

Vacuum technology

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Stationary pneumatic refuse collection

Stationary pneumatic refuse collection means that refuse is transported underground long distances in pipes to a collection station, where it is compacted in closed containers. A stationary pneumatic refuse collection system uses air to transport the waste. The air flow is generated by exhausters creating a negative pressure in the pipe system. The air enters the pipes at atmospheric pressure, entraps the solid waste and conveys it to the collection station.

A stationary pneumatic refuse collection system can handle multiple waste types concurrently. One refuse chute is used for each separate waste stream. Typically, two to four separate waste streams are handled in a pneumatic refuse system using the same transport pipe network. In the collection station each waste stream is directed to a designated container. By collecting each waste type separately the system safeguards that waste and recyclables are not mixed in the system.

The major objectives of a stationary pneumatic refuse collection system are:

- Collection of refuse and recyclables close to the point of origin.
- Automated transport of waste and recyclables from the deposit point to the collection station.
- Minimization of manual handling
- Minimization of environmental impact such as energy consumption, gaseous emissions littering etc.
- Reduction of waste volume through encouraging recycling.

Collection

A collection cycle starts by turning on the exhausters, creating a static negative pressure in the refuse transport pipe system. At the same time, the hydraulic unit in the compactor and the rotating screen on the separator are started.

The air inlet valve of the first branch is opened. When the valve is open a powerful air stream is created in the refuse transport pipe from the air inlet valve to the collection station. The air speed is kept at the right level by the air speed regulating system.

When the required air speed has been established, the control system opens the first refuse discharging valve of the branch. The refuse in the valve falls by gravity and suction into the transport pipe and is taken by the air current to the collection station. After a few seconds the valve closes. The next discharge valve opens and the refuse is discharged. When all refuse has been collected from the first branch, the air inlet valve closes and the air inlet valve of the next branch is opened.

In the collection station the air is separated from the refuse by a cyclone type separator and a rotating screen. From the separator the refuse falls by gravity into the feeding hopper of the refuse compactor. The refuse is then compacted into the container. Recyclables are blown directly into a container, as they are not to be compacted.

When the container is full, the container handling system or the operation staff receives a signal to change the container.

Operation

The refuse collection is automated. Manual assistance or supervision is generally not required.

A computer located in the central control panel in the collection station controls and manages the collection process. The collection process is generally repeated two to five times per day (depending on waste amount and storage capacity in the inlet).

The collection duration varies from 15-20 minutes (small systems), 30-60 minutes (medium systems) and several hours for larger systems. In between the collection cycles the system is idling. The refuse and recyclables can, however, be loaded into the system disposal points when idling.

Applicability

Typical areas of use for a stationary pneumatic refuse collection system and “envacable” waste types in these applications are:

	Paper	Card-board	Cans	Glass	Rigid plastics	Plastic film/poly-styrene	Textiles	Organic food waste	Garden waste	Bulky items	Clinical waste	Hazardous waste	WEEE	Liquid waste	Rest Residual waste
Residential	OK	OK	OK	c-l	OK	c-l	OK	OK	OK	no	-	no	no	no	OK
Offices	OK	OK	OK	c-l	-	-	-	OK	OK	No	-	No	No	no	OK
Restaurants	OK	OK	OK	no	OK	c-l	-	OK	-	no	-	-	-	c-l	OK
Catering industries	OK	OK	OK	no	OK	c-l	-	OK	-	no	-	-	-	c-l	OK
Public realm	-	-	OK	c-l	OK	-	-	-	-	-	-	-	-	-	OK
Retail	OK	OK	c-l	no	OK	c-l	-	OK	-	-	-	-	-	-	OK
Health care	OK	OK	-	-	-	-	-	-	-	-	c-l	no	-	-	OK
Airports	OK	OK	-	no	OK	c-l	-	OK	-	no	-	no	-	-	OK

C-l = conditional. Providing certain condition are fulfilled these fractions can be handled in an Envac system. Please check with your local Envac office for more details.

Limitations

A stationary pneumatic refuse collection system can handle most types of waste and recyclables with the exception of:

Bulky waste

Furniture's, refrigerators etc. should be collected separately

Articles likely to cause fire or explosions

Hard articles

Stones, lumps of metal scraps such as scrap iron, etc.

Spongy articles

Sponges, cushions, etc., which tend to expand and block the chute and/or the transport pipe.

Articles emitting an offensive odour

Animal faeces and urine, bodies of house pets and rats, etc

Chemicals

Acidic and alkaline solution, paint, adhesives, etc

Highly moist waste

Food waste from residents can be handled by the system. Large quantities of very liquid food waste will require a separate pipe.

Recycling

An Envac stationary pneumatic refuse collection system is very well suited for collecting recyclables. Several independent studies have shown that high participation rates and high purities of the collected recyclables are achievable with an Envac system. In order to obtain an optimal recycling result the following steps are recommended:

- Inform the users of why it is important to recycle and how the Envac system handles recyclables both before the installation is in operation and after. It is important with continuous feed back and information on a regular basis.
- Envac has designed information campaigns to improve participation and quality. Please check with your local Envac office for more info.
- The positioning of the inlets is of paramount importance. The inlets for waste and disposables should be easily accessible and highly visible to as many residents/users as possible. A high visibility will improve the discipline of the users and also provide better recycling and cleaner inlets.
- Use locks or access cards for the recyclable waste streams. Just a little bit more effort from the users generally improves the purity of the recyclables.
- Conduct spot checks of the quality and of the recyclables with feed back to the users is a good way of maintaining a high level of awareness.

Sustainability and environmental issues

The emission of Green House Gases (GHG) is today arguably the most important sustainability and environmental factor to consider when choosing a waste collection and waste management system.

There are three main sources of operational GHG emissions in any waste collection scheme to be considered:

- Emissions from vehicles used to collect and transport waste around the site and to the off-site waste transfer station.
- Emissions from the use of Envac.
- Emissions of methane and carbon dioxide that can be omitted when increasing the quantity of waste going to recycling, rather than being landfilled or incinerated.

The standard rear or front loading collection systems use waste trucks to go to each block and lift the bins/containers into the truck and then go onto the next block and so on. The carbon implications of this are twofold, one is the fuel consumed by the trucks as they move around the site and to/from the site to the garage/ transfer station. The other is that to power the bin lifting mechanism and compact the waste/recyclables the engine has to run at elevated speed for a period of time equivalent to the collection time at each block.

The Envac system uses electricity to transport the waste. The carbon impact of this process is a factor of the electricity required to run the fans and the electricity mix of the city/country where the installation is planned to be.

Other environmental issues worthwhile considering when choosing a waste collection system are:

- Noise
- Odour and gases from trucks and fouling waste
- Littering potential
- Access of heavy vehicles in residential areas

Your local Envac office can provide you with a detailed Environmental Impact Assessment (EIA) comparing the environmental effects of various collection systems using special software developed together with a leading Swedish environment institute.

Safety and security

Safety and security are important factors in choosing a waste collection system. The safety and security related exposure can be divided into four main categories:

- Risk exposure for normal users
- Risk exposure related to fire
- Risk exposure for waste handling staff
- Risk exposure related to traffic

The implications of health and safety aspects on users are related to the design and location of bins and in the case of Envac; of inlets. It is important that these are designed in such a way that no one can get hurt by depositing their refuse and recyclables.

Envac have put a strong emphasis on the design of the inlet doors. They are available with keys or access cards, restricting the access to authorized people. This is recommended for commercial users requiring larger inlet openings.

The risk of fire and terrorism is in many countries a recurrent worry when it comes to waste handling. In socially instable areas bins are set fire to. In many countries police fear terrorists putting explosives in public bins. Fire in chutes in apartment buildings can be a common problem. The Envac system offers a series of advantages with regard to these problems.

The system is hermetically sealed to the environment. All parts surrounding the waste are made out of steel and therefore not combustible. If a piece of explosive should be put into an Envac system the effect is much more limited than with a conventional system, because the detonation will take place 1-3 meters below street level. Furthermore fire in chutes is also a reduced problem with Envac. The reason is that unlike a conventional chute system the waste amount on the bottom of the chute is very limited and emptied several times a day. As the oxygen feed to the waste is very limited in the Envac system there is no, or a very limited support for a fire, which normally causes the fire to extinguish itself.

Occupational health and safety for waste collectors is a serious issue in many countries. In the EU waste collectors report twice as many work related injuries compared to the average industrial worker. Manual waste collection is a physically very tough profession. Some people compare the daily physical strain with that of a top athlete, but not exercised in a gym, but in ergonomically questionable situations. An Envac system offer great health benefits tot he waste collectors work environment. It eliminates physical handling of the waste. No more lifting or dragging of bins and containers. The risk of injuries through sharp items or allergic reactions caused by irritants in the waste is also eliminated. The waste collectors occupational health and safety becomes greatly improved when installing an Envac stationary pneumatic waste collection system.

Traffic related incidents caused by moving waste trucks are a concern in residential areas and city centres where adults and children use the streets. Therefore, many countries have placed rigid restrictions on the manoeuvrability of waste trucks in residential areas. These security aspects have impact on the design of the road structure and building design in a new area. An Envac system reduces the risk of accident of moving trucks to the location of the collection terminal. If this is located in the outskirts of the area heavy waste collection trucks can be eliminated in residential sensitive zones.