaning lockers, or one set on each deck.

## 6. INSTALLATION

Installations are to be done in accordance to local, project specific class and MANUFACTURER guidance.

The installations are tested for leakages with vacuum pressure test according to MANUFACTURER commissioning test guidelines. A positive pressure test or any pressure test with water is not possible nor useful to determine system functionality or durability.

**CVC Contact Information****Europe**

Janne Tulivuori, CVC Sales Manager  
 Mobile: +358 40 579 8043  
 janne.tulivuori@halton.com

**Asia**

David Poole, Area Sales Manager  
 Mobile: +60 12 689 5049  
 david.poole@halton.com

**Americas**

Sean S. Grigsby, Managing Director  
 Mobile: +1 423 723 9012  
 sean.grigsby@halton.com

**Middle-East**

Petteri Katainen, General Sales Manager  
 Mobile: +971 54 581 0664  
 petteri.katainen@halton.com

**Factory**

Halton Marine Oy  
 Pulttikatu 2  
 15700 Lahti, Finland  
 Tel. +358 (0)20 792 200  
 Fax +358 (0)20 792 2060

haltonmarine@halton.com  
 www.haltonmarine.com

Halton Marine's sales offices,  
 distributors and agents are listed  
 at [www.haltonmarine.com](http://www.haltonmarine.com)

# About us

**Halton Marine**

Halton Marine, one of the world's leading suppliers of marine HVAC, develops, manufactures and markets reliable, high-quality ventilation solutions specifically designed for shipbuilding, oil & gas, energy and naval applications. Our track record includes deliveries to over 150 major cruise ships, 200 oil & gas projects and 100 naval vessels.

**Halton Group**

Halton Group specializes in indoor environment solutions, ranging from public and commercial buildings to food service facilities. Founded in Finland in 1969, Halton operates today in over 30 countries around the world, with annual sales of €205 million and over 1500 employees. The company has production facilities in Brazil, Canada, China, France, Finland, Germany, Malaysia, Norway, the UK and the USA.

**Halton Marine emphasizes tailoring, which means that solutions are adapted to each customer's specific needs. Halton Marine supplies solutions not only for new-builds, but also for refurbishments.**

**Halton ProClean offering**

- Available from components to whole scope including custom system pre-design service and installation
- Product training and technical back-up for projects
- Well-established but flexible company offering long-term business relationships and after-sales service

**References**

ProClean systems have been delivered for over 2500 projects including:

- |                        |                                   |
|------------------------|-----------------------------------|
| • NASR-2               | Living Quarter (Offshore oil rig) |
| • NVC 395 POLAR        | Special Purpose Vessel            |
| • Megastar             | Fast ferry                        |
| • Polaris              | Icebreaker                        |
| • MT 6024 (hull 152-1) | DSV                               |
| • MT 6024 (hull 121)   | DSV                               |
| • SEA CHALLENGER       | Offshore installation vessel      |
| • SEA INSTALLER        | Offshore installation vessel      |
| • HSC Leonora C.       | High-speed craft                  |
| • Stena Hollandica     | Ropax                             |
| • Baltic Queen         | Cruise ship                       |