Nederman

IMPROVING YOUR WORKSPACE

Nederman Engineering Guide

FOR SOUND SAFE AND EFFICIENT WORKPLACES

Nederman

Leading solutions for improved workspaces

Nederman is a global player in working environment products and systems. Over 60 years of experience have helped the Group develop a modern and extensive product range.

Nederman is the leading company with solutions based on “capturing at source” i.e. extraction of contaminants right at the point of creation. We offer the widest range of products and solutions on the market for extracting dust, smoke and exhaust. Together with our range of supply systems for water, air, oil and other consumables, we make workspaces all around the world clean, safe and efficient.

Nederman also offers solutions for collecting, transporting and recycling dry or wet materials, masses and liquids. Applications range from swarf collection and recycling of coolant and blasting media in metal workshops to tank stripping and heavy duty cleaning in the shipping industry. The applications are in industries working in tough environments where the demands for sturdy and reliable high performing equipment are of the outmost importance.

Our global presence affords us insights into the myriad of national and international regulations and directives governing work safety, health and environmental issues. With more than 60 years of experience we are the pioneers renowned for excellent quality and reliability certified according to ISO 9001 and ISO 14001. Our successful progress is based on our commitment to continuous product development, efficient manufacturing and extensive marketing activities.

Solutions that pay off in many ways

Investing in Nederman products and systems leads to:

- *improved working environment by reducing health and safety risks*
- *assured quality of finished products*
- *reduced wear on tools and equipment*
- *minimized harmful emissions to the outdoor environment*
- *more cost-efficient operations with less manual labor.*

Every application demands its own solution. Our mission is to help you achieve the optimum result regarding performance efficiency and payback whatever the application might be.

The Nederman Engineering Guide

The Nederman Engineering Guide is especially produced for Nederman resellers to facilitate the planning and design of Nederman solutions. The guide is structured around the different applications, focusing on the characteristics and design issues specific to each application.

The Nederman Engineering Guide serves as an introduction to the application design, highlighting important aspects of the tasks and solutions. Whenever possible, The Nederman Engineering Guide provides general design rules. However, many applications need specific considerations. In those cases, The Nederman Engineering Guide provides checklists of what information needs to be gathered in order to help the Nederman engineers designing a well functioning solution.

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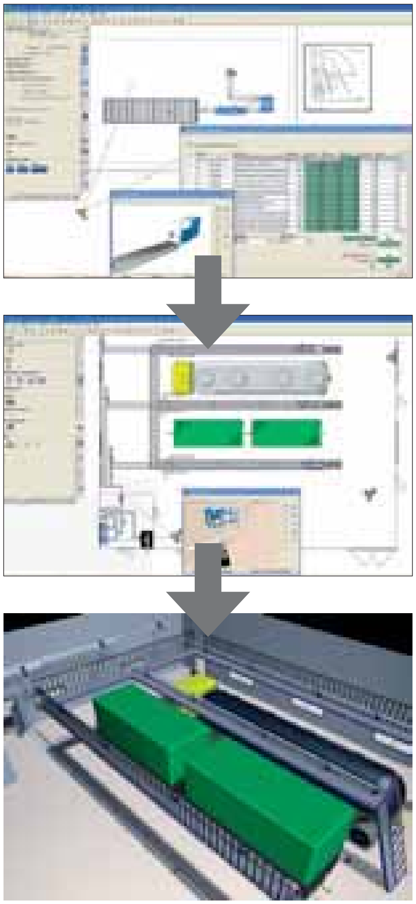


Fig.1 NedQuote simplifies the design workflow from initial 2D drawings to complete 3D models, including product specification lists and pressure drop diagrams.

NEDQuote

NEDQuote is a powerful design and calculation program developed by Nederman. It offers a unique opportunity to test different set-up scenarios and design complete installations. The following basic planning data is all we require in order to present a complete solution:

- the type of operation or process
- the number of extraction points
- the floor area and height of the premises.

Solutions can be displayed in 2 or 3 dimensional drawings and include full product specification lists, pressure drop diagrams and pricing alternatives from single product to project level. Ready-to-use symbols and product templates Visuals/graphics, including product and parts specifications, of Nederman products in DWG/DXF format for 2-D and 3-D presentation. The drag-and-drop scale symbols can be used for all design and documentation applications. NEDQuote is offered to design engineers, contact Nederman for more information about the software and license fees.

Fig.2 The rendering capabilities of NedQuote helps visualising the proposed design, facilitating the communication with all project stakeholders.

www.nederman.com

The Nederman international website contains extensive product and application information.

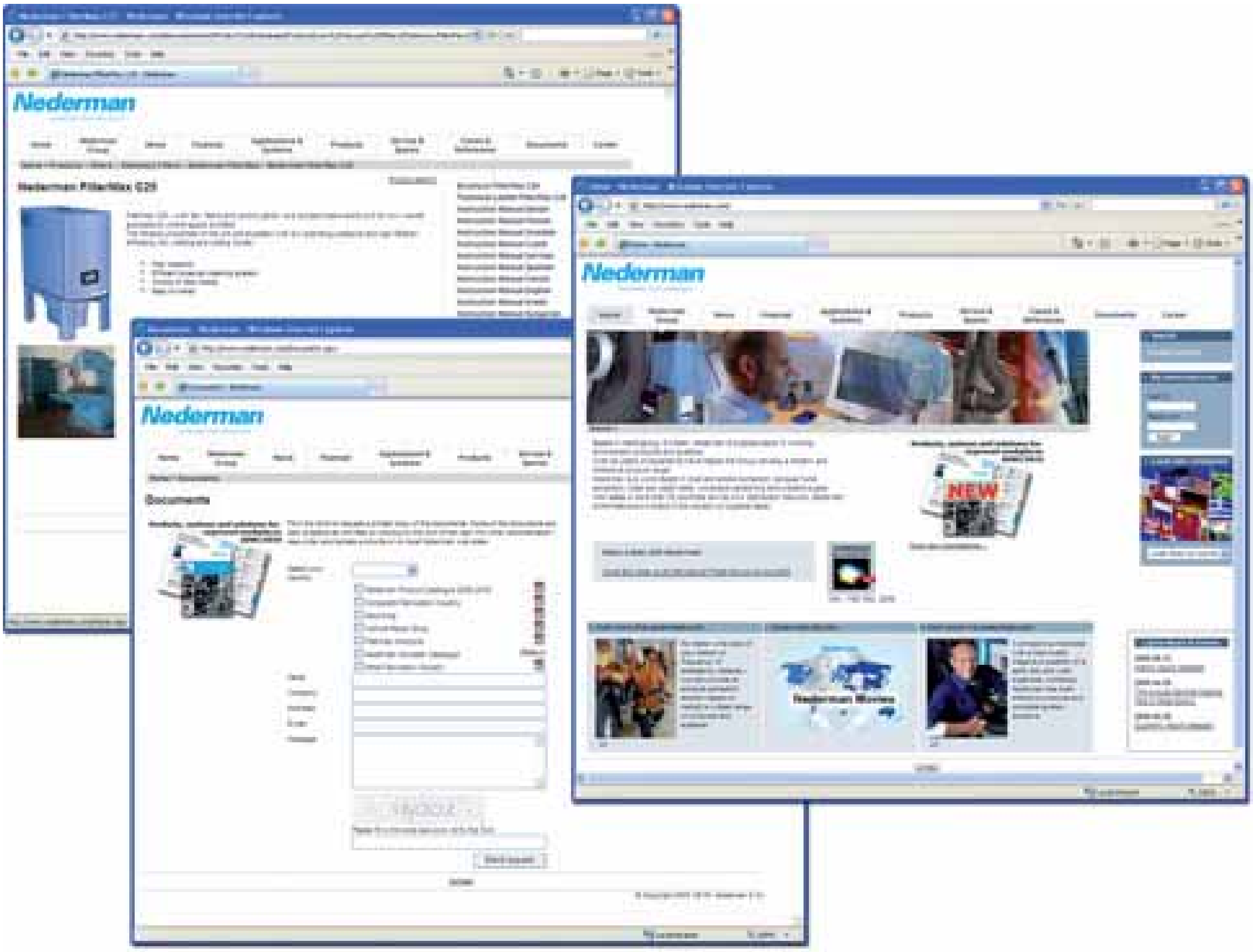
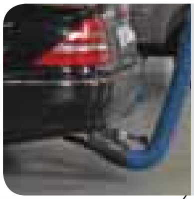


Fig. 3. Nederman international website.

Vehicle Repair Workshops

Vehicle repair shops, Inspection centers, Car manufacturing



Vehicle exhaust extraction

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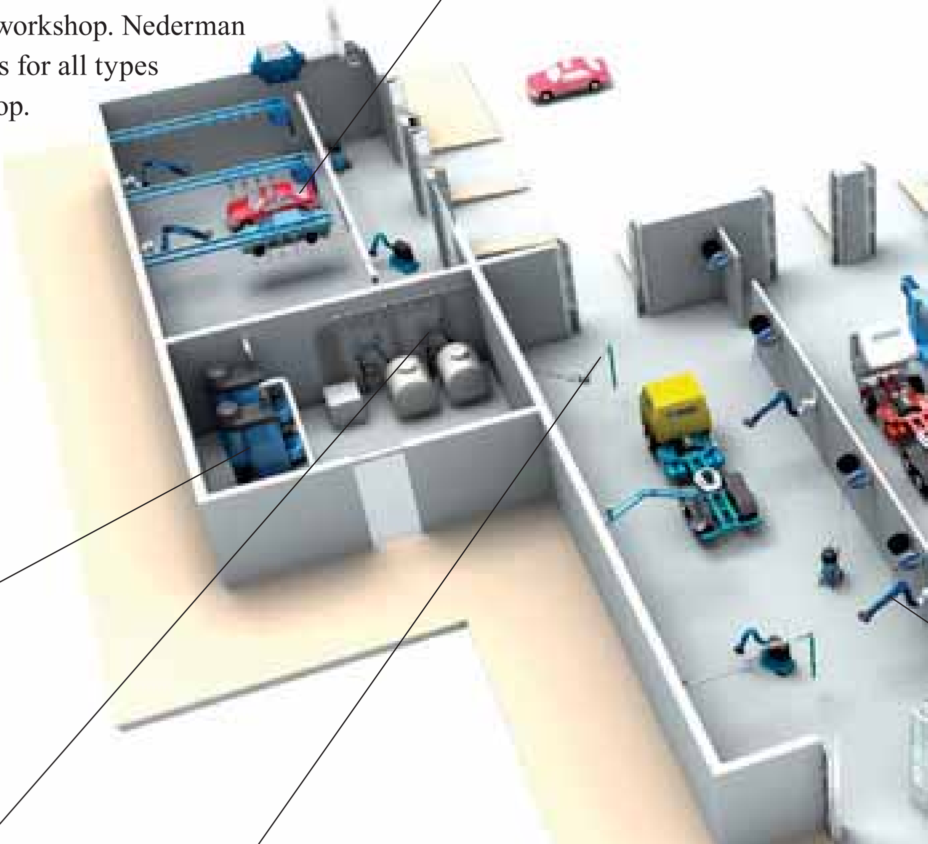
Exhaust and welding fumes, dust from sanding and grinding, oil spillage and winding hoses – these are just some of the hazards in Vehicle Repair Shops and alike. A prosperous business is a question of a safe,tidy and well-organized workshop. Nederman offers a wide range of products and systems for all types of vehicles and any kind of vehicle workshop.



Nederman systems and solutions:

- Reels for fluid and power supply
- Systems for handling, and administration of oil, grease and other liquids
- Exhaust extraction systems
- Cleaning systems for vehicles and premises
- Welding fume extraction/filtration

Central vacuum systems

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Lubrication system

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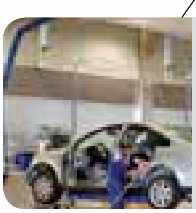

PowerBox with compressed air, vacuum, and power supply

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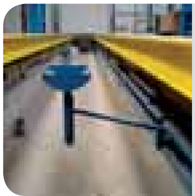

Waste oil collection

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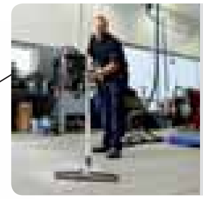

Vacuum cleaning system

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Reels for air, water, power

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Service Tower

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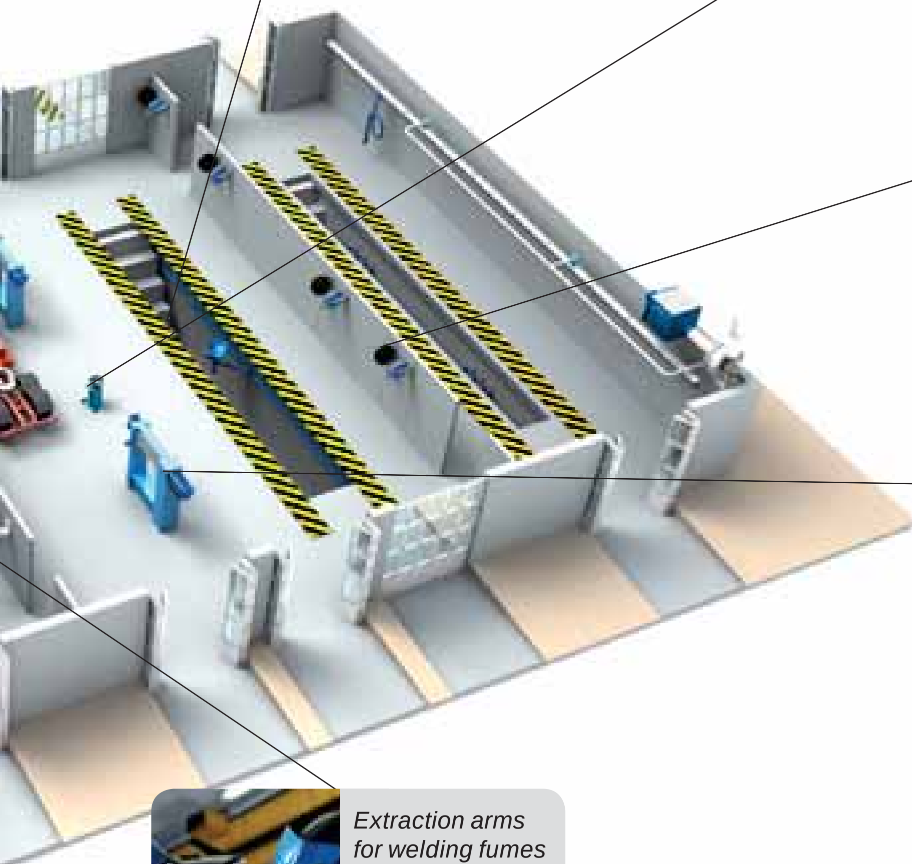

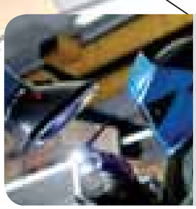

Extraction arms for welding fumes

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Emergency services

Reels for water, compressed air, power

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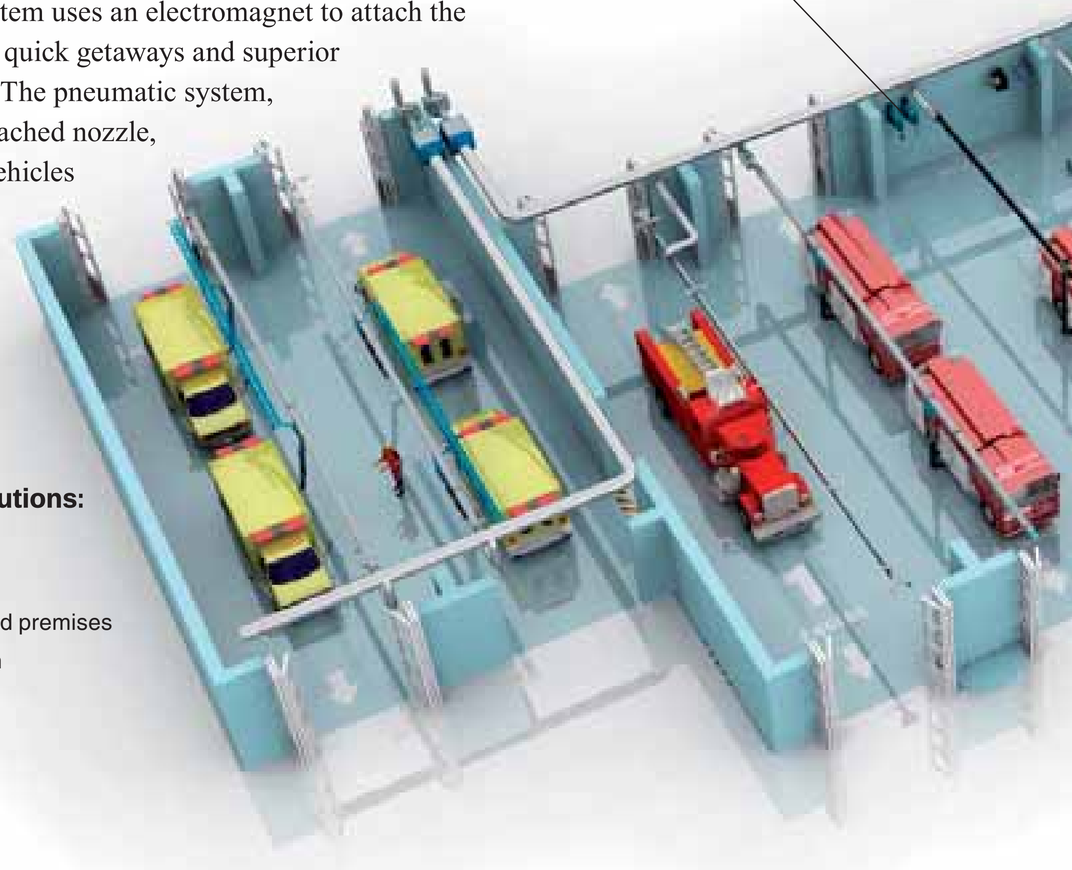
Vehicle exhaust fumes have a potential to cause a range of health problems. Nederman's exhaust extraction systems, designed specifically for emergency vehicles, remove the exhaust fumes right at the tail pipe which is the only effective way to do it. The range includes the unique MagnaSystem, as well as pneumatic systems and vertical stack systems. The MagnaSystem uses an electromagnet to attach the hose to the vehicle permitting quick getaways and superior capacity for exhaust removal. The pneumatic system, which has a pneumatically attached nozzle, is perfect for stations where vehicles vary from time to time.



Nederman systems and solutions:

- Exhaust extraction systems
- Reels for fluid and power supply
- Cleaning systems for vehicles and premises
- Welding fume extraction/filtration


Industrial vaccum cleaner
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Extraction arm for welding
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Stationary vaccum unit
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Mobile extraction unit
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Vehicle exhaust extraction
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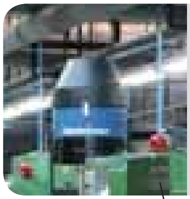
Machining



Oil mist filtering

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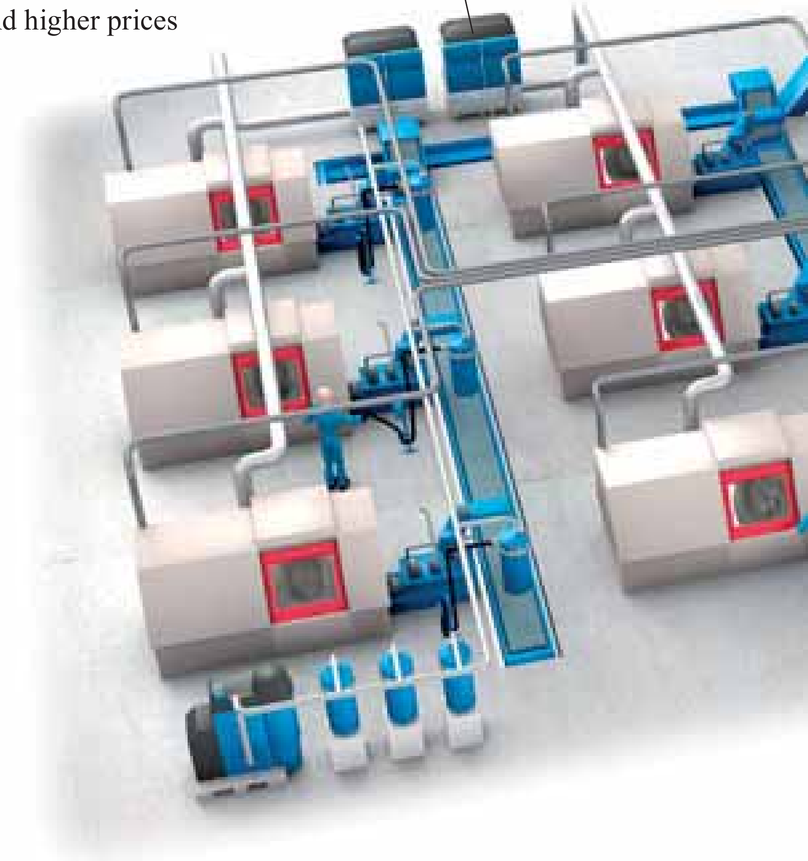
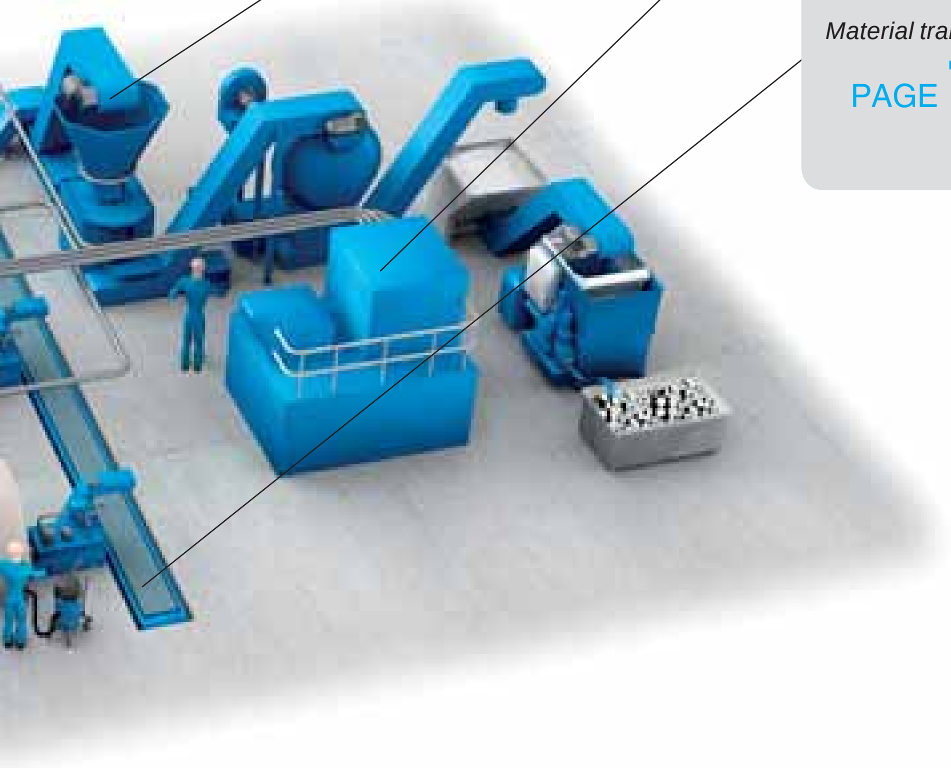
Milling, drilling and grinding generate metal chips which may affect the operations. Chips on the floor are safety risks. Oil mist in the air cause health problems. Slippery floors increases the costs for cleaning.

Nederman systems keep machines and premises free from scraps and our NOM Oil mist filters purify the air from dangerous oil drops. Our solutions also include systems for swarf handling and processing, coolant filtration and oil/water separation. The effects are prolonged life of coolant, decreased costs for swarf handling, and higher prices for scraps.

Nederman systems and solutions:

- Swarf handling, transportation/conveying
- Cutting oil and coolant filtration/purification
- Chip crushing and briquetting
- Oil mist filtration
- Machine and general cleaning
- Welding fume extraction and filtration
- Extraction of dangerous fumes and solvents





Swarf handling/recycling

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Coolant cleaning and recycling

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Material transport

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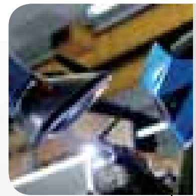
Metal workshop

Welding generates extremely small metal particulates which are very dangerous to inhale. Therefore, many countries have stipulated a maximum permissible exposure to welding fumes. The best way to control the exposure is to capture the fumes right at the source. This protects both the welder and the other workers. Nederman systems cover both high and low vaccum techniques and are used for extraction of welding fumes and for cleaning operations of premises and machines.



Welding fume extraction

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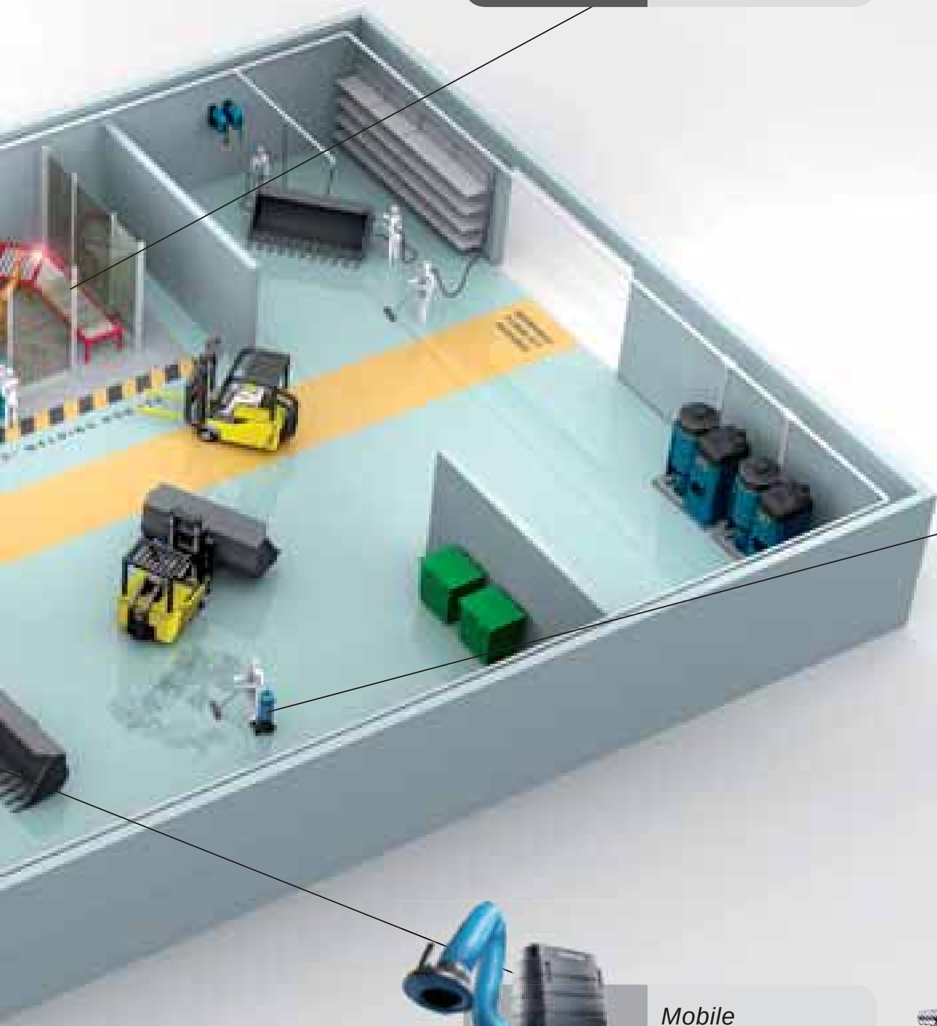
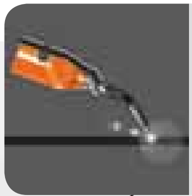
Nederman systems and solutions:

- Welding fume extraction and filtering
- On-torch welding fume extraction
- General cleaning/collection of scale rags etc
- Workplace protection with curtains and screens





Robotic welding fume extraction

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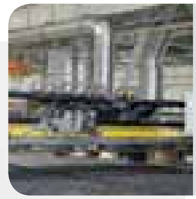

Cutting fume extraction

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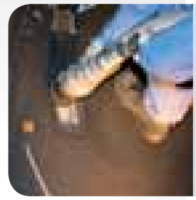

Blasting media recycling

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Dust extraction and cleaning

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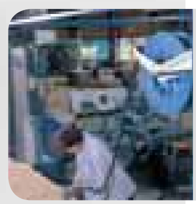

Hose and cable reels

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Mobile Welding fume extraction

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On-torch extraction

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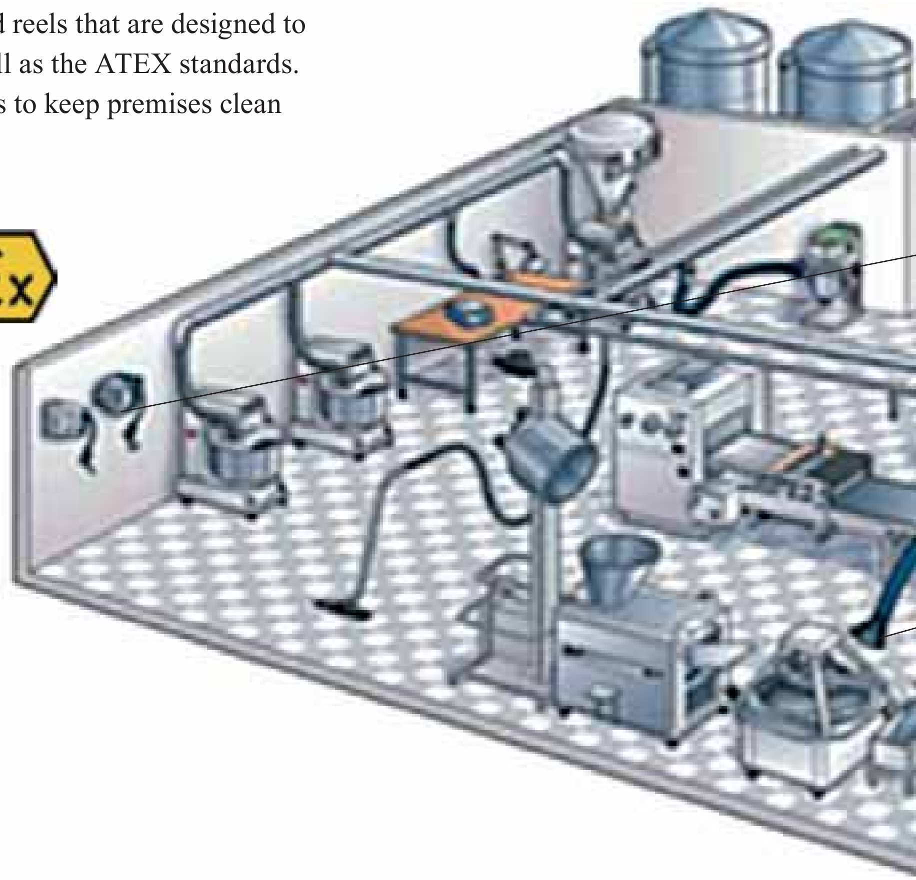
Food/Pharma industries

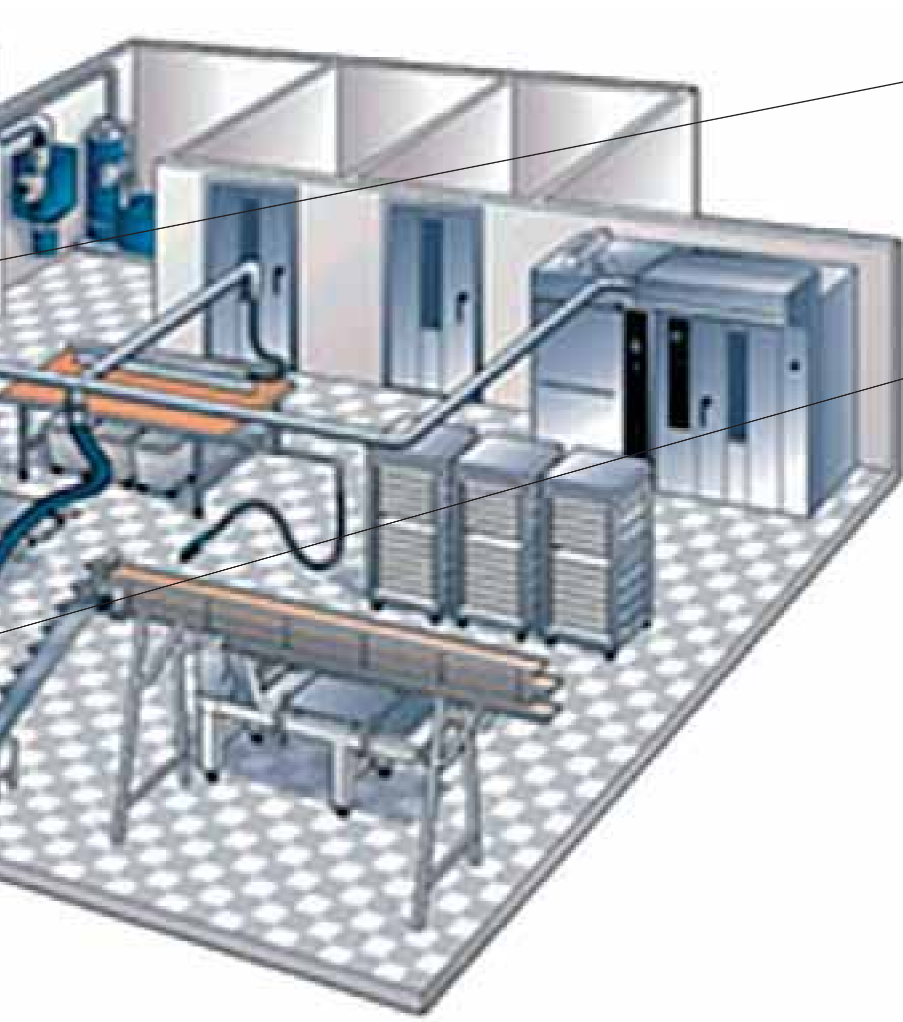
The hygienic demands in food, chemical and pharmaceutical industries are very high. Equipment must be easy to clean and withstand detergents and chemical substances. Since explosive risks often occur where ingredients are handled, the equipment must meet the ATEX directives.

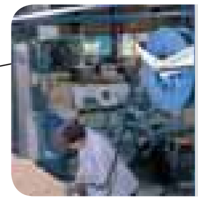
Nederman offers a range of filters, arms and reels that are designed to meet the highest demands on hygiene as well as the ATEX standards. An installation can include cleaning systems to keep premises clean and free from potentially explosive dust.

Nederman systems and solutions:

- EX extraction arms and filter systems for explosive dust and particles
- EX approved hose reels in stainless steel and conductive materials
- Industrial cleaning systems including EX approved mobile vacuum cleaners







Hose and cable reels

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Dust extraction and cleaning

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Filtration of explosive dust

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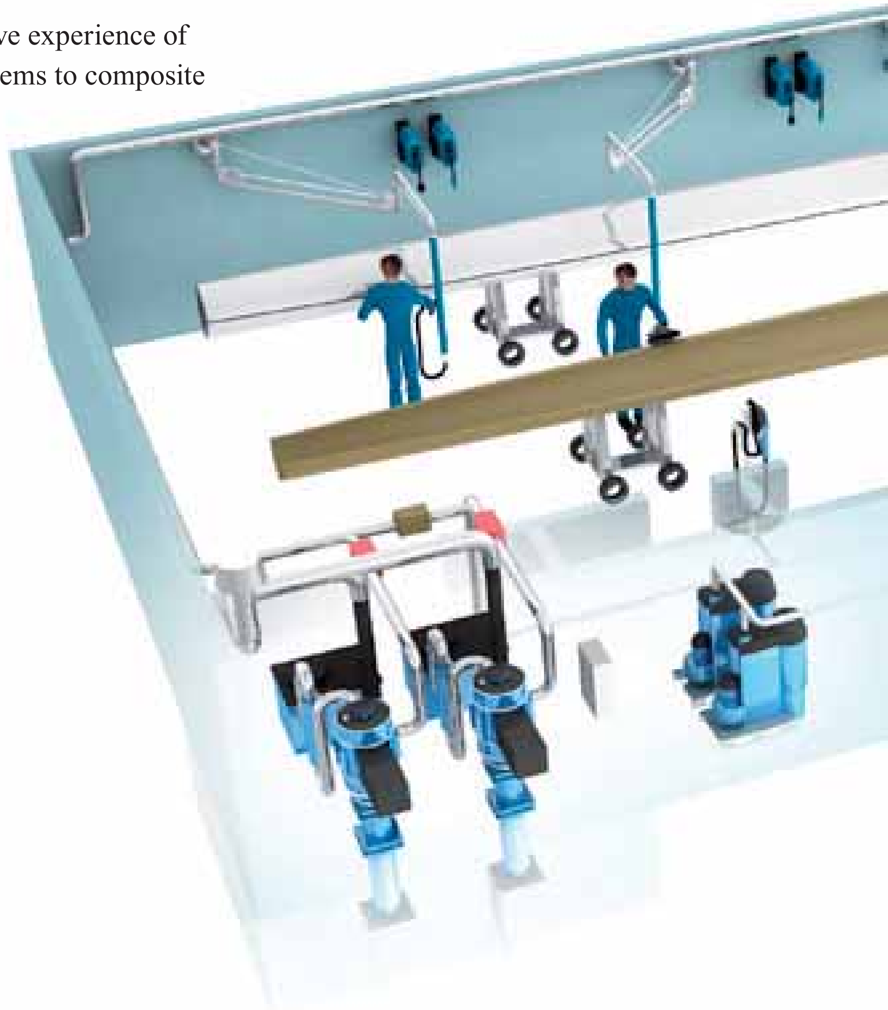
Composite and plastic fabrication industries

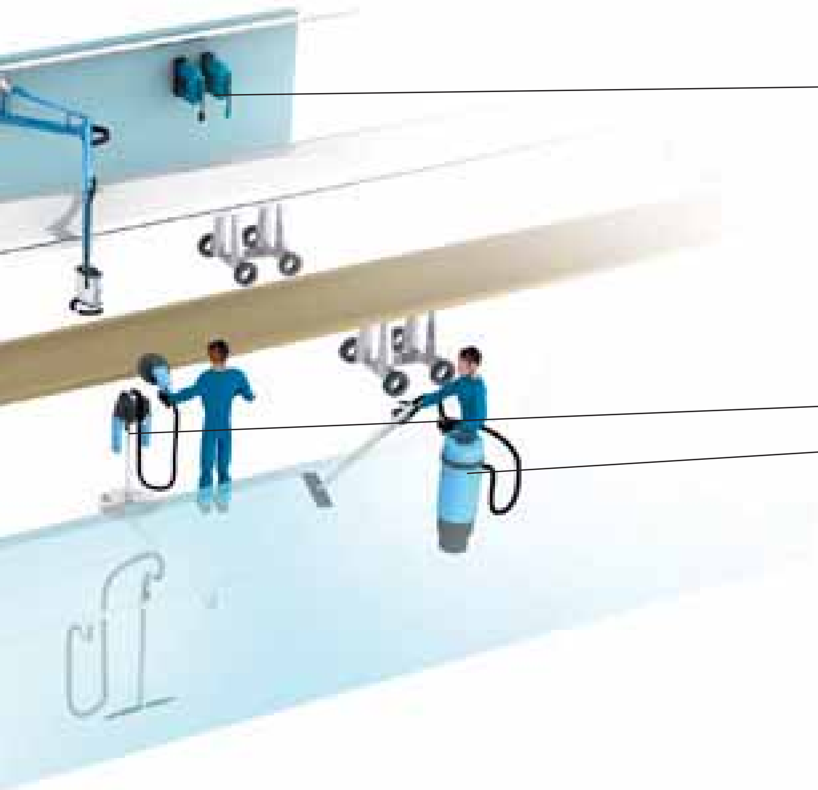
Composite working releases dust and fibres that are small enough to enter human lungs and can penetrate the skin causing allergic reactions. The most efficient way to minimise the risks is to extract the substances directly at the source.

Nederman is the leading supplier with extensive experience of designing and installing safe and efficient systems to composite working industries all over the world.

Nederman systems and solutions:

- Dust extraction systems
- Reels for media supply
- Cleaning systems for vehicles and premises
- Welding fume extraction/filtration





Hose and reels

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Dust collection

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Filtration of explosive dust

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Nederman

Welding

NEDERMAN ENGINEERING GUIDE

Welding

Welding poses serious threats to health. Welding fumes, created when base materials and additives melt during the welding operation, comprise dangerous gases as well as metal particulates so small that they are very easy to inhale. Not only the single welder is affected, but also other workers within the working place. Therefore welding should always take place in a well ventilated area to allow the toxic fumes and gases to escape. Central ventilation systems or extraction hoods over workbenches are often completely inadequate. These systems are seldom cost-effective as they require a great deal of power to run and extract enormous quantities of heated air from the premises. Moreover, the welders or operators cannot avoid inhaling the fumes as these always contaminate the general airflow, forcing them to wear uncomfortable fresh air units in addition to central ventilation.

To exactly measure the amount of particles in the air, a device such as TSI DustTrak™ can be used. This is a common practice for Nederman.

Capture-at-source most efficient

Wherever it is a viable solution, it has been proven that extraction at source is the most effective and efficient method of capturing and removing welding and similar fumes. Using this method, the risk of the welder or operator being subject to hazardous fumes is minimised. In summary, the necessary components to achieve proper source capture of welding fumes are an easily positioned fume extractor with a well-designed hood, proper airflow through the fume extractor and a conscientious welder who will position the hood in a manner that will draw hazardous fumes away from his or her breathing zone and avoid to spread the smoke in the premises. As an alternative to the hood and arm fume extractor, on-torch extraction can be used. The on-torch extraction systems extract the fumes directly from the welding torch.

The extraction systems are available as both mobile single user extraction units and central extraction systems serving several extraction points.

Capture hoods with flexible arms

A general solution comprising various hood design and a range of arms in different designs, arm lengths and hose diameters. The arms are fully flexible in all directions and easy to position, thus covering a large working area.

The Nederman range of low vacuum extraction arms covers a wide variety of applications. All arms are highly flexible and simple to position, extend and retract. Different attachments are available for wall, ceiling or extension bracket mounting as well as a number of accessories, including hoods and dampers to improve efficiency.

The arms are connected to a fan and filter system removing the contaminants from the extracted air so that it can be returned to the atmosphere or recycled without negative effects. The extraction arms can be combined with the Nederman Extension Arm for extra reach or the Nederman Fume Extractor trolley (on rail) which opens the possibility of serving several working places.

Positioning of the hood is important

Proper positioning of the extraction hood is mandatory for effective fume extraction. A hood is intended to be positioned such that the fumes will be drawn away from the worker's breathing zone. Due to the heat given off by the arc, the fumes and particulate tend to rise up in a plume above the weld.

In order to capture this plume of smoke, the hood should be positioned somewhat close to and above the arc at an angle of about 45° opposite the welder as shown in Fig. 1. To avoid the risk of fume inhalation, the welder's head must be kept outside the capture zone. This positioning allows ample room for the operator to work while protecting him or her from harmful gases and particles.

Fig 1. Proper positioning of extraction arm.

When using an air capture hood, air is drawn into the hood from all directions. Fig.2 shows that the air velocity decreases rapidly as you move farther away from the mouth of the hood. The optimum distance the hood should be positioned away from the work is variable due to specific conditions such as movement of air in the room, the amount of airflow through the extractor and the design of the hood. However, as a general rule, an exhaust hood should be placed within the distance of one to two hood diameters from the source of contaminants to be effective.

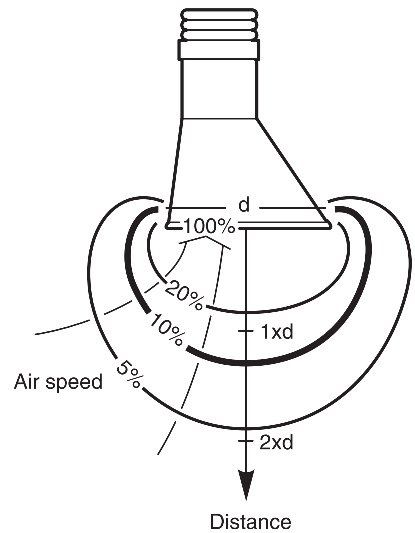

Fig.2 Capture velocity decrease by square.

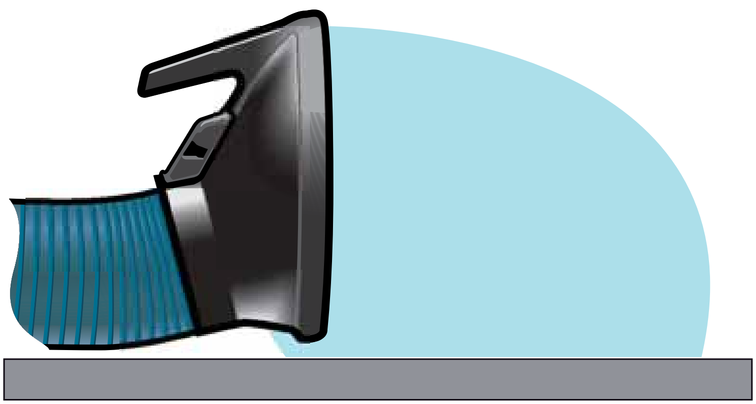

Fig.3 Using a flange and surface improves the suction field.

Extraction at source – Hood and arm systems

Generally speaking, low vacuum products and systems are used for extraction purposes where the air is contaminated with small, light and low velocity particles that can be regarded, for design purposes, as acting like a gas. Welding fumes are a good example of potentially hazardous substances that are best dealt with at source. This means that:

- their removal uses high volumes of air, 600 – 2000 m^3/h (353 – 1176 cfm)
- they are extracted via large diameter ducting at relatively low speeds, around 10 – 25 m/s (2000 – 4900 fpm)
- the pressure drops that have to be overcome are low, normally in the region of 1 – 3 kPa (4 – 12 in wg).

More detailed information about vacuum systems is found in section 'Low vacuum calculation' and in section 'High vacuum calculation' in this book.

The extraction is carried out with extraction arms, enclosures and canopies over machines, robots etc.

Different welding methods require different air flow. See Table 1 at the end of this chapter.

Extraction at source – On-torch extraction

Welding torches with integrated extraction allow the welder to work over big areas as well as inside constructions; the extraction is always at hand. Capture efficiency ranges from 70 – 98% depending on the welding method, type of shielding gas, the material and the skills of the welder. On-torch extraction is also suitable for robotic welding as operators, service personnel overseeing robotic welding equipment and others can be subject to residual fumes.

Welding situations inside constructions, such as oil-pipes or at ship yards where the welder moves over large areas or where the working space is narrow, On-torch extraction is an unrivalled extraction method.

Cost effective On-torch extraction implies that lower air volumes are extracted from the work shop, which is cost effective as it reduces the amount of heated/conditioned air extracted from the premises. Welding torches with on-torch extraction will have an integrated vacuum hose. The diameter of the hose is normally about 25 mm (1 in). Most welders will get used to the increased diameter and size of the torch within 1 – 2 weeks. The disadvantage of having an increased diameter is, however, compensated by minimising the risk of the welder being subject to hazardous fumes. Should it be necessary a balancer may be used to relief the welder from retaining the entire weight of the torch.

Fig.4 Abicor-Binzel RAB 25 air cooled fume extracting welding torch.

On-torch needs high vacuum systems

On-torch extraction uses high vacuum technology, i.e. high speed extraction and low air volumes to extract the fumes. The disturbances that possibly can be created in the shielding gas are prevented by adjusting the nozzle on the welding torch properly. In particular circumstances as welding in corners the extraction can be reduced directly in the torch by opening a small valve.

Different welding methods require different air flow. See Table 1 at the end of this chapter.

More detailed information about vacuum systems is found in section ‘Low vacuum calculation’ and in section ‘High vacuum calculation’ in this book.

More detailed information about vacuum systems is found in section ‘Low vacuum calculation’ and in section ‘High vacuum calculation’ in this book.

Robotic welding extraction

In robotic welding applications were the operator does not work in close proximity to the welding, a receptor hood can be a viable solution. The canopies utilises thermal rise of the fumes and can be fitted with curtains to minimise airflow need. Enclosures reduce the airflow need even further and also reduce other emissions such as noise, light and flying objects and liquids. Canopies and enclosures use low vacuum.

On-torch extraction that captures the fume close to the source is the most effective way to extract weld fumes. On-torch extraction needs a high vacuum solution. Depending on the capacity of the high-vacuum unit used, one up to ten torches can be served. Larger systems can cover up to 25 service points with up to ten points being in use.

See the Nederman Product Catalogue for further details.

Fig.5 Robotic welding with canopy - low vacuum.

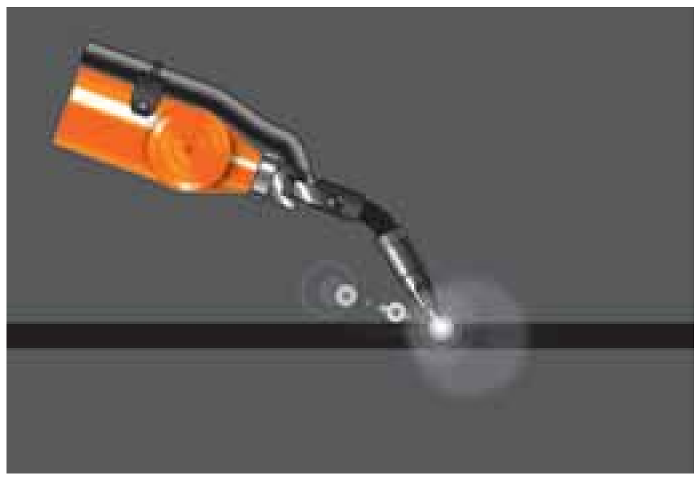

Fig.6 Robotic welding - high vacuum ”on-torch”.

Filter systems

A Nederman extraction system equipped with a particle filter can separate >99 % of contaminants. A central extraction system needs to be designed to carefully designed to ensure proper functioning.

More detailed information about how to calculate filter need is found in section 'Low vacuum calculation' and in section 'High vacuum calculation' in this book.

Fig 7. Nederman Filter System.

Energy-saving solutions

In many countries recirculation of the filtered air it is not allowed. This limits the possibilities to save energy and a lot of heat is lost when the extraction system is in operation. Nederman offers solutions where the fan operates only while work is in progress. Moreover, the fan power can continuously be adjusted to the actual demand by a fan inverter and substantial savings can be made.

More detailed information about energy saving is found in section 'Low vacuum calculation' and in section 'High vacuum calculation' in this book.

Recommended airflow for different types of welding

When you have decided what type of extraction system you need, the next step is to make sure that you have the right airflow. The airflow need for different types of welding is shown in the table below and is used as input when calculating the complete extraction system.

Welding method	Material	Critical dust components	Current	Extraction arm, recommended airflow, m^3/h (cfm)	Extraction arm	On-torch, recommended airflow, m^3/h (cfm)
TIG	Aluminum	Ozone, aluminum	Any	600–800 (353–470)	Standard, original	N/A
	Stainless steel	Chromium, nickel, ozone	Any	600–800 (353–470)	Standard, original	N/A
MIG/MAG	Mild steel	Particulate, manganese	Low	800 (470)	Original	80 (47)
			Medium	1000–1300 (588–764)	Original, NEX MD	125 (73.6)
			High	1200–1700 (706–1000)	NEX MD, NEX HD	125 (73.6)
	Aluminum	Aluminum, ozone	Low	800 (470)	Original	80 (47)
			Medium	1000–1300 (588–764)	Original, NEX MD	125 (73.6)
			High	1200–1700 (706–1000)	NEX MD, NEX HD	125 (73.6)
	Stainless steel	Nickel, chrome, particulate	Low	800 (470)	Original	80 (47)
			Medium	1000–1300 (588–764)	Original, NEX MD	125 (73.6)
			High	1200–1700 (706–1000)	NEX MD, NEX HD	125 (73.6)
FCAW (Flux cored arc welding)	Mild steel	Manganese, particulate	Medium	1000–1300 (588–764)	NEX MD	125 (73.6)
			High	1300–1700 (764–1000)	NEX HD	125 (73.6)
	Alloyed	Cr, Cr(VI),Ni, particulate	Any	1300–1700 (764–1000)	NEX HD	125* (73.6*)
MMA (stick welding)	Mild steel	Particulate, flour	Low	800–1000 (470–588)	Original	N/A
			Medium	1000–1300 (588–764)	Original, NEX MD	N/A
			High	1200–1700 (706–1000)	NEX MD, NEX HD	N/A
	Stainless	Cr, Cr(VI),Ni, NO	Any	1200–1700 (706–1000)	NEX MD, NEX HD	N/A
	High Alloyed	Cr, Cr(VI),Ni, NO	Any	1200–1700 (706–1000)	NEX MD, NEX HD	N/A

*) Not recommended unless in combination with local exhaust ventilation
For detailed dimensioning and filter load please see section ‘Low vacuum calculation’ and ‘High vacuum calculation’.

Table 1. Airflow need for different types of welding.

For more detailed information
always contact your local
Nederman Sales Company.

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Cutting

NEDERMAN ENGINEERING GUIDE

Cutting

Cutting of metal sheets and other materials through the use of cutting torches is a hazardous process, producing large amounts of smoke, fumes and sparks. Any cutting process therefore requires effective extraction. The three most common cutting techniques are, Oxy-fuel cutting, Laser cutting and Plasma Cutting.

Cutting tables

A common large scale cutting application is CNC cutting, using large cutting tables as support, adapted to the size of the metal sheets. In such an application, the fume extraction is almost exclusively done as a down draft system through the cutting table. To minimise the extracted air volume, the cutting table is divided into sections. Each section is equipped with damper doors which open as the cutting torch is active above the specific section. The section sizes usually vary from 1.5 m^2 (15 ft^2) up to 2.5 m^2 (30 ft^2) for normal cutting tables. In order to get efficient extraction one needs about 0,7 – 1 m/s (2.3 – 3.3 ft/s) down draft calculated in each open section. This gives a normal airflow of approximately 4000 to 9000 m^3/h (2352 – 5292 cfm), depending on the type of cutting.

Section area (m^2 (ft^2)) × Air speed (m/s (ft/s)) × 3600 (s) = Total airflow (m^3/h (cfm))

Fig. 1. Section of a cutting table with damper doors.

Filter dimensioning

Following advices are important to take into account when dimensioning, due to the relatively large emissions of fumes and dust.

- Cutting requires lower filter loads than compared to welding. Also the variations in loads are much bigger than when welding.
- There are also different load settings for different kind of cutting methods (See Table 1).
- The average pressure drop over the filter unit for plasma is 1 700 Pa (0.247 psi) which is about 500 Pa (0.072 psi) higher than compared to welding fumes. Also the pressure drop variations are much higher.
- In some cases the work goes on for a long time without breaks. This may require special solutions. Contact Nederman for more information.

Recommended required filter load		
Cutting method	Condition	Filter load, m³/m²/h (cfm/ft²)
Laser cutting		30–35 (166–205)
Oxygen-fuel cutting	Normal	25–30 (147–205)
	Very thick plates	20–25 (118–147)
	Multiple burners	20–25 (118–147)
Plasma cutting	1 – 4 hours cutting/day	25 (147)
	4 – 12 hours cutting/day with one stop every 4 hours	20 (118)
	More than 12 hours cutting/day with min. 3 stops	15 (88)

Table 1.

Preventing fire and explosion

For cutting FilterMax F is recommended, which is equipped with an integrated pre-separator as standard. If an external pre-separator is installed between the cutting table and the filter, a FilterMax DF can be used.

Filtering fumes from cutting give an increased risk of firew. All plasma and oxy-fuel cutting requires a spark trap to reduce the amount of sparks. Nederman therefore recommends installing a Nederman SFC spark trap or a cyclone dimensioned for the required airflow.

All cutting on oily material generates oil smoke that increases the fire risk and to prevent that we recommend a limestone injector.

Plasma cutting fumes from aluminium, or some other types of light metals, contain a lot of metallic dust. The collected dust is therefore explosive and requires an EX-application. Laser cutting organic materials also generate a combustible and explosive fume/smoke.

Fig. 2. CNC cutting table with a Nederman extraction installation.

For more detailed information always contact your local Nederman Sales Company.

Nederman

Blasting media

NEDERMAN ENGINEERING GUIDE

Blasting media

One of the main challenges in any blasting operation is to avoid the blasting media to contaminate the surrounding work environment. Abrasive blasting needs to be carried out in an enclosure. This is most often done in a dedicated blasting room, separated from other operations. The work pieces need therefore either to be moved to and from the blasting room, or encapsulated, leading to increased operating costs.

Another factor increasing costs is the blasting media. Blasting media is expensive to buy and even more expensive to destruct. Means to minimize the usage of blasting media are therefore important to consider.

Recycling of blasting media

The solutions to these problems are efficient collection and recycling of blasting media. The recycling of blasting media is an easy way to reduce cost in blasting operations. When recycling blasting media a media with longer life can be used to further improve profitability, e.g. steel based blasting media has a life expectancy of up to hundred cycles. For further information about how much you could save by recycling your blasting media, please contact Nederman.

Secondly, during blasting the blasting material is grinded, resulting in finer grains. When the recycled media is mixed with new blasting material, a mix of different grain sizes is created. The resulting mix of grain sizes actually gives a more efficient blasting and a smoother finish with fewer cavities, increasing the quality of the finished work piece.

Nederman offers solutions for efficient recycling of blasting media. The general function of the system is described below and is applicable to both central and mobile solutions.

The blasting media is collected (1) and sent to a separator (2), which separates dust and other contaminations from the blasting media and returns the blasting media to collection tank (3), where it is mixed with new blasting media.

The vacuum is created by a vacuum producer (4). The vacuum producer can be either an air powered ejector pump or an electric powered pump or fan.

The ejector vacuum producer is the recommended solution and is especially suitable for ATEX environments. The pump has no moving parts and is powered by compressed air through an external air compressor.

The separated dust is sent to a filter (5) and is collected in dust bins, big-bags, plastic bag or container.

The collection and recycling system can also be fitted with an extra cleaning system.

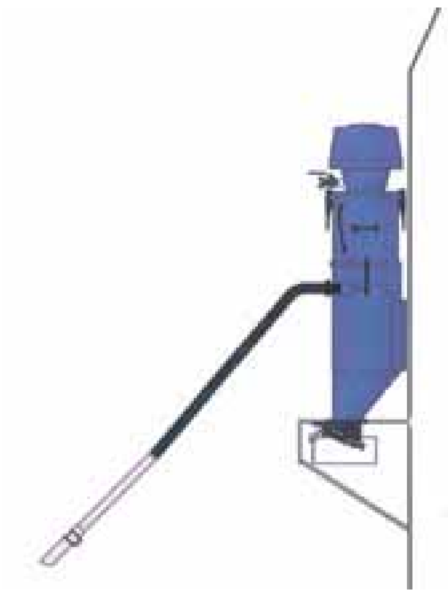

Fig. 1. Cleaning system, collection and cleaning on wheel blast machine.

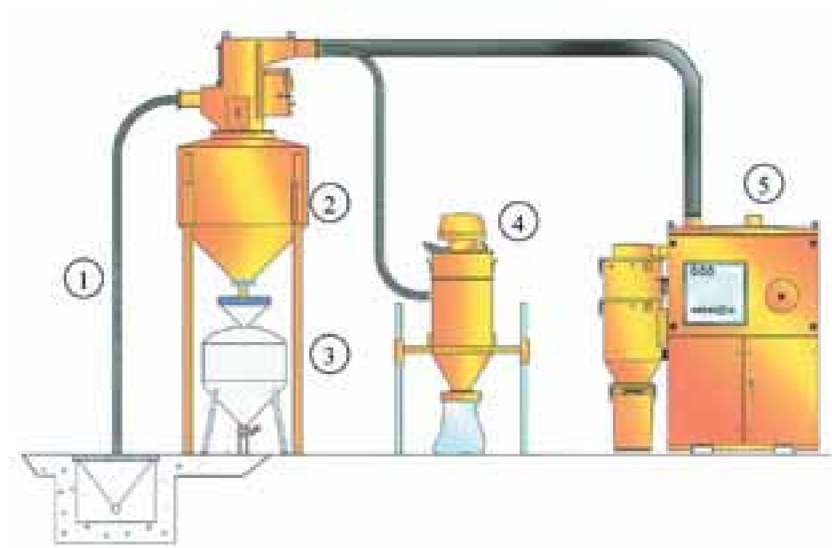

Fig. 2. General overview of a blasting recycling system. The picture shows an application for a blasting room, where the blasting media is collected in a draining gutter before it enters the recycling system.

“On tool” vacuum blaster

The possibility to carry out blasting directly on site without the risk of contamination can greatly reduce operating cost. Nederman offers an enclosed “on-tool” vacuum blast system, which collects the blasting material in direct connection of the blasting nozzle. The blasting can be carried out in any location without risk of contaminating the surrounding work area.

Fig. 3. The on-tool vacuum blaster is suitable for blasting welding-joints.

The application is very useful when blasting is needed on larger work pieces that are difficult to move to a designated blasting area, or don’t fit in a blasting cabinet or blasting container. The vacuum blast is also very suitable to integrate in a lathe allowing the operator to blast the work piece without removing it from the lathe. The nozzle is mounted on the lathe ensuring a controlled operation with high quality results.

Fig. 4. On-tool vacuum blaster mounted on a lathe.

Fig. 5. SB 750 Suction blaster.

The vacuum blasting must be carried out close to the work piece to be able to recollect the blasting material. The application is therefore less suitable when blasting large areas and/or blasting work pieces with hard to reach voids and similar shapes, where the blasting media needs space to properly reach the surface.

The vacuum blasters are also available as complete mobile blasting units. The vacuum blasters are can be equipped with different types of nozzles that ensure an enclosed blasting for different types of shapes.

Other applications

Blast container

The blasting container is a small mobile blast room that can be dispatched in direct connection to the work area. Especially suitable in larger constructions such as shipping and building construction.

Fig. 6. Blast Container.

Blast cabinet

The blast cabinet is suitable when blasting smaller work pieces, which can easily be picked up and placed in the cabinet. The cabinets are available in many different configurations.

Fig. 7. Blast Cabinet.

What to consider when designing a recycling system

When configuring a blast media recycling system the following questions are important to answer.

How much do you work?

The recycling of blasting media is carried out in between work sessions. Therefore the size of the media tank should be enough for the longest consecutive work session. Approximately 250 l/hour (55 gal (UK)/h) is used when blasting. Media tanks are available in sizes, 75 liter, 220 liter and 500 liter (16.5 gal (UK), 48.4 gal (UK) and 110 gal (UK)). An application with a blasting tank containing 180 liter and a media tank containing 500 liter (110 gal (UK)) can be used for 2:45 hours without break.

What type of blasting media is used?

The density and form, coarse or round, of the media affects the airspeed needed to transport the media. The higher airspeed needed the bigger ejector is needed. The choice of ejector is also dependant on what type of compressed air is available.

The table below shows the airflow need and tube diameter needed for different ejectors, when used for cleaning and recycling via draining gutter.

Compressed air consumption

Cleaning		
Ejector	Airflow (m^3/min at 7 bar)	tube diameter in mm
NE52	3	51
NE64	4,3	51/63
NE74	5,3	51/63
NE96	8,6	76

Table 1.

Recycling via draining gutter		
Ejector	Airflow (m^3/min at 7 bar)	tube diameter in mm
NE66	4,1	76
NE76	5,4	76
NE96	8,6	76

Table 2.

If recycling via draining gutter is combined with cleaning apparatus, the dimensioning is based on the need of the draining gutter. The tube diameter should be the same all the way to the separator. Between the separator and the ejector 76 mm (3 in) diameter is used as standard.

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Vehicle exhaust extraction

NEDERMAN ENGINEERING GUIDE

Vehicle exhaust extraction

Whenever there is a need to run combustion engine vehicles indoors, there is a need for vehicle exhaust extraction. Even though the vehicles are run only a short time indoors and with open doors, the exhaust builds up in the building, causing a work environment problem.

The vehicle exhaust extraction needs can be divided into two main categories; Stationary and In-motion.

Stationary

Engines are run stationary, when carrying out tests and fault tracing. This is common in vehicle repair shops and testing stations. Key aspects for the stationary extraction systems are; easy handling, good reach and possibility to quickly remove after use.

Single/Twin Exhaust Extractor

The Nederman Single/Twin Exhaust Extractor is ideal for small workshops where an individual solution is required or where an additional extraction point is needed to expand an existing system. A damper can be fitted to reduce noise and unnecessary extraction of air when not in use.

Exhaust Hose reels

Hose reels have a great advantage in that the hoses can be hoisted completely out of the way when not in use. They can be installed for individual fan extraction or connected to ducting with a central fan serving a number of units. In normal use, hose reel solutions are virtually maintenance free.

Extraction rail with extraction hoses or Telescope units - Touchless

These systems are mounted on trolleys sliding on rail and equipped with either extraction hoses or telescopic extraction units. Extraction hose units are available with balancer for keeping the hose raised, and damper for automatic airflow control. The Telescopic Extraction unit is a Touchless system, meaning that it extracts the the fumes without being in contact with the exhaust pipe or the car body. This ensures that there is no risk of scraping the vehicle.

The Touchless system is equipped with a balancer for smooth height adjustment and and an automatic damper. A horizontal arm with a large, efficient exhaust hood is easy and safe to position by means of adjustable joints and release/locking handle at the hood.

Extraction units are easy to move, thanks to light-weight material and ball bearing wheels. One extraction unit can serve several work bays. Two units serve cars with twin exhaust pipes.

Track arm

The Nederman Trackarm is designed for long reach applications for heavy vehicles where there are limited options for installing extraction equipment. The trackarm covers up to 76 m^2.

In-motion

Fig. 1.

In many cases there is need also for exhaust extraction from vehicles driving indoors. This is often the case for emergency vehicles, inspection centers, bus garages, and manufacturing facilities, where vehicles are driven off the assembly line. Key features in such a solution are easy connection, automatic and safe disconnection of the nozzle, and in some cases an automatic and safe return of the extraction unit.

Exhaust rail system

The exhaust rail systems offers an ergonomic and reliable solution. The trolleys and hoses are moved between the vehicles. The number of trolleys required is determined by the specific application.

Exhaust system with manual return

The extraction unit is returned by hand or by using gravity. The system is used for drive-through applications for one vehicle only.

Exhaust rail system with motorised return

A range of motorised systems for one or several suction units. Applications for only one vehicle at the time is based on a straight rail with motorised return of the suction unit. for example in a car inspection center. Applications for several vehicles at the same time are based on a straight suction rail combined with separate rail for return of the suction unit, for example in vehicle assembly plants. The systems extract exhaust fumes continuously, travel along with the vehicle and are robust and very durable.

The motorised return system uses an electric motor to drive the extraction unit. Different levels of automation can be configured from manual switch operated up to complete automatic control.

Special solutions

See the Nederman Product Catalogue for more details regarding available exhaust extraction products for both stationary and in-motion applications. Please, contact Nederman for further guidance.

Design considerations

When designing a vehicle exhaust extraction system the following aspects are important to consider when designing a well functioning system.

The exhaust pipe designs

When considering selections of exhaust nozzles for attachment to the vehicle, one has to consider

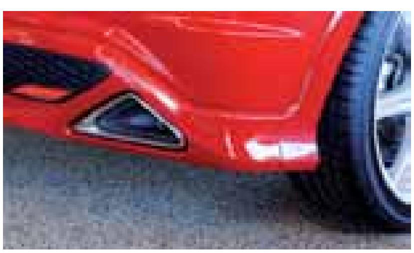
- If the system is intended for stationary vehicles or vehicles in motion
- Type, position, and size of exhaust pipe

Single.

Bend.

Twin.

Double.



Concealed.

Fig. 2. Different types of exhaust pipes.

The main types are the following:

- Standard horizontal exhaust pipes
- Twin exhaust pipes
- Concealed exhaust pipes
- Downward directed exhaust pipes
- Vertical exhaust pipes (trucks, vans)

The attachment of nozzles to the exhaust pipe varies:

- Mechanical attachment
- Pneumatic attachment
- Electromagnetic attachment (Emergency vehicles)
- Externally or internally attachment.

Fig. 3. Low level.

Nederman offers many different nozzle designs. The unique Nederman Touchless system is a specially developed to fit any type of car exhaust pipe. See the Nederman Product Catalogue for more details regarding available nozzle types.

Fig. 5. Nederman Touchless.

Exhaust volume and temperature

Depending on vehicle, engine type, and load (rpm) the exhaust temperature can differ. Most of Nederman nozzles do not fit tightly onto the exhaust pipe, allowing ambient air to be sucked into the hose, acting as a coolant. Nederman offers different types of hoses depending on the temperature of the exhaust.

- Standard use, up to 150 °C (302 °F) continously
- Heavy duty use, up to 300 °C (572 °F) continously
- Heavy duty use, up to 650 °C (1202 °F) continously

See the Nederman Product Catalogue for more details regarding available exhaust extraction hoses.

Fig. 4.

$G=(Vs/1000) \times \mu \times (Tu/Ti) \times (k) \times 60$

G = Exhaust flow, m^3/hr

Vs = Stroke volume, lit

μ = Efficiency factor, (normal aspirated ~0.8, turbo charged ~1.2)

Ti = Intake air temp., °K (273+°C)

Tu = Exhaust temp., °K (273+°C)

k = n (2-stroke engine)

k = n/2 (4-stroke engine)

n = Motor rpm

How to calculate the airflow need

The airflow need in the extraction inlet depends on the engine type and load (rpm). However, as a general rule, the following airflow and hose diameter can be used, assuming that the engines are running at idle speed. Recommendations can vary from market to market and application to application.

Passenger cars / Vans

Airflow need: 400 m^3/h (235.2 cfm)
Hose diameter: 100 mm (3.94 in)

Commercial vehicles (Buses, trucks)

Airflow need: 1000 m^3/h (588 cfm)
Hose diameter: 150 mm (5.9 in)

If engines will run over idle speed, the following formula can be used to calculate the exact airflow need.

$$G=(Vs/1000) \times \mu \times (Tu/Ti) \times (k) \times 60$$

G = Exhaust flow, m^3/hr

Vs = Stroke volume, lit

μ = Efficiency factor, (normal aspirated ~0.8, turbo charged ~1.2)

Ti = Intake air temp., °K (273+°C)

Tu = Exhaust temp., °K (273+°C)

k = n (2-stroke engine)

k = n/2 (4-stroke engine)

n = Motor rpm

Based on the airflow need in the inlets, the degree of utilisation, a suitable exhaust extraction system and ducting, a suitable vacuum unit can be chosen.

Please refer to section 'Vehicle exhaust extraction calculation' in this book to learn how to create a suitable design

For more detailed information always contact your local Nederman Sales Company.

Nederman

Lubrication and waste oil handling

NEDERMAN ENGINEERING GUIDE

Lubrication and waste oil handling

Manual handling of lubrication in for example vehicle repair shops hide many different types of costs. Fluids need to be transported to the different service bays, using different types of containers. This is both time consuming and involves heavy lifting. It is difficult to keep track of the usage, risk for wastes due to spillage and theft and it is nearly impossible to monitor how much fluid of each sort is used for each customer, making it difficult to invoice the proper amount. When lubrication is dispensed through different types of containers spillage makes the workspace difficult to keep tidy. Using long hoses to dispense the fluids increases risk of tripping and damage to the hoses. All this has a negative impact both to the work environment and the customer image of the company.

Nederman now offers solutions for central storage and distribution of fluids as well as automatic gathering of waste oil.

Centralized storage and distribution of fluids

The centralized storage and distribution system simplifies the distribution of fluids. The system includes; storage tank, pump, pipe work, and tapping point. The tapping points can be mounted on the wall or on service tower.

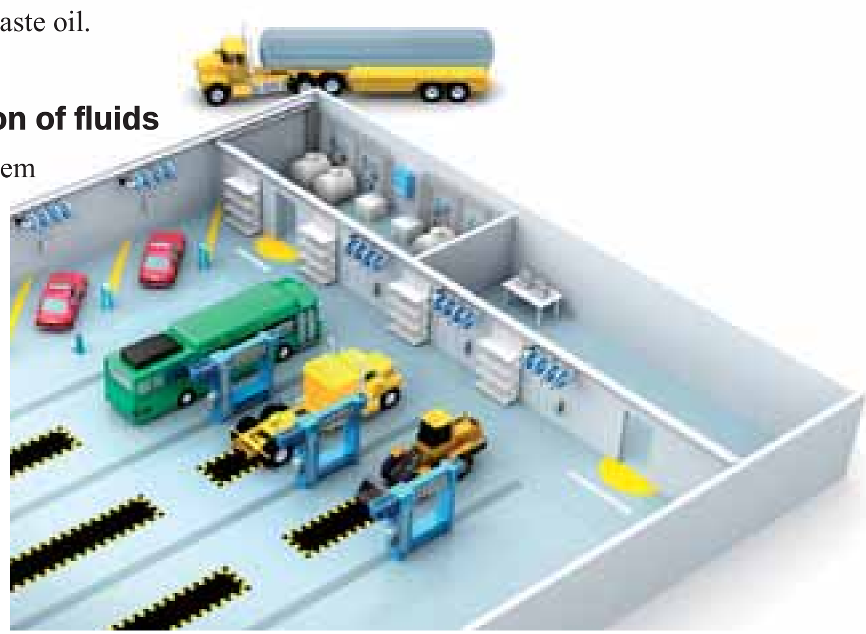


Fig. 1. The centralized storage and distribution system simplifies the distribution of fluids in a vehicle repair shop.

Nederman monitoring system NMS

The Nederman fluid monitoring system NMS offers full control of fluids in the workshop. NMS monitors the consumption of all the different fluids in the system, how much is consumed at each tapping point and how much is left in each storage tank. The system can be set to give an alarm when it is time for replenishing. The system can also monitor via order numbers the exact amount used for each customer and send the information to the business system for correct invoicing.

The centralized storage and distribution system in combination with the Nederman fluid monitoring system will increase the control, greatly reduce the waste of fluids and simplify the administration.

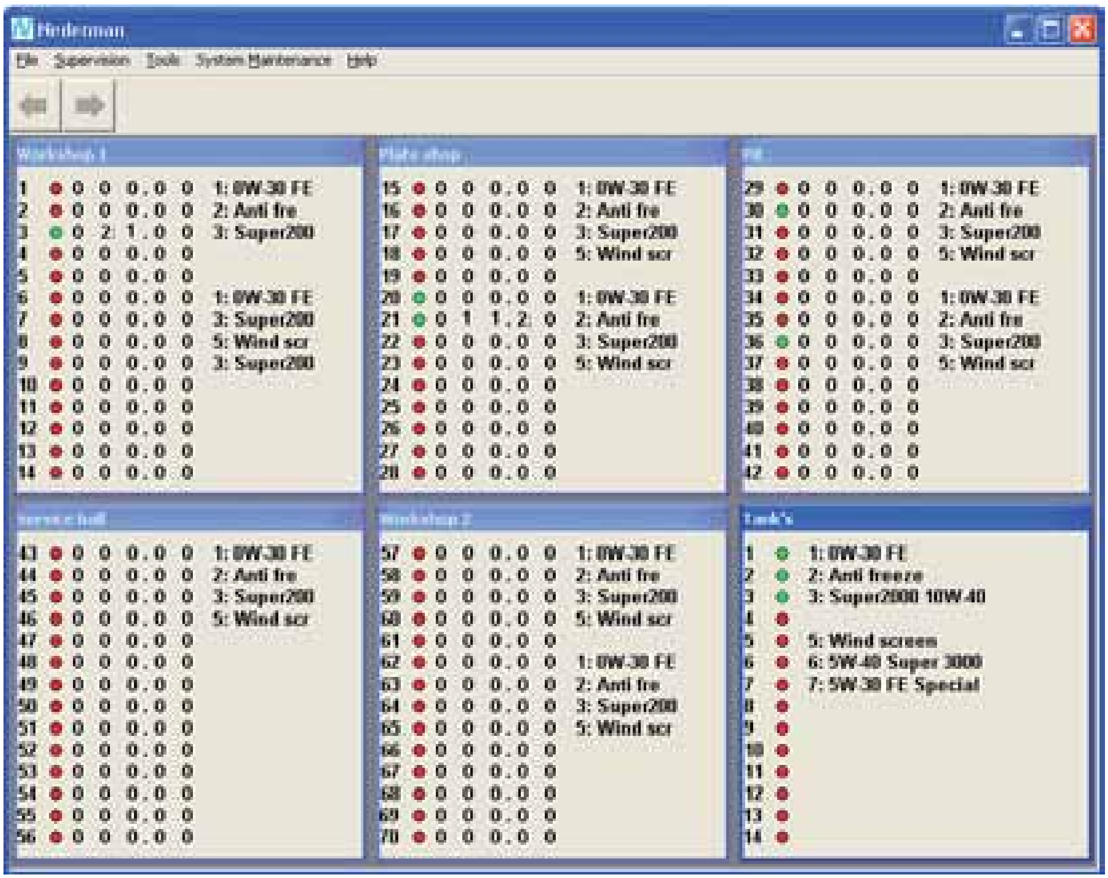


Fig. 2. Screen shot from Nederman Monitoring System, NMS, showing the status of workshop tapping points and storage tanks.

Service tower

The Nederman service tower is an easy way to improve the workspace a safe, tidy and well-organized workshop.

All equipment including lubrication, air, electricity, vacuum cleaning and vehicle exhaust extraction is easily accessible. A space-saving construction with an integrated work bench.

The self retracting hose and cable reels make sure that no cables or hoses lay on the floor. This means no more injuries caused by tripping over tangled hoses and cables on the workshop floor and no more damage to the equipment. Hose and cable reels improve ergonomics and make the workplace more efficient.

The cost-effective and complete supply system for oil, grease and liquids give each vehicle exactly the right amount.

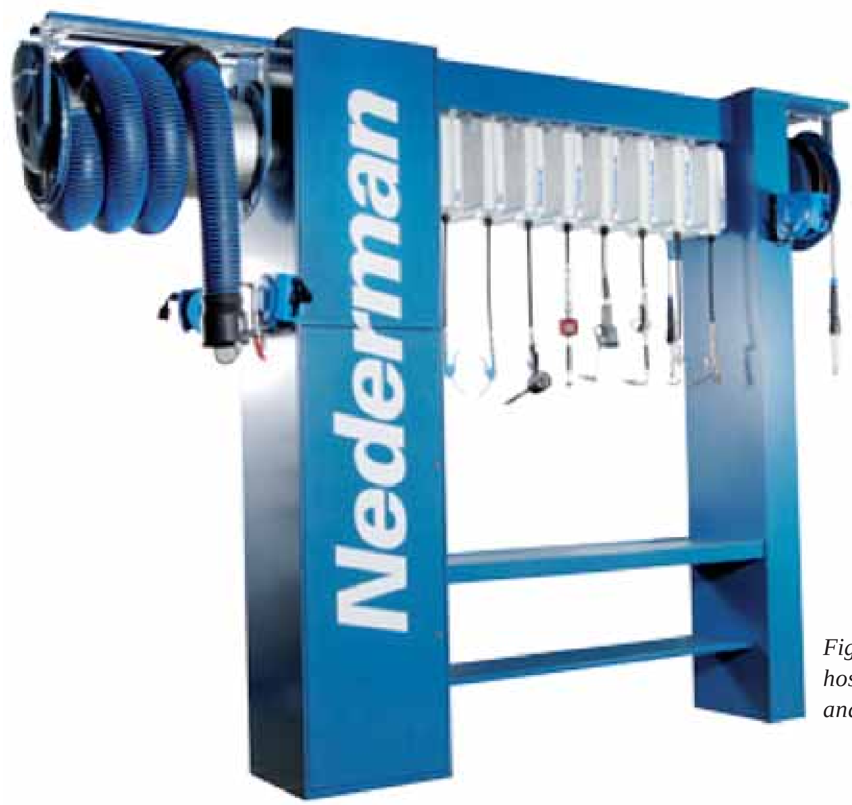


Fig. 3. Service tower fitted with hose reels for lubrication, fluid and vehicle exhaust extraction.

Fixed waste oil system

Nederman's fixed waste oil system consists of a unit with a swing arm with a funnel, and a rail that the swing arm moves along. The system can include one or more swing arm units. The rail is mounted with a small incline along the work pit, which makes the waste oil automatically flow to the end of the rail, where it is temporarily stored in an 80 l (17.6 gal (UK)) tank. From there the waste oil can either drain or be pumped into the central waste oil tank. When the system is not in use, the arm unit can be positioned out of the way along the pit wall, thanks to the swivelling funnel and the adjustable height of the arm.

Fig. 4. Oil pitt fitted with Nederman fixed waste oil system. Hose reels for air, fluid and power.

Storage tank and fluid pump

The storage tanks should be placed as close to the work places as possible to shorten the distance between the storage tank and the taping points. The service bays consume more fluids than the repair bays, thus it is recommended to place the tanks closer to the service bays.

Fluids with high viscosity such as grease should not travel more than 30 meters (98.43 ft) to be able to keep good pressure in the tapping. If the grease gun needs extra power, to open nipples or dispense large quantities of grease, the tapping point should be placed even closer to the storage tank.

The local regulations regarding storage of each type of liquid must be considered. This includes both the material and design of the tanks as well as the positioning. The tanks should also be positioned to assure easy access for tank replenishing.

The type of pump to be used for each tank depends on the number tapping points connected to the tank, the distance to the tapping points and the viscosity of the fluid.

The pump ratio is the relationship between the effective area of the air motor's piston and the effective area of the pump's piston.

Air operated multi-fluid pump.

Compression Ratio	1:1	3:1	3:1	5:1	5:1	6:1
Capacity, l/min (gal/min (UK))	18 (4.0)	12 (2.7)	20 (4.4)	14 (3.1)	40 (8.9)	23 (5.1)
Low viscosity fluids: various oil (SAE 15/20), hydralic fluid, gas oil and allied products, etc.	<15m (<49 ft)	50–100m (164–328 ft)	50–100m (164–328 ft)	100–200m (328–656 ft)	100–200m (328–656 ft)	>200m
Medium viscosity fluids: motor oil, gearbox oil (SAE 15/140), etc.	<15m (<49 ft)	50–100m (164–328 ft)	50–100m (164–328 ft)	100–200m (328–656 ft)	100–200m (328–656 ft)	>200m
High viscosity fluids: motor oil, gearbox oil (SAE240), etc.				50–100m (164–328 ft)	50–100m (164–328 ft)	100–200m (328–656 ft)
Medium and viscosity grease				<15m (<49 ft)		
Anti freeze fluid	<15m (<49 ft)	50–100m (164–328 ft)	50–100m (164–328 ft)			

Table 1.

Pipe work

It is important to carefully consider the layout of the building to find the shortest practical distance between the tanks and the tapping points. The pipe work can be installed in the ground, along the walls or in the ceiling. Ceiling mounted pipe work is often not possible in truck repair shops due to overhead cranes. The dimensions of the pipes depend on the type fluid and the distance to the furthest tapping point.

Media	Distance	Tube	Standard
Air	N/A	12 x1 mm	DIN
Oil	0–50 m (0–164 ft)	22 x 2 mm	EN10305-4
	51–100 m (167–328 ft)	28 x 2 mm	EN10305-4
	101- (331 ft)	35 x 3 mm	EN10305-4
Grease	0–20 m (0–66 ft)	20 x 3 mm	EN10305-4
	21–35 m (69–213 ft)	25 x 3 mm	EN10305-4
	26–60 m (85–197 ft)	38 x 4 mm	EN10305-4
Antifreeze	0–250 m (0–820 ft)	22 x 2 mm	EN1.4301

Table 2.

A: Air management kit
B: Oil Inlet
C: Pressure relief valve
D:Monitoring valve

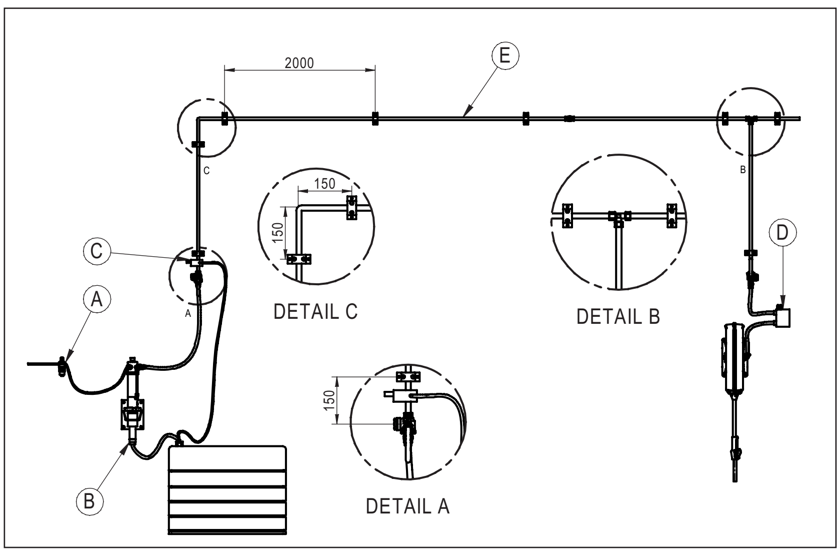


Fig. 5. Installation details for pipe work

Workspace

The tools needed in the work area can either be mounted on the wall or on a service tower. The service points in the vehicle repair shop need most types of fluids, the storage tanks should therefore be placed as close as possible to the service points. Repair bays need mostly air and electricity and can therefore be situated further away from the storage tanks. It is recommended to add the following tapping types in the waste oil pit; grease, transmission oil, gearbox oil, air and electricity.

Waste oil handling

The design of a fixed waste oil system is quite simple. However, one needs to consider the position of the waste oil pit in relation to the waste oil tank. It is recommended to position the waste oil tank lower than the temporary storage tank in the oil pit to be able to use gravitation to move the waste oil, otherwise a pump is needed. Secondly, one needs to decide how many waste oil connection trays are needed in the pit and make sure that the inclination of the rail has sufficient inclination to efficiently transport the waste oil to the temporary storage tank.

NMS installation

A NMS installation comprises the following components.

Tapping point valve unit

Each tapping point is equipped with a valve unit. The valve unit contains a solenoid valve, flow meter and pulse transmitter. The valve unit receives signals to allow tapping, measures the passed volume and returns the consummation to NMS. The valve unit is connected to an I/O cabinet via a 2 × 2 × 0.75 shielded cable.

Operator terminal

The operators use the operator terminal to start new work orders in NMS and to activate the tapping points. The work orders can registered using bar code readers. The operator terminal is connected to an I/O cabinet via a 2 × 2 × 0.75 shielded cable.

I/O cabinet

I/O cabinet (Input/Output) is the connection point for all the parts of the system. Several I/O cabinets can be connected via an SIOX bus (2 × 1 × 0.75 shielded), to allow for more valve units and operator terminals in the system. A maximum of four operator terminals can be installed in a single cabinet.

PC with NMS

The actual NMS software is installed on a PC with Windows XP professional or Vista Business and SQL 2005 express. When the system is installed all configuration is made in the NMS software. The NMS PC is connected to the I/O cabinet via a 2 × 2 × 0.75 shielded cable, a field bus converter and a serial cable.

Pump valve unit

The pumps can also be monitored by NMS. When no orders are active in the system NMS automatically shuts down the power supply to the pump via a magnetic valve unit on the compressed air, alternatively connector on the pump's electric engine.

An I/O cabinet needs to be installed in or close to the storage space. In case the storage space is classified as EX area, EX-certified equipment and/or EX-barriers must be used.

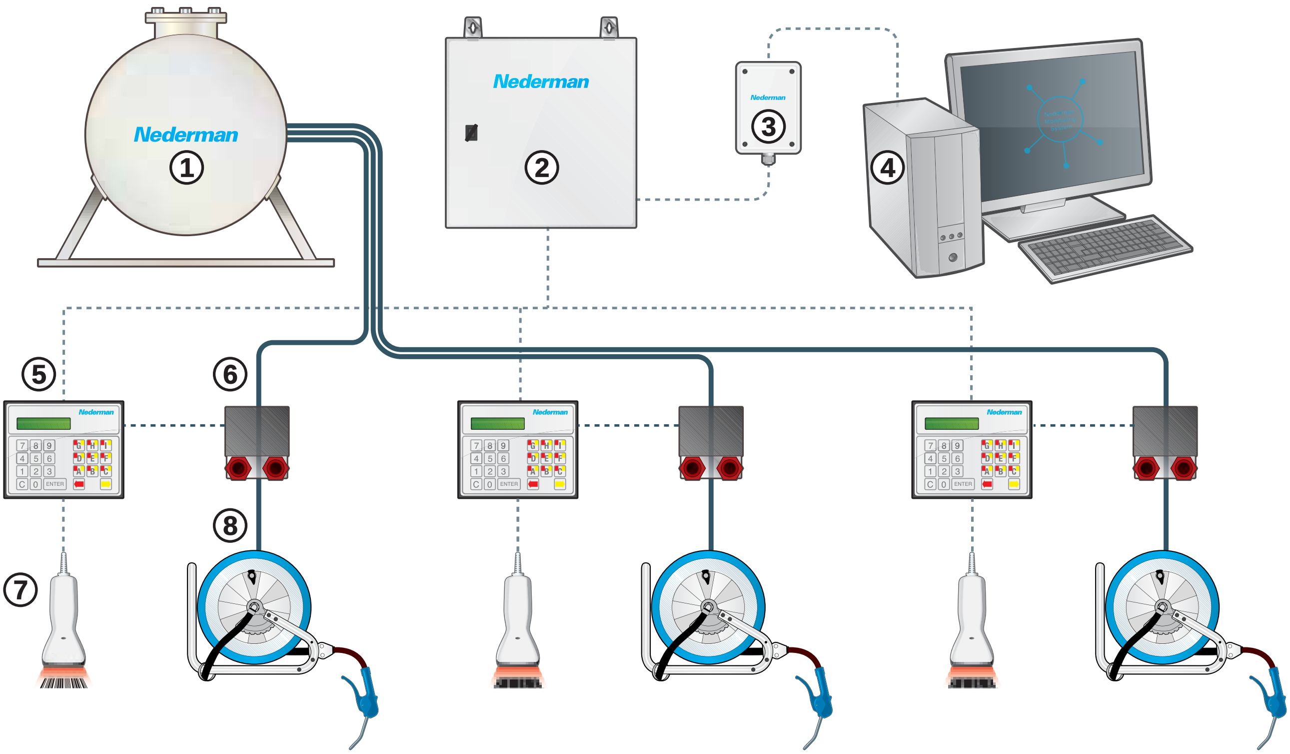


Fig. 6. Schematic overview of a fluid monitoring system.

1. *Tank with pump*
2. *I/O cabinet*
3. *Field bus converter*
4. *Customer PC (Not offered by Nederman)*
5. *Operator terminal*
6. *Tapping point valve unit*
7. *Bar code reader*
8. *Tapping point*

For more detailed information always contact your local Nederman Sales Company.

Nederman

Oil mist filtering

NEDERMAN ENGINEERING GUIDE

Oil mist filtering

All machining operations create oil mist to some extent. Oil mist is the aerosol that is often formed when oil is used as a coolant/lubricant during the machining of metal and some plastic components. Vaporising from swarf-container is also an issue. Emulsions normally contain 90 – 95% water and the remaining is soluble. The mist consists of aerosols from oil or oil/water emulsion. Mineral oil-based metalworking fluids are known as neat cutting oils or straight oils. Emulsions normally contain a number of undisclosed additives that will affect in different manners the human been.

Problems surrounding oil mist

It is well known that prolonged and repeated exposure to oil products can be harmful to health, which means that good ventilation must be ensured under all working conditions. Oil mist almost always results in oily premises, equipment and products. Modern metalworking machinery is often controlled by sensitive electronics and production is lowered by unplanned disruptions – caused by contaminated circuit boards. Handling equipment and pieces of products coated in a thin film of oil is not acceptable working practice and definitely not production-friendly. Removing oil mist is therefore essential for workplace to grant safety and cleanliness.

How to identify if there is an oil mist problem

In many cases the presence of oil mist is quite evident. In severe cases the oil residues are clearly visible on the floor and on the machinery. There is also a distinguishing odor wherever there is oil mist present. When machines are running oil mist might also be visual under the ceiling. To exactly measure the amount oil mist in the air, a device such as TSI DustTrak™ can be used. This is a common practice for Nederman.

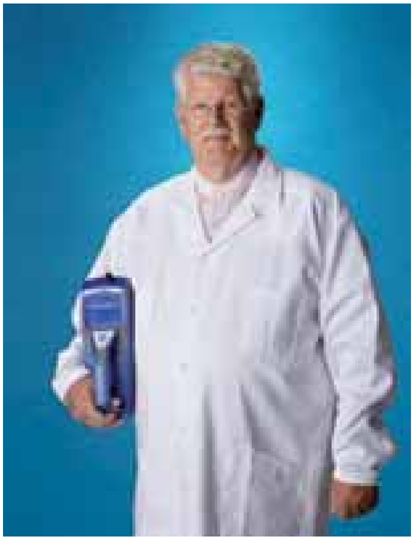


Fig. 1. DustTrak

The solution

The Nederman oil mist filters can be used in a process wherever oil mist is generated, from conventional machines to the latest high-speed CNC equipment. We offer highly efficient filter and extraction solutions for numerous operations, such as grinding, turning, machining, drilling.

High-speed machining is a growing trend and the equipment used creates even finer oil mists. Thanks to our latest developments in filter technology, contamination problems can be effectively dealt with, for instance in modern CNC lathes.

These machines operate at speeds of > 20,000 rpm or more and use high-pressure > (145 to 220 psi/10 to 15 bar) coolants. In situations like these, NOM filter units are the ultimate choice for oil mist removal.

The NOM filter unit cleans the air in up to three stages:

1. In the initial stage, contaminated air is drawn into the filter unit and turbulator plates separate out the relatively large drops of oil.
2. A washable main filter then removes up to 97.5 % (<PM10) of the particle content of the mist.
3. In an optional third stage a HEPA filter can remove practically all remaining traces of contamination. The discharged air will contain only 0.03% of its original oil content, which means that the extracted air could even be re-circulated into the workshop premises without causing any discomfort.

Filter selection

The Nederman range of oil mist filters NOM is designed for to use in conjunction with machining work where emulsions are used as the coolant/lubricant. (They can also be used in the metalworking press and stamping industry.)

If straight oil is used the filter-surface load must be within a certain limit 8 – 100 mg/m³ (50–624 lb/ft³) in the aerosol phase. Occasionally for certain applications a pre-separator is recommended. The viscosity of the coolant has to be considered in conjunction with the airflow. The degree of contamination (graphite) will affect the life time of the filter system.

Coolant viscosity ranges and suitability

Viscosity, mm²/s (ft²/s)	Emulsion	Straight oil
0–50 (0–538)	Suitable	Suitable*
50–100 (538–1076)	Suitable	Contact Nederman for further information
100–200 (1076–2153)	Contact Nederman for further information	Contact Nederman for further information
200 + (2153 +)	Contact Nederman further information	Contact Nederman for further information
*EU regulations specify 7 – 25 mm²/s (75–269 ft²/s)		

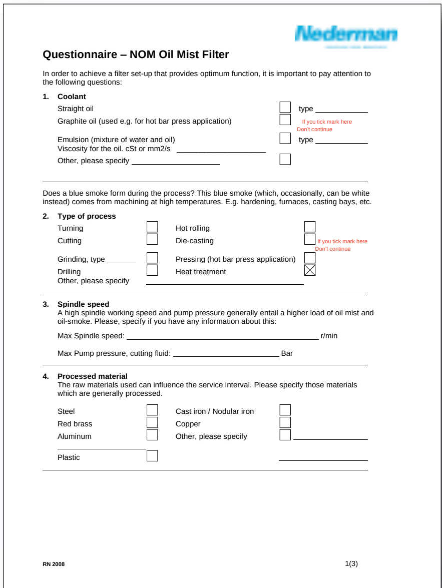
Table 1.

Nederman NOM 4

The NOM 4 is designed for single CNC machines with limited oil mist, enclosed cabinet.

Nederman NOM 11, NOM 18 and NOM 28

These filters are designed for applications with need for larger airflow capacities. In all metal fabrication with oil mist troubles, these filters will fit for single installations or into a cell of machines, which consist of several CNC machines connected to a nom filter in order to reduce the cost.



Questionnaire – NOM Oil Mist Filter

In order to achieve a filter set-up that provides optimum function, it is important to pay attention to the following questions:

1. Coolant
   - Straight oil ☐ type ______
   - Graphite oil (used e.g. for hot bar press application) ☐ If you tick mark here Don't continue
   - Emulsion (mixture of water and oil) ☐ type ______
   - Viscosity for the oil. cSt or mm2/s ______
   - Other, please specify ______ ☐

Does a blue smoke form during the process? This blue smoke (which, occasionally, can be white instead) comes from machining at high temperatures. E.g. hardening, furnaces, casting bays, etc.

2. Type of process
   - Turning ☐
   - Cutting ☐
   - Grinding, type ______ ☐
   - Drilling ☐
   - Other, please specify ______
   - Hot rolling ☐
   - Die-casting ☐ If you tick mark here Don't continue
   - Pressing (hot bar press application) ☐
   - Heat treatment ☒

3. Spindle speed
   A high spindle working speed and pump pressure generally entail a higher load of oil mist and oil-smoke. Please, specify if you have any information about this:
   - Max Spindle speed: ______ r/min
   - Max Pump pressure, cutting fluid: ______ Bar

4. Processed material
   The raw materials used can influence the service interval. Please specify those materials which are generally processed.
   - Steel ☐
   - Red brass ☐
   - Aluminum ☐
   - Plastic ☐
   - Cast iron / Nodular iron ☐
   - Copper ☐
   - Other, please specify ☐ ______

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Fig. 2. The Nederman NOM filter questionnaire, a helpful tool to select the right type of NOM filter.

The Nederman NOM filter questionnaire can be used and will be a helpful tool to select the right type of NOM filter. Please contact Nederman to receive a questionnaire. There we need the below mentioned information.

- Coolant
- Process
- Machine data
  - Max spindle speed (rpm)
  - Coolant pump pressure (bar)
  - Processing space (m^3)
  - Type of door
  - Door opening area (m^3)

- Manufacturing process
  - Cycle time (min)
  - Working hours/day
- Viscosity

Based on the input above the required airflow (m^3/h) and the recommended NOM filter(s) will be specified.

Installation recommendations

To ensure a well-functioning oil mist filtering with a long life time, the following recommendations should be followed.

Balancing the system

Investigate the routines to get full information regarding number of machines operating at the same time, size of machines, working hours a day (shift) and the cycle time. For frequently openings of the door (manually handling of tools, item, etc) an increased airflow is required in the opening period due to increased open areas. For automatic machines with normally closed doors it is necessary to delay opening of the door.

It is of primary importance to generate well balanced under-pressure so the oil-mist is removed and the bigger droplets of oil or emulsion stay back in the machine for recycling. Recommended air velocity is 0.2 m/s (0.66 ft/s) through closed machines. If the system has too much airflow, the grinding dust will come into the filter material and block the filter. The grinding dust should always remain in the machines. Open machines need a hood.

Example:

Scrap openings and other openings and gaps in a closed machine might give an area like 1.0 m² (10.76 ft²).
$1.0\ m^2 \times 0.2\ m/s \times 3600\ s = 800\ m^3/h$
$(10.76\ ft^2 \times 0.66\ ft/s \times 3600\ s = 470.4\ cfm)$

A totally open machine needs a column hood or an arm from the Nederman product range.

Ductwork

The recommended duct material is PVC, transfer or Spiro with silicon sealing. Hosing more then 1.5 m (4.92 ft) should be avoided. The Nederman oil mist filters are able to handle a temperature of around 60 °C (14 °F). If the temperature is higher the air has to be diluted with air from the surrounding environment using an adapter as seen in the figure to the right.

In order to eliminate bigger droplets to enter and saturate the filter, a T-connector with a drain should be installed before the filter inlet. The NOM 4 filter should be installed with a 90 degree elbow duct before the T-connector.

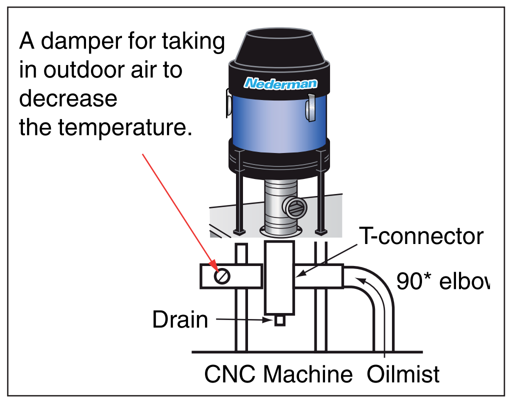

Fig. 3. Nederman oilmist filter, NOM 4 filter.

Fig. 4. Electric motor damper.

Electric motor damper

In some application it can be valuable to use electric motor dampers, Fig. 1, to control up-and down-time of a set of NOM filters. In general, when there is no activity in the machines or when the cycle time is short and frequent door opening is applicable and reinforced ventilation is necessary to avoid flush back of an oil-mist cloud when the doors opened. Always fit the damper horizontal to avoid small leaks from the shaft.

During operation with closed door the airflow can be reduced, i.e. with a motorised damper. Before the end of the cycle the airflow can be increased by opening of the damper. The reduced airflow will reduce the amount of extracted oil mist and oil vapors. The damper control could be connected to a dedicated output from the machine control system or from a signal from the coolant pump system. The position of the outlet in the CNC machine should be protected from direct oil injections, as from the chuck. Install adjustable dampers for each machine.

Recommendation for emulsions

Balance the airflow carefully. Make sure the filter cartridges never run with clean air through the filters. When running a filter unit with clean air, the filter will dry out and generate crystallising on the filter surface, and star blocking the filter. (Nederman filters can be cleaned with lukewarm water and hand dishwashing liquid, if necessary). Never leave the dirty filters unused for a longer period time. After a month, bacteria start growing.

Recommendations for straight oil

Applications with straight oil and high workload need a well balanced down time period for at least 2 × 30 min/24 hours for draining the filters. Or use 2 NOM in parallel with flush back system to shorten draining time and extend the filter life time.

For more detailed information always contact your local Nederman Sales Company.

Cutting Fluid cleaning and recycling

NEDERMAN ENGINEERING GUIDE

Cutting Fluid cleaning and recycling

Present and future trends in the cost of oils and cutting compounds requires the planning for recycling and reusing cutting fluids. Coolant management is the efficient means of looking after machining coolants. It requires the use of equipment to remove tramp oils, leak oils, and solids, and possibly for bacteria control.

Solids in the form of fine metal chips and particles from the machining process are the most common form of contamination. Tramp oils come from various sources such as lubricating oils from e.g. slide ways, hydraulic oils from leaking seals on hydraulic rams, cutting and corrosion prevention oils carried by the work piece and poorly mixed or poor quality coolant concentrates. Other contaminants that may require removal are metal soaps, flocculated material, bacterial slime, fungal growths.

The big advantages of coolant management are, longer lasting coolant, the reduction of waste, less machine down time, extended tool life, improved surface finish, less frequent machine cleaning, less risk of coolant pipe blockage and automatic top up of machine tools. Coolant management also improves the work environment by the reduction of bad smells and the reduction of risks of skin infections and other health problems.

Coolant management can be used in almost every machining application that use water based emulsions as coolants, wash fluids, de-burring fluids and grinding fluids. It can be applied as a single piece of equipment for a specific machine or as a compilation of equipment for a number of machines.

The most important first step coolant management is to avoid mixing different types of cutting fluids. Mineral oil coolant must not be mixed with water soluble coolant. Parallel systems for processing mineral oil and water soluble are therefore the norm. Heavy mineral oil coolants are readily purified by settling and simple filtration means to a degree permitting reuse. Water soluble coolants may be collected in a central system, treated, and purified for reuse.

Solutions

Nederman offers several solutions for both coolant filtration aimed at removing solids as well as tramp oil separation. The solutions can be a system connected to a single machine or a central system serving a group of machines.

Coolant filtration

Centrifuge clarifier	Suitable for Grinding, Honing, Superfinishing and other fine finish applications. Cleans down to 5 microns.
Rotary drum filter	Filtering of non-ferrous and ferrous materials at flow rates between 100–1000lpm. A filtration down to 30 micron is supported.
Magnadrum clarifier	The Magnadrum" continuously removes magnetic particles from the flow of liquid and deposits them into a bin. The system is ideal for production machine tools cutting and grinding ferrous materials and will cope with high rates of swarf production. The equipment is often married to other clarifiers acting as a very efficient prefilter.
Hydrostatic clarifier	The Hydrostatic Clarifier is a versatile filter that handles flow rates between 100–2000 lpm and filters down to 10 µ when a fine filter media is used.
Universal clarifier	Universal Clarifier continuously removes solid particles from water based emulsions and other light viscosity liquids.

Oil/Water Separation

Hyde tilted plate separator	The Hyde Tilted Plate Separators both filter sludge and separates free oil from coolant or water.
Tramp oil separator	Tramp oil removal from oil-based, semi-synthetic and synthetic coolants along with alkaline wash waters.

Perpetuum system

The fundamental idea with the PERPETUUM system is to achieve an automatic system which is able to drain off and continuously remove tramp oil from the different machine tools. The system receives a small part of the flow from each machine tool, removes the tramp oil and drains off the coolant before it is delivered back to the machine tool. The Perpetuum system cleans coolant from tramp oils, contamination and bacteria and will give greatly extended life to coolants. The system has a built-in mixer, which replaces evaporated, or otherwise missing coolant. The system may also be equipped with devices to analyze the coolant concerning concentration, pH and temperature.

Fig. 1. The ***Perpetum System*** *connects to several machines, continuously removing bacteria. This system reduces the number of necessary coolant changes by more than 90%.*

Presto system

The Presto system is so called a full-flow system. The general design and function is similar to the Perpetuum system, but instead of taping off a small portion of the cutting fluid everything is brought to the separation process. The full-flow system enables us to combine the cutting fluid cleaning with the collection and transportation of chips and swarf from the machines.

In addition to the parts needed in the Perpetuum system the Presto system may need Crushers to reduce the size of the swarf to prevent blockage in the pipes. The Presto system carries a much large amount of chips and sludge, why the sediment tank should be fitted with a sludge scraper to automatically remove sediment from the tank.

Fig. 2. Coolant Filtration Systems
Our coolant cleaning solutions cover most operational requirements. This includes the Presto System that delivers coolant to two or more machine tools of the same type.

The Presto system requires large tanks, to be able to properly sediment and clean the cutting fluid. If the tanks are too small the speed of the fluid through the system will be too fast resulting in poorly cleaned cutting fluid and the risk of over heating the fluid. Heated (above 20–25 °C (68–77 °F)) fluid may result in increased bacteria growth in the cutting fluid, unnecessary evaporation, and temperature expansion in the work pieces, which will lead to poor tolerances.

If the removal of chips and swarf will be handled separately from the cutting fluid cleaning process, the Perpetuum system is the more cost efficient solution, since it works with a smaller amount of fluid and therefore requires much smaller tanks.

Design questionnaire

When it comes to cutting fluid cleaning and recycling it is difficult to define standard but easy to understand design rules. The answers to the following questionnaire will give our design engineers the input needed to deliver a well functioning system.

	Design questionaire
1	Will the system be used for cutting fluid cleaning only or used for material transport as well (Perpetuum/Presto)?
2	How many machines are there and are there plans to expand?
3	Describe the general layout of the premises and the placement of the machines.
4	What types of machines will be served?
5	What types of cutting fluids are handled?
6	What types of material are processed? (Governs the choice of filter, drum/hydrostatic.)
7	What are the sizes of the machine coolant tanks? (Governs the flow rate of the system, normal sized machines 20 liters/min. (4.4 gal– (UK))
8	Cutting fluid volume? (Affects the size of the filter. If the volume is not known, you can simply measure the time it takes to fill a bucket.)
9	Local or Centralized filtering?
10	Define what type of pump station is suitable for each machine. Is there enough room to install the pump station in the existing machine tank or is an additional tank needed?
11	Is there enough room to install the central system?

*The extracted material can be separated and collected in a container, bin or a big bag before it reaches the filter and the bin. The material might be used in a recycling process.

For more detailed information always contact your local Nederman Sales Company.

Nederman

Metal Chip and Scrap Handling

NEDERMAN ENGINEERING GUIDE

Metal Chip and Scrap Handling

Efficient material transport is vital in any modern machining operation. The most primitive method, used in many shops large and small, is to allow chips to accumulate in the base of the machine until the operator manually rakes them out in self defence and packs them into a container, for further processing. The manual handling is both time consuming, costly and may pose risks for injuries.

With Nederman transportation solutions the process can be automated and the following savings can be achieved; savings in internal transportation costs, no danger of injury, clean working areas and great flexibility.

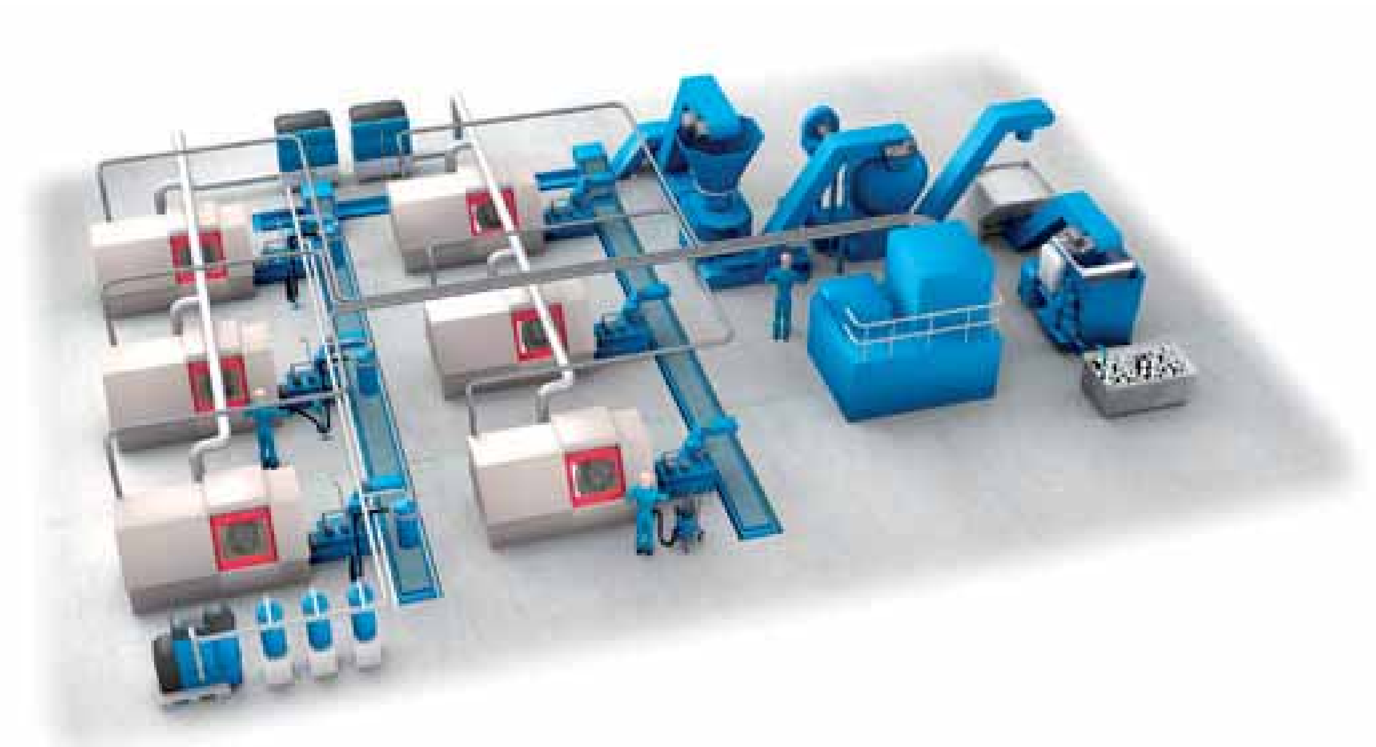

Fig. 1. Overview of machining operations with metal chip and scrap handling equipment.

This chapter will focus on transport of chips and scrap from metal machining operations and is limited to those commonly used by metal working manufacturers. Nederman does design and build such systems for many other types of material transportation tasks, and will provide details on request.

Three means of transportation are covered in this chapter; vacuum transportation, conveyor transportation and fluid transportation. A complete transportation system is often made up of a combination of these transportation types. The typical system will include equipment for under-floor collection of scrap, elevation of raw scrap to crusher, crushing, elevation of crushed scrap to centrifuge, centrifuging, and finally elevation and discharge of scrap to containers, carriers, or storage bins.

Fig. 2. High vacuum unit (portable).

Fig. 3. High vacuum unit (stationary) with pre-separator.

Vacuum transport

The main task of a vacuum transportation system is to by means of vacuum automatically remove metal chips from the machine tools and to transport them, via piping, out of the production line to a collection point. The Nederman vacuum transportation system can be connected to almost any production plant. It can also be integrated later into already existing production facilities. All components of Nederman vacuum transportation systems are mounted on the factory floor and the pipes hang from the ceilings.

High Vacuum Unit

The high vacuum unit builds up the vacuum and supplies the transportation air needed in the pipe system for chip transportation. The key criteria for selecting the high vacuum unit are the material type, the longest distance from the unit to one of the machine tools and the number of machine tools served. The standard Nederman units can serve up to 20 normally sized machine tools. If more machines are served additional vacuum units are needed.

Pre-Separator

The pre-separator receives the metal chips and decelerate the speed of the chips to stop them. It serves as the central collection point for the metal chips and dumps them into an adjacent bin, conveyor, or chip processing system. Two units are recommended in the system to be able to maintain the vacuum pressure even when one of the units is emptied. The size of the pre-separator depends on the volume of chips to be handled. Smaller units require more frequent emptying, which in turn reduces capacity of the system. When cast iron chips are to be transported the system should be equipped with a coarse grain separator in stainless steel.

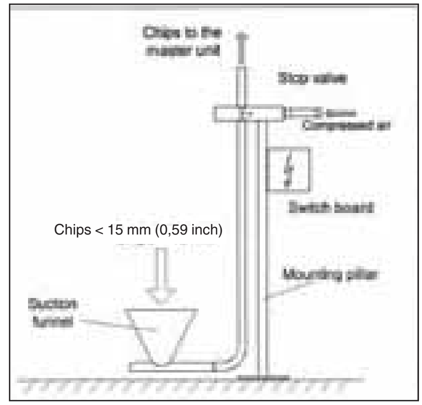

Fig. 4. Hopper-Type suction Vacuum

Vacuum Station

The vacuum station is the actual inlet of the vacuum system. It is built up of two components, a valve and a suction sluice, and an electrical cabinet. The suction sluice is fitted against the conveyor of the machine tool to receive the chips or to a crusher if necessary. The suction sluice can either be a simple chip collecting hopper Fig. 4 or a hopper fitted with a screw Fig. 5.

In the Nederman design, the valve is always a knife gate valve. If the metal chips are relatively loose and ALL chips are shorter than 15 mm, a simple chip collecting hopper may be used as suction sluice.

In case some of the chips are longer than 15 mm (0.59 in), but shorter than 30 mm (1.18 in) a Screw type suction sluice is used. Screw-Type, vacuum station Fig. 5, 6.

When longer chips than 30mm occur, a crusher should be installed between the machine tool conveyor and the Screw Type Suction Sluice. See next section. A vibrating grid to protect vacuum system from occasional bar ends may also be deployed at the vacuum station.

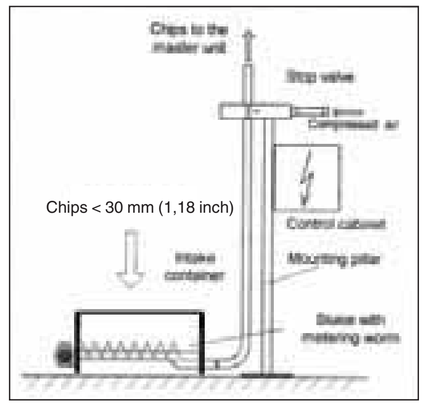

Fig. 5. Screw-Type Vacuum Station.

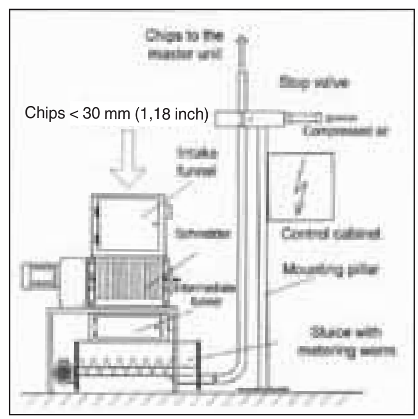

Fig. 6. Vacuum Station with Crusher.

Pipe work design

The pipe work includes a main pipe for transportation up and connecting pipes for connection to each vacuum station. For the main pipes 100 mm (3.94 in) diameter sized pipes are used. As for the “feeding”

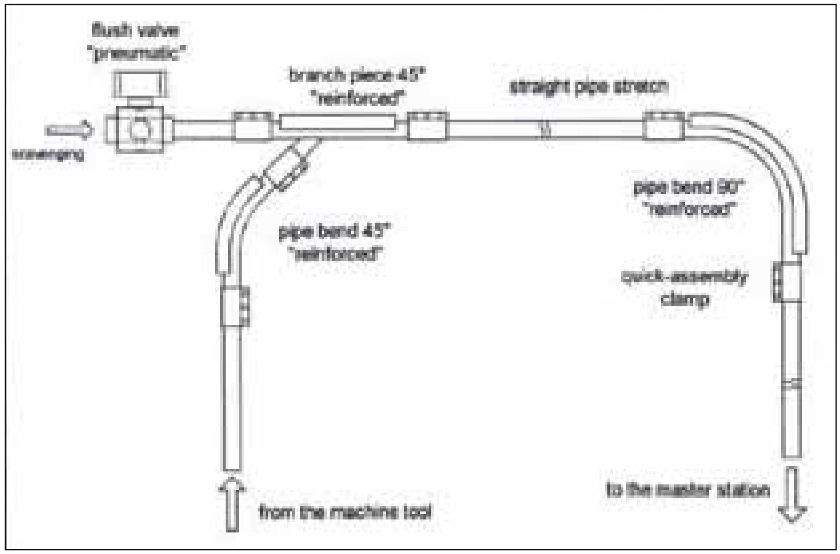

Fig. 7. Schematic drawing showing suitable pipe work design with reinforced bends and branch piece.

pipes connecting to the vacuum station and machine tools 76 mm (3 in) diameter is used. The pipe work consists of straight pipes, branch pieces and bends. Due to the abrasiveness of metal chips, the straight pipes are made of steel. Bend and branch pieces and are always re-enforced with so called chip boxes in order to withstand the abrasion of the metal chips. The thickness and geometry of the pipes depends on the type metal transported. For brass 1.2 mm (0.05 in) thick pipes are used. Bends are re-enforced with chip boxes. Steel and some Aluminium Alloys are more abrasive than brass. For this reason re-enforced pipe works with 3.0 mm (0.12 in) thick pipes are used. Bends should have a wider radius of 550 mm (21.6 in) and are made in high-grade steel. For other materials contact Nederman.

Optional Cleaning Equipment

As an added benefit of the vacuum transportation system, cleaning equipment consisting of a valve, hose and a fastening device can easily be deployed at some or all of the vacuum stations. The cleaning equipment can be used to remove metal chips from the floor around the machine tool or on the machine bed.

Conveyors

Conveyors can be used for material transport as a stand alone solution or in conjunction with vacuum transport, e.g. as feeders into the vacuum system.

Fig. 8. Hinged steel belts.

Individual chip conveyors may be placed in the machine tools, eliminating the manual labour of removing the chips. These conveyors can in turn either empty into local containers or into conveyors which form part of a collection system. One advantage of this method is that bar ends and other foreign matter can be picked out of the machine base and prevented from getting into processing equipment which can be damaged. The following types of conveyors can be considered

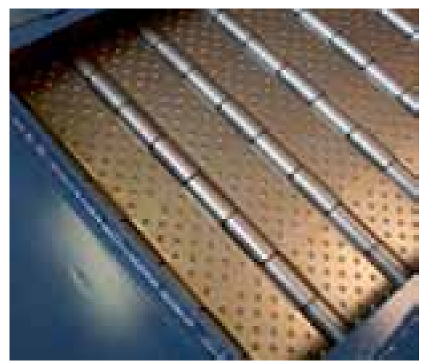

Fig. 9. Modular steel belt conveyors.

Hinged Steel Belt Conveyor

Hinged steel belt conveyors are the most commonly applied type of conveyor. It may be used to transport chips and metal scrap out of the machine as well as for longer haul transportation to a central collection point.

The advantage of the steel belt conveyor is its wide application span. However, it is not suitable to use when there is a high percentage of fines or sludge in the material to be transported. In this case a drag chain conveyor or screw conveyor is more suitable.

Drag Conveyor

Drag conveyors make excellent collection conveyors where the chips are fine and there are no long curly chips whatever. However, even a small quantity of long curly chips will tend to jam a conventional double chain drag conveyor and cause a great deal of maintenance and down time.

Fluid

Chips and swarf from machining operations may also be transported via the coolant in a full flow Presto system. The individual machine tools can be provided with open bottom bases to permit all scrap, tramp metal, etc. to drop into the collection conveyors directly along with all coolant liquid. This arrangement is efficient in many ways and eliminates the need for individual cleanout conveyors on the machine tools. It does require a central coolant treatment and return supply system. The "drop-through" system, while generally more efficient and more suitable to high production, does create serious consequences in the event of a shut down because there is no storage capacity for chips and coolant in the bases of the individual machines.

Read more about coolant cleaning in section 'Cutting Fluid cleaning and recycling' in this book.

Defining the problem

In order to enable Nederman to correctly analyse the transportation task and provide the best possible solution the following checklist has been created. Because the scrap collection system is not easy to change or increase in capacity once it has been installed, capabilities and capacities should be estimated on the basis of expected rates at a future time – say 5 or 10 years ahead.

	Memorandum
1	How many Machine Tools should be handled and what is the longest distance to the Machine Tools?
2	What material type should be transported (Alu, Brass, Mild Steel, other)?
3	What is the shape and size of the metal chips and do bar-ends occur?
4	Types and quantities of scrap to be handled and processed
5	Process rate – surge loading
6	Method of scrap collection in the plant
7	Method of loading out and transporting scrap from the plant
8	Location of reclaimed cutting fluid storage
9	Determination of pollution and safety regulations that will influence system design
10	Consideration of noise problems
11	Location of the processing equipment
12	"Garbage" scrap (mixed metals and mixed oils which are not worth reclaiming) – method of disposal
13	Building limitations – water table limitations on trenches
14	Overhead clearance heights, fixed locations of basic
15	Equipment, esthetical considerations.

For more detailed information always contact your local Nederman Sales Company.

Nederman

Metal Chip and Scrap Handling

NEDERMAN ENGINEERING GUIDE

Metal recovery / Swarf handling

Machining operations have an unwanted and costly by-product, metal chips and swarf. But there are ways to minimise the cost for chips and swarf. One way may be to improve the initial shape of the work piece, hence reducing the amount of chips and swarf needed to be removed during the machining process. Another way may be to raise the value of the resulting chips and swarf and to lower the cost of the chip and swarf handling. The main ways of increasing the value of swarf is to minimise contamination with other metals, cutting fluids and rainwater and to minimise the volumes of the recycled material to lower the transportation and handling costs.

Fig. 1.

Individual non-ferrous metals and stainless steel can command a significant premium. Returns on carbon steel are currently small and mixed metals may have no value or even require payment for their removal. To meet specifications for individual metals, contamination of swarf with other metals needs to be avoided.

Swarf is frequently contaminated with cutting fluids, either neat oil or emulsions. Even well-drained swarf still typically contains 5 – 10% contamination. Wet swarf has to be dewatered by the scrap metal dealer or recycler. Swarf with a higher oil content is usually sold at a lower price to a scrap metal merchant. If you separate your cutting fluids on-site, you may also be able to re-use them yourself and thus reduce your purchase costs for cutting fluids.

Skips of swarf left out in the rain will become contaminated with rainwater, leading to a need to dewater and dry the swarf before it can be processed. This will reduce the price paid for the swarf. Rainwater can also cause oil sumps linked to bunded storage areas to overflow, leading to contamination of soil and water sources with oils.

A properly designed and sized swarf handling system will reclaim valuable oil, upgrade the value of metal scrap and reduce handling and hauling costs. These savings will normally pay for a complete system very rapidly. The system normally consists of a crusher to reduce the size of the swarf, a wringer to de-oil wet swarf and finally a briquetter to create briquettes, which have a higher value.

Fig. 2. Swarf Handling and Processing The integrated system crushes the swarf, de-oils the chips and recovers coolant.

Crushing

The purpose of crushing is to reduce the size of the swarf for easier handling and transport. Crushing is also necessary to do before briquetting. Ring type horizontal shaft crushers are the most familiar type of machine used to reduce turnings and borings to a chip size suitable for continuous centrifuging. However, this type of crusher is very sensitive to wads or bundles of chips which will cause it to stall and jam very easily. The size of the bundles which are commonly developed in a small automatic screw machine shop are tough enough to jam ring type crushers with 300 HP or more. Such jams do a lot of structural damage to the crushers, as well as causing unscheduled system shut-downs.

In most industrial applications where the tonnage of scrap is relatively small and the bundle size is relatively large, the ideal answer is a vertical axis turnings crusher which nibbles away at the bundles gradually reducing them to shoveling chips. The Nederman vertical shaft crusher is really more of a grinder than a crusher, almost like a coffee grinder. There is no major metal cutting or shearing actions and there is no need for sharp knives and the crusher operates at low revolutions.

Most chips from machine shops contain some amount of bar ends, tramp metal, and foreign matter. A high frequency of large parts will create big problems in a chip processing system. A low frequency of small parts will pass through the processing equipment with little or no damage. Long chips from e.g. turning operations tend to be tamped together in individual containers to form large bundles. When these bundles contain large scrap parts or tramp metal, the problem is at its worst. A good scrap collection system, on the other hand, will provide for automatic mechanisms to extract bar ends, tramp metal, and foreign matter.

Vertical axis crushers will pass through bar ends below a certain size, and will automatically shut down when the bar ends are above that size. As long as this does not occur too frequently, no further protection against bar ends is required. On the other hand, if the system is continually shut down due to bar ends, it is necessary to try to impose some discipline on the manufacturing processing.

Heavy bar ends will absolutely destroy a ring type horizontal shaft crusher in a very short time, even though the crusher is fitted with a ballistics hopper to bounce the bar ends out of the stream of chips. This makes them a limited option as it often is very hard to remove bar ends from long or bushy swarf.

Fig. 4. Swarf Centrifuge
Separates effectively coolant from chips via a high speed centrifuge.

De-oiling

After the crushing the resulting chips should be de-oiled to remove any remaining cutting fluid. The purpose of the de-oiling is both to be able to have dry chips, with a higher value and to recuperate the cutting fluid for re-use in the machining operations.

Fig. 3.

Fig. 5. The Perpetum system *connects to several machines, continuously removing bacteria. This system reduces the number of necessary coolant changes by more than 90 %.*

Fig. 6. Conveyors
We have a conveyor for every need: Belt Conveyors, Magnetic conveyors, Drag Conveyors and Vacuum Conveying Systems.

Fig. 7. Briquetting
Presses chips from machining into cylindrical briquettes and recovers coolant.

Constant RPM continuous centrifuges are now the most popular choice for wringing the fluids from the crushed chips. These are available in both vertical axis and horizontal axis type. The horizontal axis type has the advantage of removing the drive machinery from the processing area, permitting easier maintenance. Also, the wear parts of the centrifuge are more accessible, and the horizontal axis centrifuge will let remaining chips and the sludge which is normally entrained with the coolant drain out of the centrifuge when stopped.

Briquetting

In large operations, particularly those involving foundries, it may be desirable to briquette the processed scrap for more economical melting operations. While centrifuged cast iron or steel turnings can be formed into briquettes successfully, the inclusion of more than 1% of oil or water by weight is considered detrimental due to air pollution problems. Therefore there is a growing trend to further process scrap either by thermal drying or detergent washing in order to provide briquettes of the highest quality and the lowest melting cost. Nederman is experienced in providing such systems, and is in a position to advice as to the desirability of adding such treatment in specific situations.

Design considerations

It is quite difficult to give any specific design rules when it comes to swarf recovery. However, it is important to get a very clear picture of the situation to be able to design well working solution. Because the chip collection and chip processing system is not easy to change or increase in capacity once it has been installed, capabilities and capacities should be estimated on the basis of expected rates at a future time – say 3 to 5 years ahead. A suggested checklist of estimates and decision to be made is as follows:

	Memorandum
1	Types and quantities of scrap to be handled and processed
2	Process rate-surge loading
3	Process requirements – collect, crush, wring, store
4	Method of scrap collection in the plant
5	Method of loading out and transporting scrap from the plant
6	Location of reclaimed cutting fluid storage
7	Determination of pollution and safety regulations that will influence system design
8	Consideration of noise problems
9	Location of the processing equipment
10	"Garbage" scrap (mixed metals and mixed oils which are not worth reclaiming) – method of disposal
11	Building limitations – water table limitations on trenches – overhead clearance heights, fixed locations of basic equipment and esthetic considerations.

The main purpose of the preliminary layout is to take some account of all of the factors noted above, and to define the problem in a clear and graphic manner. The routing of collection conveyors, proposed pit depths, drainage plans, access for containers and trucks, location of storage hoppers and storage tanks, provision for handling rail cars if any should be indicated.

For more detailed information always contact your local Nederman Sales Company.

Nederman

Dust extraction and Cleaning

NEDERMAN ENGINEERING GUIDE

Dust extraction and Cleaning

Many industrial processes generate contamination to the air in form of dust and particles. Airborne dust and fine particles can be hazardous to the human health, and should be extracted at the source before it reaches the breathing zone. Typical sources are dust from cutting, grinding, sanding, handling of powders in food, and pharmaceutical industries. Textile, wood and composite working may also release dust and fibers that are harmful to human lungs and can cause allergic reactions by penetrating the skin. Nederman offers three types of extraction solutions for dust; extraction arms, on-tool extraction and cleaning applications.

Extraction hoods with flexible arms

The Nederman extraction arms are especially suitable for light airborne dust and cover a wide variety of applications. A typical application is extraction of dust when handling different types of powders. The arms are fully flexible in all directions and easy to position, thus covering a large working area.

Nederman offers a wide range of arms in different designs, arm lengths, hose diameters and various hood designs. Different attachments are available for wall, ceiling or extension bracket mounting as well as a number of accessories, including hoods and dampers to improve efficiency.

The arms are connected to a fan and dust collector system removing the contaminants from the extracted air so that it can be returned to the atmosphere or recycled without negative effects. The extraction arms can be combined with the Nederman Extension Arm for extra reach or the Nederman Fume Extractor trolley (on rail) which opens the possibility of serving several working places.

See the Nederman Product Catalogue for further details.

Fig. 1. NEX-arm, specially designed for working environments with explosive dust.

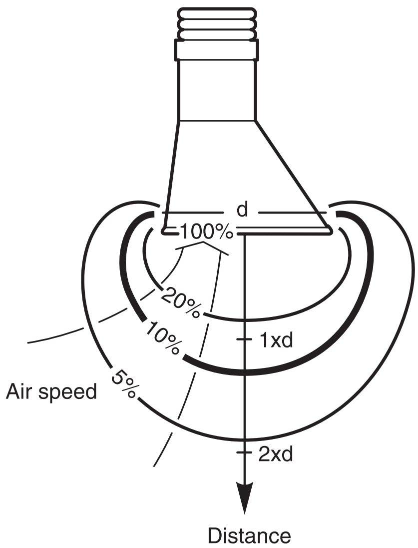

Fig.2 Airspeed.

See section 'Low vacuum calculation' in this book to learn how to design a low vacuum extraction system.

Positioning of the hood is important

Proper positioning of the extraction hood is important for effective fume extraction. A hood is intended to be positioned so that the fumes will be drawn away from the worker's breathing zone.

When using an air exhaust hood, air is drawn into the hood from all directions. Fig.1 shows that the air velocity decreases rapidly as you move farther away from the hood inlet. The optimum distance the hood should be positioned away from the work is variable due to specific conditions such as movement of air in the room, the amount of airflow through the extractor and the design of the hood. As a general rule, an exhaust hood should be placed within the distance of two hood diameters from the source of contaminants to be effective. The Nederman extraction arms use low vacuum extraction.

On-tool Extraction

Cutting, grinding and sanding produces large amount of dust. For these types of applications, on-tool extraction is the most efficient way to capture dust and particles. The dust is extracted at high speed directly from the tool, thus avoiding extracting large air volumes and above all the pollutant is not spread around in the room. On-tool solutions also are also flexible, allowing the operators to work over larger areas.

Nederman offers a wide range of on-tool extraction kits, see Fig. 3 (Attachment kit) for more than 600 tools for cutting, grinding, sanding etc. Attachment kits are available for both electric and pneumatic tools. Table 1 shows the airflow need for different types of on-tool extraction.

Application	Airflow, m³/h (cfm)
Welding-on-torch 160 – 250 A	80 (47)
Welding-on-torch 315 – 500 A	125 (74)
Welding nozzle Ø 40 mm (1½")	200 (118)
Welding nozzle Ø 50 mm (1¾")	250 (147)
Welding nozzle Ø 63 mm (2¼")	400 (235)
On-tool sanding Ø 25 mm (1")	125 (74)
On-tool grinding Ø 25 mm (1")	125 (74)
On-tool grinding Ø 32 mm (1¼")	200 (118)
On-tool grinding Ø 38 mm (1½")	250 (147)
Bench grinder 2 x Ø 38 mm (2 × 1½")	400 (235)
Bench grinder 2 x Ø 50 mm (2 × 2")	400 (235)
Belt grinding machine 1 x Ø 63 mm (2¼")	400 (235)
Cleaning Ø 38 mm (1½")	250 (147)
Cleaning Ø 50 mm (1¾")	400 (235)

Table 1.

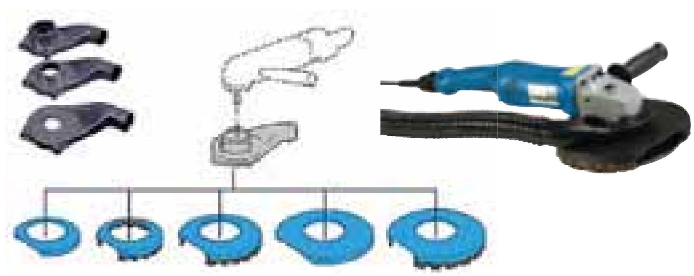

Fig.3 Extraction kit mounted on a fibre disc sander.

The airflow is used when calculating the capacity need for the high vacuum extraction system.

For more detailed information about high vacuum calculation, see section 'High vacuum calculation' in this book.


Fig. 4.

Heavy duty applications

Vacuum extraction can also be used for cleaning and transport of abrasive or bulky material, such as wood chips, and metal swarf. Nederman offers robust and extremely powerful cleaners, built for tough applications in heavy industries. Combined with high-efficiency cyclones and pre-separators they build a powerful cleaning system. Please contact Nederman for further advice on heavy duty extraction systems.

Ejector vacuum cleaners

The ejector vacuum units have no moving parts which results in a maintenance free, long lasting, easy to use product. The EX-application of ejector vacuum cleaners are especially recommended in explosive environments, since they do not have any moving parts and are powered with an external air compressor. The ejector vacuum cleaners are available in a wide range of models, mobile or fixed. See the Nederman Product Catalogue for further details.

Pre-separators

The pre-separators separate liquids and big objects to prevent them from going into a stationary piping system and destroying or clogging the main filter. The pre-separator captures coarse materials, metal chips, cans and cutting fluids preventing clogs in the piping system. Pre-separating near the work station prevents wear on piping system. See the Nederman Product Catalogue for further details.

Condition	Remark
Titanum dust	Self-igniting contact Nederman!
Magnesium dust	Self-igniting contact Nederman!
Aluminium dust	Risk of dust explosion depending on application – ask for specialist advice!
Textile	Risk for clogging up filter and pipes – use preseparators!
Liquids	Risk for clogging up filter and pipes – use preseparators!
Big materials wood industry	Risk of clogging up pipes!
PVC-pipes	Do not use PVC-pipes! Risk of static electricity!
Plasma cutting fumes	Risk of clogging up filter – ask for specialist advice!
Different applications	Do not mix too many applications with a too big difference of vacuum need!
High temperature	Gas welding – melting hoses ask for specialist advice!
Spiro pipes	Risk for flat pipes. Higher pressure drop. Leakage.
Explosive dusts	ASK FOR SPECIAL ADVICE

Dust explosions

A dust explosion is the rapid combustion of a mixture of dust and gas – usually air. Many types of dust, metallic or organic, may be explosive. Potential ignition sources are also important to assess. For example, sparks from grinding or welding, electrical sparks, and glowing material from the work process. Also see 'Handling equipment for potentially explosive dust'.

For more detailed information always contact your local Nederman Sales Company.

Nederman

Odour and gas extraction

NEDERMAN ENGINEERING GUIDE

Odour and gas extraction

Schools, laboratories, health clinics and medical research institutions are workplaces that benefit from bench top extraction of odour and gas. The use of bench top extraction equipment is extremely effective in minimising exposure to odour or gas and is the preferred method for reducing airborne concentrations odour or gas.

Bench top extraction of fumes, vapours and light dust is often used in small scale or light industrial applications such as soldering and gluing or working with solvents.

Schools, laboratories, health clinics and medical research institutions are some of the workplaces that can benefit from these solutions.

Bench top extraction arms and accessories

A customised bench top extraction system consists of an extraction arm, always with a mini hood, completed with different accessories such as brackets, extension arm, reducers, hoses etc. A bench top extraction system can be connected to a single fan/filter, or to a central fan/filter system. Nederman also offers extraction arms with anodised aluminium with increased corrosion resistance against solvents.

The Bench Top extraction arms are also available as kits, including extraction arm with hood or nozzle, a fan with speed control and a standard filter, a hose, connection details, and mounting bracket.

Detailed product information about bench top extraction can be found in the Nederman Product Catalogue.

Fig. 1.

Positioning of the extraction arm

All Nederman extraction arms are simple to position, extend and retract. Different attachments are available for wall, ceiling or extension bracket mounting as well as a number of accessories, including hoods and dampers to improve efficiency.

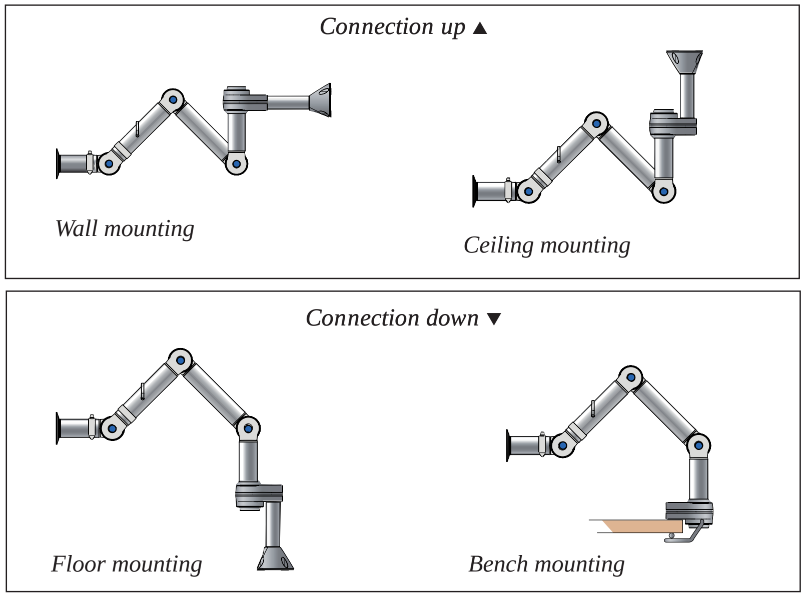

Fig. 2. Mounting alternatives for extraction arms.

When using an extraction hood, air is drawn into the hood from all directions. Fig. 3. shows that the air velocity decreases rapidly as you move farther away from the inlet. The optimum distance between the hood and the work is variable due to specific conditions such as movement of air in the room, the amount of airflow through the extractor, the design of the hood and the size of dust particles, if present. However, as a general rule an exhaust hood should be placed within the distance of two hood diameters from the source of contaminants to be effective. See fig. 3.

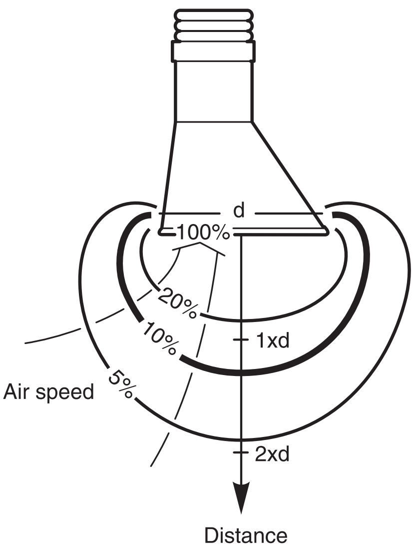

Fig. 3. Airspeed decreases rapidly with the distance from the inlet.

Carbon filter

The extracted air is filtered through a carbon filter that absorbs smells, gases, smoke and organic solvents such as toluene and methyl ethyl ketone. Non organic chemicals and acids can seldom be filtered efficiently. The solvents should have a molecular weight over 50. Lighter molecules will not be absorbed very well and the life time of the filter will be very short. The molecular weight is found on the data sheet for the chemical. Carbon filters cannot handle dust. If there is dust present a pre-filter suitable for dust must be used.

The filters may not be used with toxic chemicals. There are two reasons for this. The extractor arms can not capture 100% of all fumes and a filter that is saturated may blow toxic chemicals in the air. This may harm the operator. The solvents must also have a clear smell, as we depend on the smell to detect that the filter is saturated.

The concentration must never be so high that there is an explosion risk. Too high concentration will also make the filter life time very short. You can not measure pressure drop over a carbon filter to calculate the life time. A saturated carbon filter will have the same pressure drop as a new one. The carbon can absorb 10–25% of its weight before it is saturated, so one way to determinate is to weigh the filter and compare the weight between a new and saturated filter. If you know the concentration and the air flow, this can be used to estimate the filter life.

Fig. 5. Nederman FilterCart Carbon.

For more information regarding dust extraction please refer to section 'Dust extraction and cleaning' in this book.

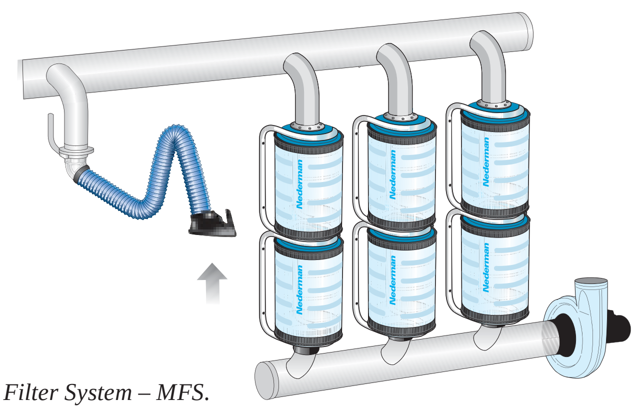

Fig. 4.
Nederman Modular Filter System – MFS.

Please refer to section 'Low vacuum calculation' in this book to learn more about how to create a suitable design.

Airflow need

When designing a well-functioning extraction system the airflow needs to be established. The airflow need for the system is based on the airspeed needed to extract gases, fumes or dusts. Suitable air speed is typically 7 – 15 m/s (23–49 ft/s) for gases and fumes and 15 – 25 m/s (49 – 82 ft/s) for dust. The table below shows suitable airflow for gases and fumes using different inlet diameters.

When you are calculating MFS carbon filters, always make sure that the airflow does not exceed 500 m^3/h (294 cfm). Higher airflow will decrease the filtration efficiency.

Inlet diameter	Airflow
50 mm (1.97 in)	50 – 110 m^3/h (29.4 – 64.7 cfm)
75 mm (2.95 in)	110 – 240 m^3/h (64.7 – 141.1 cfm)
100 mm (3.94 in)	200 – 450 m^3/h (117.6 – 264.6 cfm)

For more detailed information always contact your local Nederman Sales Company.

Nederman

Tank stripping

NEDERMAN ENGINEERING GUIDE

Tank stripping

When emptying and cleaning ship tanks on board oil tankers and product carriers, the main pump is not able to pick up the last residues (50–60 liters (11–13 gal (UK)). Without any additional equipment the tank needs to be cleaned out manually, which is a time consuming and hazardous task, especially when dealing with flammable liquids and gases. To deal with this in a safe and efficient manner, a tank stripping unit can be installed.

Tank stripping units

The Norclean line vacuum units are used onboard tankers and product carriers for tank stripping operations. The heavy duty compressed air powered units can collect liquids over long lifting heights and horizontal lengths. Special care has been taken to eliminate explosion hazards, and the units are EX-certified by well known testing and approval organizations. All parts of the various models are made of antistatic/conductive materials. Nederman Norclean Line supply small flexible and easily portable units, as well as stationary central installations for cleaning of cargo tanks. The units are located on deck and extract vertically from sumps in the tank bottom, either through special installed stainless pipes installed by the cargo pump manufacturer, or through special conductive suction hoses and suction tools supplied with the vacuum units. The collected residues can be pumped or flushed into slop tanks or other reservoirs.

Nederman Norclean Line stripping ejector

The Nederman Norclean Line ejector cleaner for example is so powerful that, even stationed on the catwalk, liquids can be easily captured from up to 30 m. The suction hose is coupled to the stripping line on deck and the ejector cleaner will do the job. The Nederman Norclean Line ejector cleaners have no moving parts which results

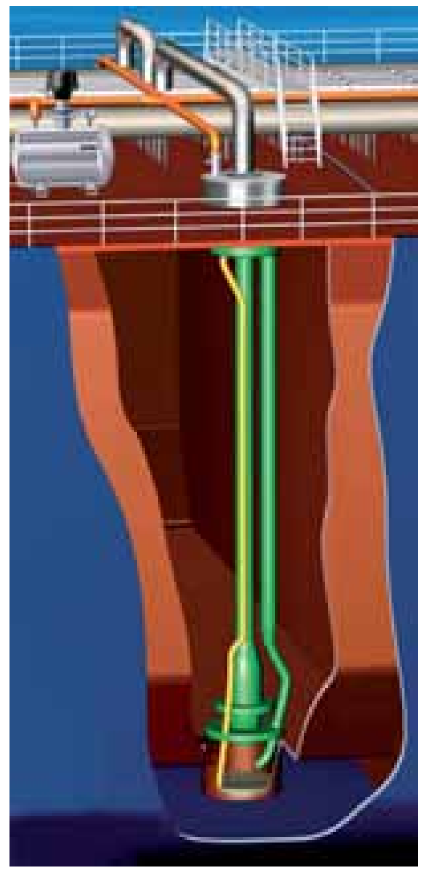

Fig. 1. Stripping ejector, Nederman Norclean Line.

Fig. 2. Stationary ejector cleaner Ab950Ex (Ejector unit: NE74)

Fig. 3. Mobile ejector cleaner Ab140Ex. Ejectorcleaner System 50 (Ejector unit: NE64)

in a maintenance free, long lasting, easy to use product. Next to that, they can be easily executed to be used in explosion hazardous surroundings. The Nederman Norclean Line vacuum units are available in a wide range of models, mobile or fixed, and can be powered by air, nitrogen or electricity to meet specific requirements onboard.

Selecting the right ejector

The EX-application of ejector units are especially recommended in explosive environments, since they do not have any moving parts and are powered with an external air compressor. It is therefore important to the capacity of the on board air compressor, when selecting the appropriate ejector model. See table below.

Ejector	Airflow, at 7 bar (101 psi)	Vacuum
NE64	330 m^3/h (194 cfm)	68 kPa ⇨ 6800 mm up (9.86 psi ⇨ 267.7 ft up)
NE74	318 m^3/h (187 cfm)	78 kPa ⇨ 7800 mm up (11.31 psi ⇨ 307.1 ft up)

For more detailed information always contact your local Nederman Sales Company.

Nederman

Low vacuum calculation

NEDERMAN ENGINEERING GUIDE

Low vacuum calculation

Low vacuum extraction is suitable when dealing with air contaminated with small, light and low velocity particles that could be regarded, for design purposes, as acting like a gas. Examples of usages are; fume extraction from stationary welding and cutting, extraction of light dust from grinding, oil mist filtering, extraction of powders in food and pharmaceutical processes and extraction of vapors and odors.

The low vacuum extraction typically removes high volumes of air, 600 – 2000 m^3/h (353 – 1200 cfm) and extraction point, at relatively low speeds, 10 – 25 m/s (33 – 82 fpm) and through large diameter ducting, 125 – 500 mm (5 – 20 in) in diameter. A typical system consists of extraction points with extraction arms, canopies or enclosures, a filter and a fan connected with a duct work. In some cases the values can differ from the limits above.

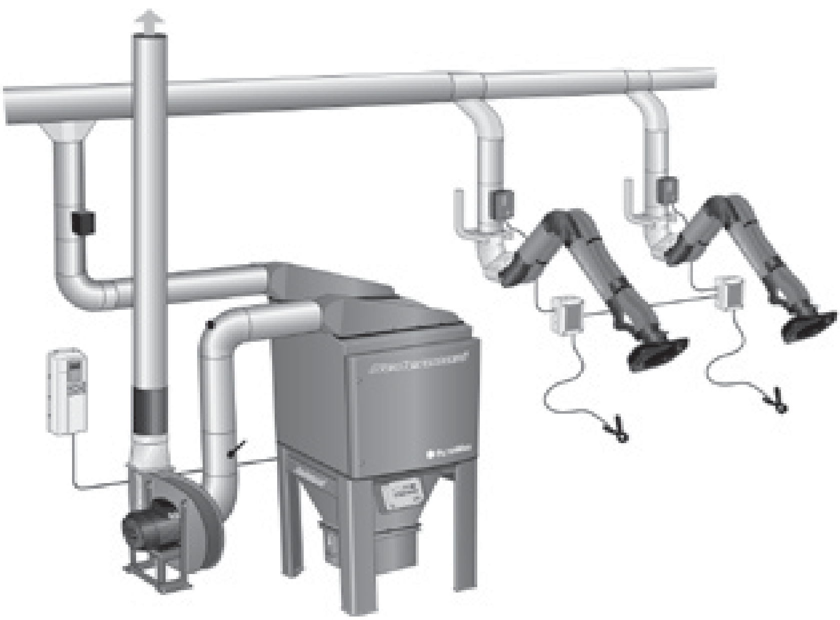

Fig. 1. A low vacuum installation with fan, filter and arms.

Calculation of low vacuum system

1. Define the extraction task.
2. Draw a scetch.
3. Dimension the filter.
4. Dimension the ductwork.
5. Select a fan.

Extraction task

Before you can calculate the low vacuum extraction system you need to define the extraction task, i.e. what will be extracted, from what position and using what type of equipment.

In our example we will design a system serving four welding workspaces using flexible extraction arms. We have decided to use two 4 m (13 ft) and two 2 m (7 ft) NEX HD arms and the airflow at each extraction point must is chosen to be 1 200 m^3/h (706 cfm) in this example.
The airflow need at the extraction points depends on what type of welding is carried out at each point.

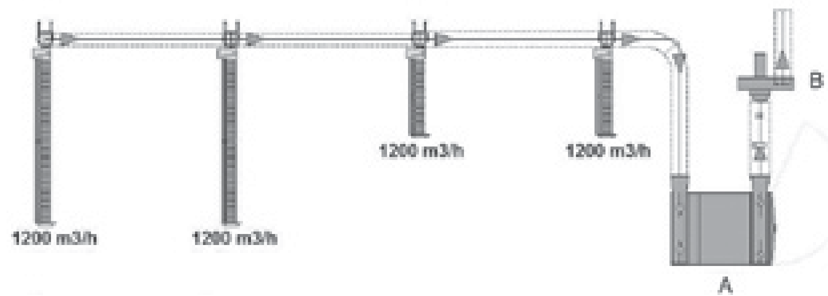

Fig. 2. Overview of our example system including airflow need for each extraction point. (Generated in NedQuote).

Draw a sketch

The next step is to sketch the layout of the solution. Mark the position of the extractor arms, filter, fan and ductwork. It is important to note the design of the building to make sure that it is feasible to install the ductwork in accordance to the sketch. If the design needs to be changed the system needs to be recalculated! It is also important to make sure that the ductwork is drawn where it can be fastened in a secure manner to the ceiling or walls.

Dimensioning of the filter

The filter need is based on the airflow through the filter.The total airflow of the system is simply the sum of the airflow need for all extraction points times the degree of use of the extraction arms.

- The example system will be used for heavy welding, requiring an air flow of 1 200 m^3/h (705.6 cfm) on each extraction point.
- Total of four extraction points.
- Average use of the extraction points is approximately 50%

1200 m^3/h (705.6 cfm) × 4 extraction points × 50% =
= **2400 m^3/h (1411.2 cfm) in total air flow**

NOTE! To be able to design the system based on 50% usage the extraction arms need to be equipped with dampers. Dampers can either be manual or automatic.

The filter capacity depends on what type of fume or dust is extracted. (See separate table for recommended filter loads). We have selected FilterMax F with pre-separator and an operational filter load of 40 m^3/m^2h, for heavy welding.

- Airflow 2400 m^3/h (1411.2 cfm)
- Filter load 40 m^3/m^2h (235.4 cfm)

2400 m^3/h **/** 40 m^3/m^2h = **60 m^2 filter area**
(1411.2 cfm / 235.4 cfm/ft^2 = **646 ft^2 filter area**)

With a filter area of 60 m^2 (646 ft^2) the FilterMax F30 is suitable for this application. This is exactly the anticipated need for the system.

However, it could be advantageous to consider the FilterMax F60 to ensure sufficient capacity and longer cartridge life.

NOTE!

To be able to design the system based on 50% usage the extraction arms need to be equipped with dampers. Dampers can either be manual or automatic.

See 'Airflow control' in this section for more information.

Recommended required filter area		
Operation	**Filter load, m³/m²h (cfm)**	**Notes**
Dry dust and grinding	60 (353)	Fire risk working on olily steel
Light welding	50 (294)	Fire risk working on olily steel
Heavy welding	40 (235)	Fire risk working on olily steel
Heavy load dust	40 (235)	Requires dust feeder

Table 1.

Recommended Filter loads FilterMax			Filter load, $m^3/m^2/h$ (CFM/ft^2)
Dust	Dry dust and grinding		60 (3.3)
	Heavy load dust		40 (2.2)
Welding fumes	Light welding		50 (2.7)
	Heavy welding		40 (2.2)
Cutting fumes and dust	Laser cutting		30–35 (1.6–1.9)
	Oxy fuel cutting	Normal	25–30 (1.4–1.6)
		Very thick plates > 4”	20–25 (1.1–1.4)
		Multiple burnners	20–25 (1.1–1.4)
	Plasma cutting	1 – 4 h cutting/day	25 (1.4)
		4 – 12 cutting/day with one stop every 4 h	20 (1.1)
		> 12 h cutting/day with min. 3 stops	15 (0.8)

Table 2.

Dimensioning the ductwork

The duct dimensions are calculated based on the airflow and air velocity. The air speed should always be between 10 – 15 m/s (32.8 – 49.2 ft/s) for fumes and 15 – 25 m/s (49.2 – 82.0 ft) for dust, to ensure proper flow through the system and avoiding residues in the ductwork.

Duct diameter for different airflows, mm (inch)		
Air volume 15 – 25 m/s (49 – 66 fpm)	**Fume, Air velocity, 10 – 15 m/s (33 – 49 fpm)**	**Dust, Air velocity, 15 – 25 m/s (49 – 88 fpm)**
up to 600 (3)	125 (1)	100 (1)
700 – 1100 (4 – 6)	160 (1)	125 (1)
1100 – 1700 (6 – 9)	200 (1)	160 (1)
1700 – 2600 (9 – 13)	250 (1)	200 (1)
2600 – 4200 (13 – 21)	315 (2)	250 (1)
4200 – 6800 (21 – 35)	400 (2)	315 (2)
6800 – 12000 (35 – 61)	500 (3)	400 (2)

Table 3.

In our example, we are extracting welding fume and the airflow is 1 200 m³/h (705 cfm) between the first two extraction points and 2 400 m³/h (1411 cfm) in the rest of the system. The following duct dimensions are therefore required. (See table Duct dimensions.)

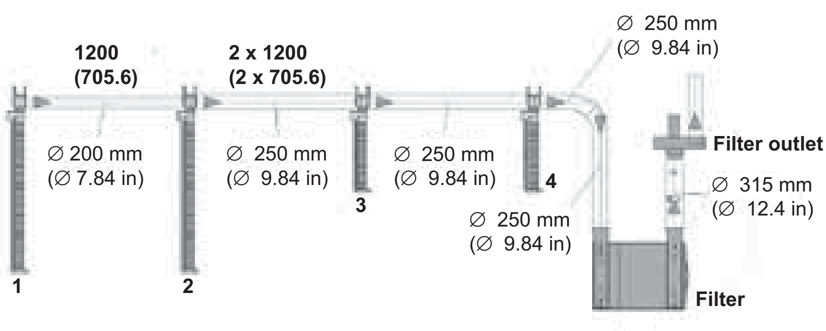

Fig. 3. Our example system with duct diameters (Generated in NedQuote).

Duct	Airflow, m³/h (cfm)	Duct, mm (in)
From arm 1 to arm 2	1200 (705.6)	200 (7.87)
From arm 2 to arm 3	2400 (1411.2)	250 (9.84)
From arm 3 to arm 4	2400 (1411.2)	250 (9.84)
From arm 4 to filter	2400 (1411.2)	250 (9.84)
From filter to fan	2400 (1411.2)	315 (12.4)
From fan to outlet	2400 (1411.2)	315 (12.4)

Table 4. Duct dimensons.

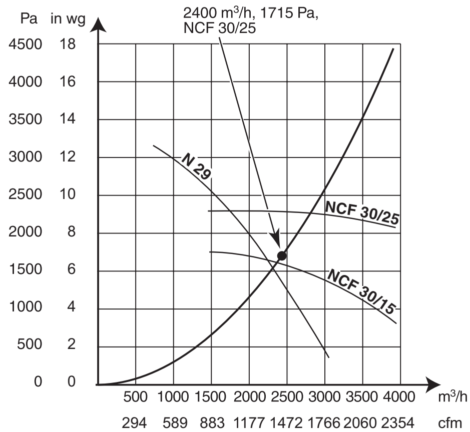

Fig. 4.
Fan diagram; x=airflow, y=static pressure (Generated in NedQuote).

Selecting the fan

The last thing to do in the dimensioning is to select a fan. In order for the system to extract the required air volume, the fan has to be able to overcome the pressure drop in the system. Each fan has its own pressure/airflow curve. The airflow is already calculated. The required vacuum is based on the extraction point which has the highest pressure drop. The pressure drop is calculated based on the sum of the pressure drop over the extraction arm, the duct and the filter.

Arm: (note, just one calculated!)	340 Pa (1 in wg)
Duct: 25 m × 5 Pa/m =	125 Pa (1 in wg)
90 degree bends: 4 × 15 Pa =	60 Pa (1 in wg)
Filter: (Add the pressure drops to each other)	1200 Pa (5 in wg)
Total pressure drop:	**1725 Pa (7 in wg)**

Table 5.

The required fan capacity in our example is 2400 m^3/h at 1725 Pa (1413 cfm at 7 in wg) – working point of the fan. Choose the nearest fan **above** the working point; in this case the NCF 30/25.

Airflow control

Fans designed to handle full-time use of all extraction arms (100% degree of use) in an installation risk being over- dimensioned. This is because the frequency of use at each workplace is generally significantly lower than a theoretical maximum design load. To deal with these situations there are Nederman solutions that offer considerable savings.

- Bringing down the power consumption, due to reduced airflow in the total number of extraction points.
- Extracting less heated or cooled air, while venting to atmosphere.
- Lower investment costs due to smaller fan and control equipment. This also affects the sizing of the ducts and the installation.

- The total noise levels will be reduced if airflows can be kept to a minimum.
- Lower maintenance costs.

Nederman offers solutions where the fan operates only while work is in progress and substantial savings can be made as follows.

Damper

The efficiency of a multi-extraction point system can also be improved if the fan only extracts air from the extraction points that are in use. Less heated air is extracted, as the extraction is present only while work is in progress. With a reasonable total air volume, the suction efficiency for each extractor is improved as the extractors operate only while work is in progress. A lower number of extractors in operation need less total airflow while a smaller fan can be used for the very same system. The damper opens or closes the connection to the ducting system allows a closing delay of up to 5 minutes to ensure extraction of remaining dust and fumes. The motor dampers are connected in series and one of them is connected to a Fan Contactor that starts and stops the central fan. You can connect as many motor dampers as required in series. Systems with larger capacity fans can be combined with a Fan control unit or Fan inverter.

Fan control unit

The fan control unit can be activated either from a switch on the fume extractor arm hood or automatically with a sensor clamp initiating start/stop. The sensor is developed in order to work with any welding process and it senses very low welding current.

Fan inverter

Since it can be difficult to correctly estimate the precise capacity need for a system or usage varies over the duration of the workday, Nederman recommends to us a frequency converter to automatically adjust the fan speed to the current extraction need.

NEDQuote

NEDQuote is developed by Nederman. Contact Nederman for more info regarding NEDQuote.

NEDQuote

This example has given you an explanation on how to calculate a low vacuum system. To be able to quickly design and evaluate different solutions and set-ups Nederman recommends using NEDQuote. NEDQuote automatically calculates the design to quickly find the optimal solution.

For more detailed information always contact your local Nederman Sales Company.

Nederman

High vacuum calculation

NEDERMAN ENGINEERING GUIDE

High vacuum calculation

A Nederman high vacuum systems are multifunctional and offer solutions for a wide range of applications, such as; on-torch extraction for welding fume, dust extraction for sanding, grinding and cutting, cleaning and material transportation.

High vacuum systems typically extract small volumes of air, at relatively high speeds, through small diameter pipes. The dimensioning of a high vacuum extraction system is strictly forward, provided you stay within following rules of thumb. A simple model is shown below (Fig 1).

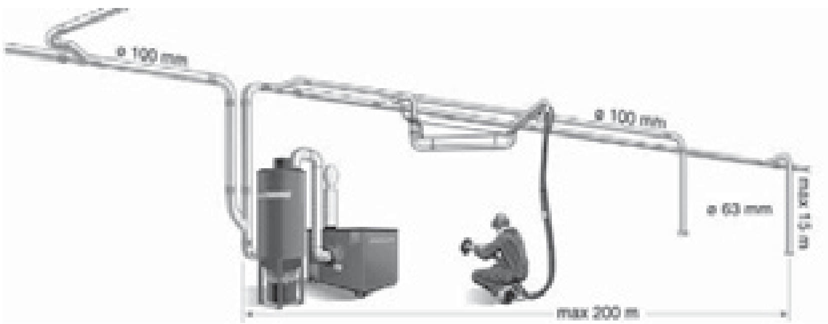

Fig 1. High vacuum system.

Rules of thumb:

- Total length from vacuum unit to the furthest away located inlet, depends on the appl.
  - RBU, VAC and Flexpak 800 = Max length 200 m (656 ft). (see chart 1)
  - L-PAK, E-PAK and Flexpak 1000 = Max length 100 m (328 ft). (see chart 1)
- Main pipe diameter is 100 mm (3.94 in).
- Max flow/main pipe 600 – 800 m³/h (353 – 470 cfm) (600 m³/h is the norm, 800 m³/h can be accepted intermittent)
- When required the main pipe system is build up by several 100 mm pipes.

RULES OF THUMB

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  - L-PAK, E-PAK and Flexpak 1000 = Max length 100 m (328 ft). (see chart 1)
- Main pipe diameter is 100 mm (3.94 in).
- Max flow/main pipe 600 – 800 m^3/h (352.8–470.4 cfm) (600 is the norm, 800 can be accepted intermittent)
- When required the main pipe system is build up by several 100 mm (328 ft) pipes.
- Dropper pipe diameter is 63 mm (2.48 in).
- Max length of a dropper pipe is 15 m (49.2 ft).
- Only one inlet (> 150 m^3/h (88.2 cfm))/dropper.
- Keep small hoses as short as possible.

- Dropper pipe diameter is 63 mm (2.5 in).
- Max length of a dropper pipe is 15 m (49.2 ft).
- Only one inlet (> 150 m^3/h (88.2 cfm))/dropper.
- Keep small hoses as short as possible.

Dimensioning

To dimension a high vacuum installation, the total airflow (m^3/h) must be established. The total airflow in the system is the sum of the airflow for each active inlet. It is much depending on the application and the choice of valve.

As long as we stay within the above rules of thumb, we do not need to calculate the pressure drop, as needed for the low vacuum systems. However, a high vacuum system needs a minimum pressure drop in the system to work properly as e.g. filter cleaning is based on a pressure difference in the system and the outside atmosphere. Using short hoses or big diameters in pipes and hoses, the pressure drop can be considerably lower than normal and therefore result in poor filter cleaning.

Each pipe dimension has a different pressure drop, (Fig. 2.) that together with the droppers, hoses and extraction tools affects the choice of vacuum unit.

NB. When there is a demand of a minimum airflow, for instance in ATEX applications, please contact Nederman for further advice.

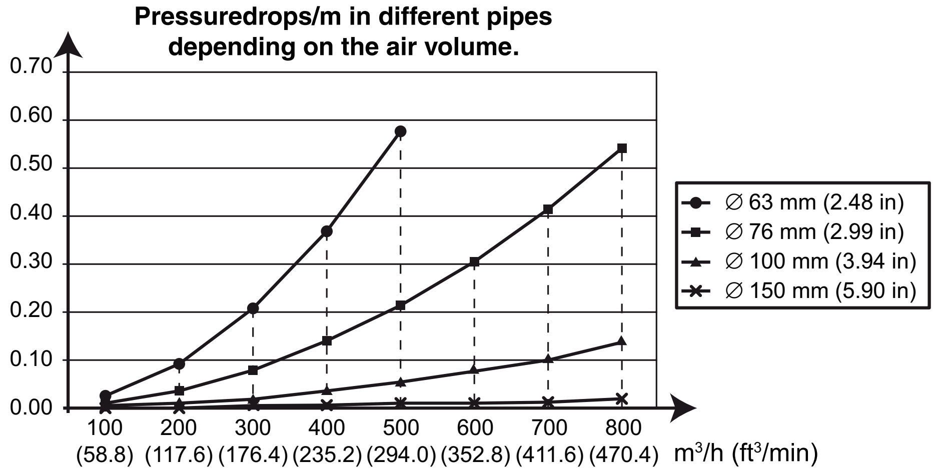


Fig. 2. Pressure drops/m in different pipes depending on the air volume.

Extracted material

- The material is not abrasive to metal piping.
- The material does not risk creating bundles or otherwise clogging the pipes, e.g. metal swarf, long splinter of wood or textile fibers.
- No liquids or explosive gases
- The material is not made up of heavy, smooth and round objects that can be difficult to catch and move with vacuum e.g. metal balls.

If the planned extraction system does not comply with these assumptions, special design measures must be taken. Please contact Nederman for further advice.

Valves

Installations without automatic valves must be dimensioned for the full use of all outlets.

It is known from experience that the number of users on an average is about 30% of the total number. An installation equipped with automatic valves can be reduced in size. Automatic valves are a better choice since we then know for sure that the valve is closed when not used.

NOTE!

The average number of users for which the installation is designed should be agreed upon together with the customer.

NOTE!

When a system is used by few operators, compared to the calculated simultaneous factor, the amount of air taken in at a specific inlet can be much higher than mentioned in the calculation sheets, or the velocity in the pipes might be too low to transport the material.

On larger installations, the required airflow can therefore be reduced up to 30% of the flow for full use of all outlets. Hence, the total airflow need in the system is the sum of the airflow for each inlet times the inlet simultaneously factor.

The average number of users for which the installation is designed should be agreed upon together with the costumer.

The Nederman range of valves can be used for welding, grinding, sanding, cutting and floor cleaning or other applications. Some valves can also be fitted with a micro switch, which controls the vacuum unit to switch to stand-by mode when all valves are closed and to make it start again as soon as a valve is opened. A pilot signal cable and a suitable motor starter are required to obtain this function. All this will save operating costs.

High vacuum units

When we have established the airflow need we can select the vacuum unit. The high vacuum unit capacity is the airflow at a specified vacuum, e.g. -20 kPa (-2.9 psi). The Nederman vacuum units are named by their airflow capacity in a specific vacuum level, e.g. RBU 1300 witch has an airflow capacity of 1300m^3/h at -20 kPa (764 cfm at -2.9 psi).

Dimensioning examples

Ex. A without automatic valves

The following example calculation shows how to calculate the airflow based on manual valves.

The system will serve 7 grinding places (Ø 32 mm (1.26 in), airflow need: 200 m^3/h (117.6 cfm) per inlet) and 2 cleaning places (Ø 38 mm (1 ½¨), airflow need: 250 m^3/h (147 ft^3/in) per inlet).

All grinding places are permanently connected to the system. Floor cleaning is carried out *after* normal working hours and the equipment is disconnected when not in use, therefore that airflow can be disregarded.

Grinding: 7 × 200 m^3/h = 1400 m^3/h (7×117.6 cfm =823.2 cfm)

Cleaning: 2 × 250 m^3/h = 500 m^3/h (2 × 147 cfm = 294 cfm)

Required airflow = 1400 m^3/h (823.2 cfm)

Choice:
1 piece VAC 20-1500 (1500 m^3/h at -20 kPa (882 cfm at -2.9 psi))

If floor cleaning is to be carried out during normal working hours, 500 m^3/h (294 cfm) has to be added to the total airflow, and a different vacuum unit might have been required.

Ex. B with automatic valves.

The following example calculation shows how to calculate the needed airflow based on the simultaneously factor.

All grinding places are equipped with automatic valves. Floor cleaning is carried out after normal working hours and the equipment is disconnected when not in use, thus that airflow can be disregarded. It has been agreed together with the customer that a simultaneous factor of 25 % is the average for his workshop.

Grinding:
7 × 200 m^3/h × 0.25 = 350 m^3/h (7 × 117.6 cfm × 0.25 = 29.4 cfm)

Cleaning:

2 × 250 m^3/h = 500 m^3/h (2 × 147 cfm = 294 cfm)

Required airflow = 500 m^3/h (294 cfm)

Choice:
1 piece E-PAK 500 (500 m^3/h at -15 kPa (294 cfm at -2.17 psi))

Automatic valves optimizes the system and reduces the cost.

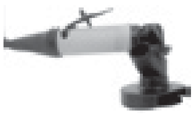
Extraction unit Type	Airflow m³/h (cfm)	Vacuum kPa (psi)	Motor kW	Filter Type	Max vacuum kPa (psi)
Stationary/Semi-Portable					
E-PAK 150	110 (65)	-15 (-2.17)	3.0		-26 (-3.77)
E-PAK 300	290 (170)	-15 (-2.17)	5.5		-30 (-4.35)
B → **E-PAK 500**	**500 (294)**	**-15 (-2.17)**	**12.5**		**-26 (-3.77)**
FlexPak 800	800 (470)	-20 (-2.90)	-15		-35 (-5.08)
FlexPak 1000	1000 (588)	-15 (-2.17)	15		-20 (-2.90)
L-PAK 150*	150 (88)	-15 (-2.17)	3.0		-22 (-3.19)
L-PAK 250*	250 (147)	-15 (-2.17)	5.5		-21 (-3.04)
Stationary -20 kPA					
A → **VAC 20-1500**	**1500 (882)**	**-20 (-2.90)**	**22.0**	**FlexFilter Single**	**-20.1 (-2.92)**
VAC 20-2500	2500 (1470)	-20 (-2.90)	30.0	FlexFilter Twin	-21.5 (-3.12)
VAC 20-3000	3000 (1764)	-20 (-2.90)	37.0	FlexFilter Twin	-21.5 (-3.12)
VAC 20-4000	4000 (2352)	-20 (-2.90)	45.0	FlexFilter Single x 3	-22 (-3.19)
Stationary -30 – -40 kPa					
RBU 1300	1300 (764)	-20 (-2.90)	22.0	FlexFilter Single	-33 (-4.79)
RBU 1600	1600 (941)	-20 (-2.90)	30.0	FlexFilter Single	-33 (-4.79)
RBU 1600 E	1600 (941)	-20 (-2.90)	37.0	FlexFilter Single	-45 (-6.53)
RBU 2100	2100 (1235)	-20 (-2.90)	37.0	FlexFilter Twin	-33 (-4.79)
RBU 2100 E	2100 (1235)	-20 (-2.90)	45.0	FlexFilter Twin	-45 (-6.53)
RBU 2600	2600 (1529)	-20 (-2.90)	55.0	FlexFilter Twin	-45 (-6.53)
Semi-Portable**					
C-PAK 20-1500	1500 (882)	-20 (-2.90)	30.0	C4000	-22 (-3.19)
C-PAK 20-1500 B	1500 (882)	-20 (-2.90)	30.0	FlexFilter Single RF	-22 (-3.19)
C-PAK 20-2500	2500 (1470)	-20 (-2.90)	37.0	C4000	-22 (-3.19)

* L-PAK see information in the Nederman Product Catalogue.
**Semi-portable large units for i.e. offshore industry and shipyards.

NOTE!
When a system is used by few operators, compared to the calculated simultaneous factor, the amount of air taken in at a specific inlet can be much higher than mentioned in the calculation sheets, or the velocity in the pipes might be too low to transport the material.

Condition	Remark
Titanum dust	Self-igniting – contact Nederman!
Magnesium dust	Self-igniting – contact Nederman!
Aluminium dust	Risk of dust explosion depending on application – ask for specialist advice!
Textile	Risk for clogging up filter and pipes – use preseparators!
Liquids	Risk for clogging up filter and pipes – use preseparators!
Big materials wood industry	Risk of clogging up pipes!
PVC-pipes	Do not use PVC-pipes! Risk of static electricity!
Plasma cutting fumes	Risk of clogging up filter – ask for specialist advice!
Different applications	Do not mix too many applications with a too big difference of vacuum need!
High temperarature	Gas welding – melting hoses ask for specialist advice!
Spiro pipes	Risk for flat pipes. Higher pressure drop. Leakage.
Explosive dusts	ASK FOR SPECIAL ADVICE

Calculation sheet

	Application	Airflow m³/h (cfm)	Number of users	Simultaneous factor	Total airflow m³/h
	Welding-on-torch 160 – 250 A	80 (47)	x _________ x	______ (0.30)	= __________
	Welding-on-torch 315 – 500 A	125 (74)	x _________ x	______ (0.30)	= __________
	Welding nozzle Ø 40 mm (1 ½")	200 (118)	x _________ x	______ (0.30)	= __________
	Welding nozzle Ø 50 mm (2")	250 (147)	x _________ x	______ (0.30)	= __________
	Welding nozzle Ø 63 mm (2 ½")	400 (235)	x _________ x	______ (0.30)	= __________
	On-tool sanding Ø 25 mm (1")	125 (74)	x _________ x	______ (0.25)	= __________
	On-tool grinding Ø 25 mm (1")	125 (74)	x _________ x	______ (0.25)	= __________
	On-tool grinding Ø 32 mm (1 ¼")	200 (118)	x _________ x	______ (0.25)	= __________
	On-tool grinding Ø 38 mm (1 ½")	250 (147)	x _________ x	______ (0.25)	= __________
	Bench grinder 2 x Ø 38 mm (1 ½")	400 (235)	x _________ x	______	= __________
	Bench grinder 2 x Ø 50 mm (2")	400 (235)	x _________ x	______	= __________
	Belt grinding machine 1 x Ø 63 mm (2 ½")	400 (235)	x _________ x	______	= __________
	Cleaning Ø 38 mm (1 ½")	250 (147)	x _________ x	______	= __________
	Cleaning Ø 50 mm (2")	400 (235)	x _________ x	______	= __________
			Airflow in total __________		

Dimensioning

The machine models are operated either with compressed air supplying the ejector system or electrical. We are able to offer ATEX models as well.

Nederman application with **Ab, Bb and Cb** machines requires accurate technical input data before any selection of machine and equipment is possible.

We recommend using the guide “suction data registration sheet”, which you can order from Nederman.

Below you will find a list of issues we recommend you to consider.

	Questionaire
1	What kind of material is going to be extracted?
2	How much volume (tonne/hour) is going to be extracted?
3	How much bulk weight (kg/m^3 (lb/ft^3)) is going to be extracted??
4	How much specific weight (kg/m^3 (lb/ft^3)) is going to be extracted??
5	What particle size (µm (µin)) is going to be extracted??
6	What is the longest distance from extraction point to suction unit?
7	How many extraction points are used at the same time?
8	Is compressed air (7 bar) (100 psi) capacity in m^3/min or electricity available?
9	Is a mobile or stationary machine requested?
10	How is the material to be collected?*

*The extracted material can be separated and collected in a container, bin or a big bag before it reaches the filter and the bin. The material might be used in a recycling process.

NOTE!

Ab- Air powered ejector systems.

Bb- Electric vacuum systems.

Cb- Central heavy duty systems.

Separator:

If the extraction is now and then (not continuously) a separator is the best choice. This is also due if the intention is to separate dust from grit for example.

Cyclone:

With constant extraction, steady airflow a cyclone is effective. Very light and small particles needs often a cyclone to separate most of the material before the filter.

Silo:

Nederman offer different silos for wall and frame mounted.

Discharge valves:

The counterweight valve is to prefer as heavy material can push it open, for light materials pneumatic discharge is preferable.

Useful applications:

Ab216/Bb216 aim at dust and common cleaning. This machine is NOT intended for extraction any liquid.

Ab510/Bb515 is useful for general cleaning and extract liquid.

Ab710, and **Ab722** are good for sandblasting extraction.

Bb181 is useful to extract liquid.

For more detailed information always contact your local Nederman Sales Company.

Nederman

Vehicle exhaust extraction calculation

NEDERMAN ENGINEERING GUIDE

Vehicle exhaust extraction calculation

Exhaust extraction is suitable when dealing with particles and gases from vehicle exhaust fumes. Examples of usages are; vehicle repair shops, emergency stations, bus garages, vehicle inspection centers, vehicle assembly centers, etc. This means that the type of vehicle can vary from motorbikes and passenger cars to trucks, buses, emergency vehicles, construction vehicles etc.

The low vacuum extraction typically removes high volumes of air, 250 – 2000 m^3/h (352.8 – 1176.0 cfm) and extraction point, at relatively low speeds, 10 – 25 m/s (32.8 – 82.0 ft/min) and through large diameter ducting, 100 – 500 mm (4.92 – 19.68 in) in diameter.

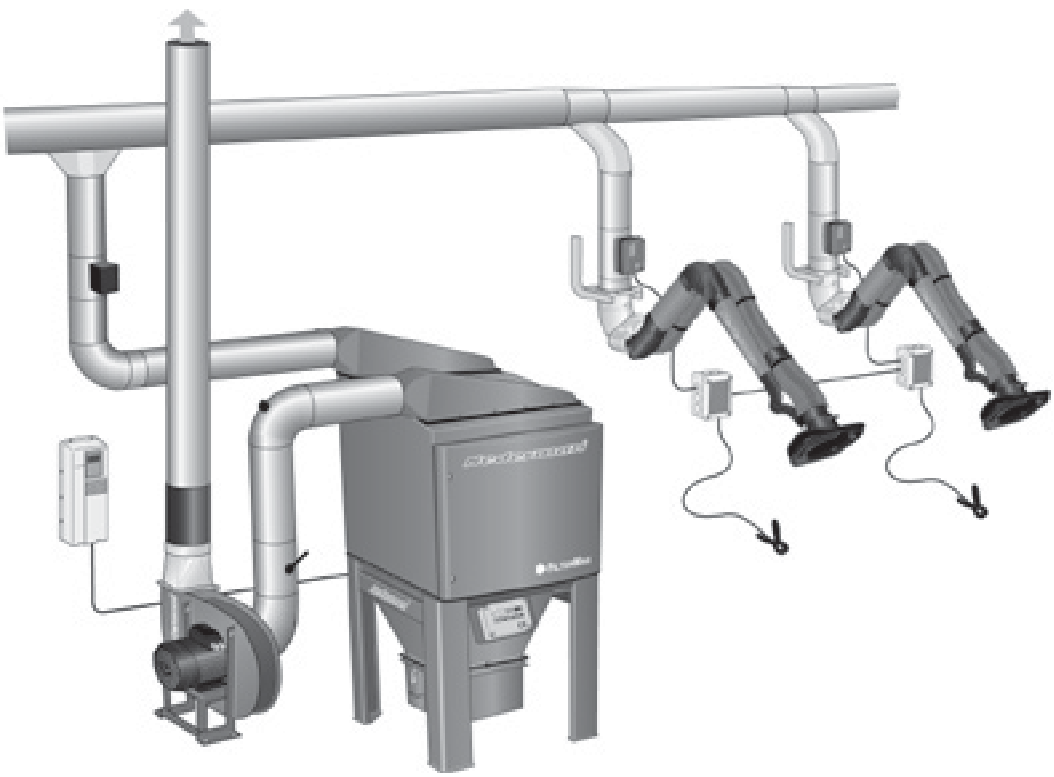


Fig. 1. A vehicle exhaust extraction installation with exhaust hose reels and fan.

Calculation of low vacuum system

1. Define the extraction task.
2. Draw a scetch.
3. Dimension the air flow need.
4. Dimension the ductwork.
5. Select a fan.

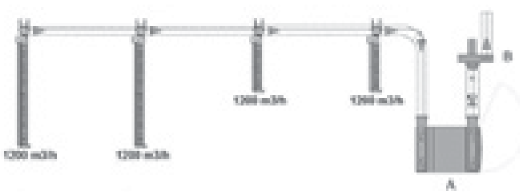


Fig. 2. Overview of our example system including airflow need for each extraction point. (Generated in NedQuote).

Define your application

Before you can calculate the exhaust extraction system you need to define the extraction task, i.e.

- Type of application (repair workshop, fire station, inspection center, manufacturing plant, bus garage etc)
- Type of vehicle (car, van, trucks, fire truck, ambulance, military, others)
- Stationary workplace or Vehicles in motion
- Engine type and size
- Operation conditions (idling/tests/rpm)
- Total number of workplaces and the maximum amount that are running simultaneously.

In our example we will design a system serving four truck repair workplaces. We have decided to use motor operated hose reels with remote control and 10 m NRCP 6'' hose. The airflow at each extraction point is chosen to be 1000 m^3/h (705.6 cfm) in this example. The airflow need at the extraction points depends on engine type/hose and operation conditions – rpm/idling/tests.

Draw a sketch

The next step is to sketch the layout of the solution. Mark the position of the exhaust hose reels, particle filter, fan and ductwork. It is important to note the design of the building to make sure that it is feasible to install the ductwork in accordance to the sketch. If the design needs to be changed the system needs to be recalculated! It is also important to make sure that the ductwork is drawn where it can be fastened in a secure manner to the ceiling or walls.

Dimensioning an airflow need

The airflow need in the extraction inlet depends on the engine type and load (rpm). However, as a general rule, the following airflow and hose diameter can be used, assuming that the engines are running at idle speed.

Passenger cars / Vans

Airflow need: 400 m^3/h (235.2 cfm)

Hose diameter: 100 mm (3.94 in)

Commercial vehicles (Busses, trucks)

Airflow need: 1000 m^3/h (588 cfm)

Hose diameter: 150 mm (5.9 in)

If engines will run over idle speed, the following formula can be used to calculate the exact airflow need.

$G = (Vs/1000) \cdot \mu \times (Tu/Ti) \cdot (k) \cdot 60$

G = Exhaust flow, m^3/hr

Vs = Stroke volume, lit

μ = Efficiency factor, (normal aspirated ~0.8, turbo charged ~1.2)

Ti = Intake air temp., °K (273+°C)

Tu = Exhaust temp., °K (273+°C)

k=n (2-stroke engine)

k=n/2 (4-stroke engine)

n = Engine rpm

Based on the airflow need in the inlets, the degree of utilisation, a suitable exhaust extraction system and ducting, a suitable vacuum unit can be chosen.

In our case we choose required air flow need to 1000 m^3/h. Average utilization degree is calculated to be 50% in our example.

NOTE!

G = Exhaust flow, m^3/hr

Vs = Stroke volume, lit

μ = Efficiency factor, (normal aspirated ~0.8, turbo charged ~1.2)

Ti = Intake air temp., °K (273+°C)

Tu = Exhaust temp., °K (273+°C)

k=n (2-stroke engine)

k=n/2 (4-stroke engine)

n = Engine rpm,

$G=(Vs/1000) \cdot \mu \times (Tu/Ti) \cdot (k) \cdot 60$

NOTE!

Please refer to section 'Low vacuum calculation' in this book to learn how to create a suitable design

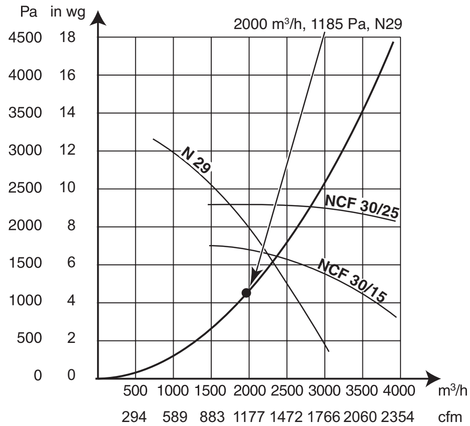


Fig. 3. Fan diagram; x=airflow, y=static pressure (Generated in NedQuote).

Dimensioning the ductwork

The duct dimensions are calculated based on the airflow and air velocity. The air speed should normally be between 10 – 15 m/s (32.8 – 49.2 ft/s) for exhaust fumes, to ensure proper flow through the system and avoiding residues in theductwork.

Duct diameter for different airflows, mm	
Air volume, m³/h velocity, 15–25 m/s (49 – 66 ft/s)	**Fume, Air velocity, 10–15 m/s (33 – 49 ft/s)**
up to 600 (23.62)	125 (4.92)
700–1100 (27.56 – 39.37)	160 (6.30)
1100–1700 (39.37 – 66.93)	200 (7.87)
1700–2600 (66.93 – 102.36)	250 (9.84)
2600–4200 (102.36 – 165.35)	315 (12.40)
4200–6800 (165.35 – 267.72)	400 (15.75)
6800–12000 (267.72 – 472.44)	500 (19.68)

Table 1.

In our example, we are extracting welding fume and the airflow is 1000 m^3/h (589 cfm) between the first two extraction points and 2000 m^3/h (1177 cfm) in the rest of the system. The following duct dimensions are therefore required. (See table Duct dimensions.)

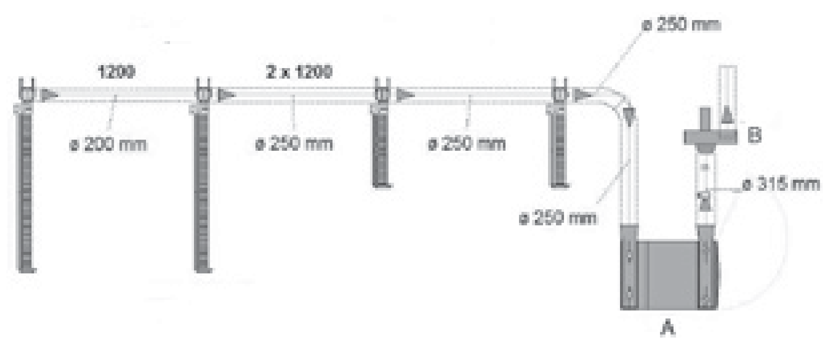


Fig. 4. Our example system with duct diameters (Generated in NedQuote), and 50% utilization degree.

Selecting the fan

The last thing to do in the dimensioning is to select a fan. In order for the system to extract the required air volume, the fan has to be able to overcome the pressure drop in the system. Each fan has its own pressure/airflow curve. The airflow is already calculated. The required vacuum is based on the extraction point which has the highest pressure drop. The pressure drop is calculated based on the sum of the pressure drop over the exhaust reel, the duct and the filter.

Exhaust reel: (note, just one calculated!)	200 Pa (0.03 psi)
Duct: 25 m × 5 Pa/m =	125 Pa (0.02 psi)
90 degree bends: 4 × 15 Pa =	60 Pa (0.01 psi)
Filter SFC40:	200 Pa (0.03 psi)
Total pressure drop (Add the pressure drops to each other):	**1185 Pa (0.172 psi)**

Table 2.

The required fan capacity in our example is 2000 m^3/h at 1185 Pa (1177 cfm at 0.172 psi) – working point of the fan. Normally choose the nearest fan above the working point; in this case the N28.

Airflow control

Fans designed to handle full-time use of all the exhaust hose reel (100% degree of use) in an installation risk being over-dimensioned. This is because the frequency of use at each workplace is generally significantly lower than a theoretical maximum design load. To deal with these situations there are Nederman solutions that offer considerable savings.

- Bringing down the power consumption, due to reduced airflow in the total number of extraction points.
- Extracting less heated or cooled air, while venting to atmosphere.
- Lower investment costs due to smaller fan and control equipment. This also affects the sizing of the ducts and the installation
- The total noise levels will be reduced if airflows can be kept to aminimum.
- Lower maintenance costs.

Nederman offers solutions where the fan operates only while work is in progress and substantial savings can be made as follows.

Damper

The efficiency of a multi-extraction point system can also be improved if the fan only extracts air from the extraction points that are in use. Less heated air is extracted, as the extraction is present only while work is in progress. With a reasonable total air volume, the suction efficiency for each extractor is improved as the extractors operate only while work is in progress. A lower number of extractors in operation need less total airflow while a smaller fan can be used for the very same system. The damper opens or closes the connection to the ducting system and allows a closing delay of up to 5 minutes to ensure exhaust fumes. The motor dampers are connected in series and one of them is connected to a Fan Contactor that starts and stops the central fan. You can connect as many motor dampers as required in series. Systems with larger capacity fans can be combined with a Fan control unit or Fan inverter.

Fan control unit

The fan control unit is activated from the remote control unit.

Fan inverter

Can be difficult to correctly estimate the precise capacity need for a system and the usage variations over the duration of the workday. For systems with larger capacity, fans and high utilisation degree Nederman recommends to use a frequency converter to automatically adjust the fan speed to the current extraction need.

NEDQuote

This example has given you an explanation on how to calculate an exhaust extraction system. To be able to quickly design and evaluate different solutions and set-ups Nederman recommends using NEDQuote. NEDQuote automatically calculates the design to quickly find the optimal solution.

NEDQuote

NEDQuote is developed by Nederman. Contact Nederman for more info regarding NEDQuote.

For more detailed information always contact your local Nederman Sales Company.

Nederman

Handling equipment for potentially explosive dusts

NEDERMAN ENGINEERING GUIDE

Handling equipment for potentially explosive dusts

Due to the fact that dust from most organic materials, synthetic materials and metals can explode, attention needs to be given to prevent dust explosions. This chapter will give an introduction to what needs to be considered when installing dust extraction systems where potentially explosive dust is present. The information is based on the ATEX EX directives. Compliance with additional requirements in accordance with national or local government regulations are the responsibility of the local Nederman sales company and the customer.

ATEX EX directives

The intention of the ATEX EX directives, besides facilitating free movement of goods within the member countries of the EU, is to protect employees, the public and the environment from accidents with explosive atmospheres. Since July 1, 2006 all existing sites, as well as new sites, must be fully ATEX EX compliant.

The ATEX EX directives consist of two parts. The first directive, 94/9/EC, deals with responsibilities placed upon manufacturers and suppliers of machinery and equipment for use in explosive atmospheres. While the second directive, 1999/92/EC deals with responsibilities placed upon owners and operators of the equipment.

End user responsibility

It is the owner/end user's responsibility to determine the possible explosion risk in his premises. One of the obligations is to classify the areas where explosive atmospheres may occur. Another obligation of the owner/end user is to develop an "Explosion Protection Document", that demonstrates amongst other:

- Explosion risk and assessment.
- Adequate measures will be taken to attain the aims of the directive.
- The areas that have been classified into "zones".
- That the workplace equipment is operated and maintained with due regards for safety.

Only when the end user has declared the zones, will it be possible for the Nederman sales person to determine whether Nederman can provide the machinery and equipment required. The Nederman sales person will need the following data from the customer who will be the owner and end user of the equipment.

- The ATEX zone classification of the areas into which the equipment will be installed. This is the responsibility of the end user.
- The properties of the dust to be handled, including its explosion class St1, St2 or St3.

ATEX zone classifications

Zone 20: A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently. Examples: In general these conditions arise only inside equipment such us pneumatic conveying lines, mills, dry mixers, sieves etc. Zone 20 atmosphere is typically found inside equipment.

Fig.1 Label used for indicating ATEX classified zones.

Zone 21: A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally. Examples: In general, these conditions can arise where dust clouds are frequently present during normal operation, e.g. grinding, sanding, open charging etc. The extent of zone 21 atmosphere is typically a distance of 1 meter around the source of release. Human beings typically find it extremely difficult to breathe in zone 21 atmospheres.

Zone 22: A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only. Examples: In general, these conditions can arise in places with dust lying on the floor and other surfaces which can be dispersed and form explosive dust clouds. Normally, a manned area or an area close to people is most likely to be a no-zone (safe – non hazardous) area. For the general area to be classified even as Zone 22 there could be considerable deposits of dust lying on surfaces. Zone 22 atmosphere can occur in places where dust can escape through leaks and form hazardous quantities, in bag storage areas (bag breakage) etc. The extent of zone 22 atmosphere is typically a distance of 1 meter around the source of release.

Dust classification

The very same dust normally becomes more "explosive" the smaller the dust particles become. Therefore the properties of the dust to be handled in the Nederman equipment are of great importance. The specific KSt value or St class of the dust must therefore be provided by the customer. The KSt value is the maximum rate of explosion pressure rise in a 1 m^3 (0.30 ft^3) container. St classes are categories into which dusts are classified on the basis of their KSt values. See Table 1.

Dust explosion class	KSt , bar m/s (psi ft/s)
St 1	> 0 to 200 (0 – 61)
St 2	> 200 to 300 (61 – 91)
St 3	> 300 (91)

Table 1: St classes

Nederman equipment installed outdoors is suitable for explosive dusts of class St1 or St2. The equipment is not suitable for gas, chemical instable dusts or materials that self ignite, e.g. magnesium.

Manufacturer’s responsibility

It is the manufacturer’s responsibility to state the ATEX category of the machinery and equipment produced by the manufacturer. Products are categorized 1D, 2D and 3D with category 1D meaning the product employs a very high level of protection (zone 20, 21, or 22); category 2D, a high level of protection (zone 21 or 22); category 3D, a normal level of protection (zone 22). The Nederman symbol for products suitable for handling explosive dusts is DX.

Fig. 2 Nederman equipment label.

If Nederman as the manufacturer determines that the equipment/filter unit etc. is intended to be installed in a classified area, the equipment must be marked according to the ATEX directive (94/9/EC). Fig. 2 is an example of how Nederman equipment can be marked.

Ex in a hexagon is the explosion protection symbol, followed by equipment group II (non mining), category 3D for Dust (D). Protection by constructional safety is represented by the “c”. Max surface temperature 125°C (257 °F).

Fig.3 Label used for ATEX classified products.

Nederman Customization of Products

Product customization can be done by Nederman as long as it does not jeopardize the safety (risk assessment) of the product. Enlarging the total volume and/or area of the filter unit could put the strength of the product at risk. Additional electrical components or similar equipment representing an ignition source must be categorized if they are to be placed in a hazardous area.

Installation

As Nederman DX equipment is category 3D, it can be installed in zone 22 atmospheres or nonhazardous areas. The EX triangle sign indicating the possible presence of explosive atmosphere is to be installed by the end user.

Safe Positioning

There should be a suitable distance between the explosion relief panel and any nearby walls or equipment to allow sufficient pressure relief. The Nederman filter itself should be safely anchored to the floor to prevent unwanted reaction, due to explosion pressure relief. Suitable signs must be clearly visible to indicate the presence of an explosion relief venting device. Make sure the relief panel is vented to a safe, dust free, area to avoid the risk of secondary explosions.

Installing a Safety/Control Filter

The airway after the main filter can normally be classified as zone 22. This means that the fan or pump must be category 3D to comply. Only the NCF DX is a category 3D fan. When none categorized, non EX, fans or pumps are used, a safety/control filter must be installed between the filter unit and the fan or vacuum unit.

The safety/control filter protects the fan or pump and prevents combustible dust and particles from entering the fan or pump in case something goes wrong with the filter unit. A safety filter provides cost effective protection, and is especially recommended for protection of pumps from particles or debris in case of a broken main filter. It is also recommended to supervise and detect main filter failure, in the control system, by installing a pressure switch measuring the pressure drop over the safety/control filter. Nederman fans and pumps that are not categorized must be installed in a no-zone (safe – non hazardous) area.

Mechanical Explosion Isolation Valve

In case of an explosion inside the filter, the spreading of the flame through the pipe system to connected equipment and back to the workplace must be stopped. Otherwise it could cause a secondary explosion. An isolation valve must therefore be installed on the inlet pipeline to the filter to protect from explosion propagation towards places where the dust is being extracted from. One isolation valve

Pipe Diameter, mm (in)	Dust explosion class, m (ft)	
	St 1	**St 2**
100– 250 (3.9–9.8)	2 m (6.6)	4 m (13.1)
280–355 (11.0–14.0)	4 m (13.1)	4 m (13.1)
400–500 (15.7–19.7)	4 m (13.1)	5 m (16.4)

Table 2: Installation Distance Between the Nederman Isolation Valve and Filter.

Filter Unit	Size of Risk Area, meters (ft)
E-PAK DX	8 (26.2)
FlexPAK DX	12 (39.4)
FlexFilter DX	12 (39.4)
FilterMax DX 3000	11 (36.1)
FilterMax DX 6000	17 (55.8)
FilterMax 9000 SR	18 (59.1)

Table 3: Explosion Risk Area Size.

must be installed prior to each dust collector inlet pipe. The isolation valve allows normal airflow going through, but pressure stroke going from the opposite direction will mechanically close the valve, preventing the flame from spreading in the pipe system. The isolation valve must be placed at a certain minimum distance from the filter, depending on the dust explosion class and the pipe diameter, see table below. Flanged piping must be used between the filter and the isolation valve to withstand the pressure stroke of 0.5 bar (7.25 psi).

Ducting the Explosion Relief Panel

If the explosion relief panel is to be ducted out to a safe area, the duct must normally be straight and withstand a pressure stroke of minimum 0.4 bar (5.8 psi) (1 600 in.w.g). The maximum length must not exceed a certain distance, see figure 4. Longer ducting would build up pressure inside the filter not allowing a quick enough pressure release.

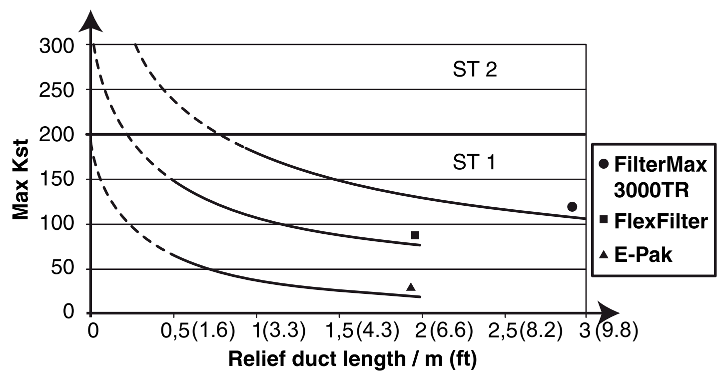


Fig.4 Diagram of Max Kst vs. Relief duct length. Assumed Pmax=10 bar (145 psi).

Explosion Risk Area

The explosion risk area is an area from which personnel and the general public are excluded, to allow the safe relief of hot flames and burning material from the explosion relief panel. It must be positioned to eliminate as far as possible the risk of a secondary explosion. People must not enter this area without permission and it must be clearly marked in accordance with national or local government regulations. The size of the risk area must be between 5 and 20 meters (16.4 and 65.6 ft) surrounding the explosion relief panel, see Table 3.

Installing Explosion Deflectors

Where it is not practical to accommodate a safe "keep out" area of the size indicated above it is often possible to add a deflector in front of the explosion relief panel, which deflects the fireball 45 degrees upwards reducing the size of the risk area by approximately 50%.

Explosion Suppression Systems

If indoor installation is necessary, and a duct for the relief panel cannot be used, then an Explosion Suppression System can be used instead. An Explosion Suppression System can also be used where there is no possibility of maintaining a safe exclusion area, or where there remains a risk of secondary explosion or fire.

The explosion suppression system detects and extinguishes the flames, suppressing the explosion before it reaches excessive levels of pressure. No explosion relief panels are therefore required. However, isolation valves must still be installed to avoid spreading of the flame through the pipe system.

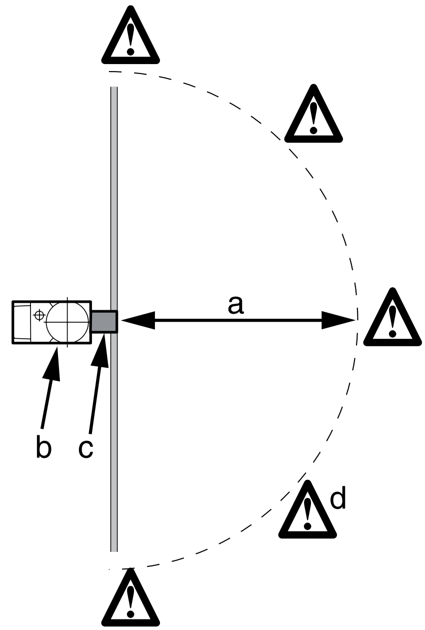


Fig. 5.
a) Risk zone 5 – 20 m (16.4-65.6 ft) (depending on material).
b) Unit securely ancored to the floor.
c) Max. length, see fig. 5, min. 2 mm (0.08 in) pipe thickness. No diameter reducation.
d) Well displayed warning signs.

For more detailed information always contact your local Nederman Sales Company.

Nederman

Energy saving

NEDERMAN ENGINEERING GUIDE

Energy saving

Extraction systems designed to handle full-time use of all extraction units in an installation, risk being over-dimensioned. This is because the frequency of use at each workplace is generally significantly lower than a theoretical maximum design load. To deal with these situations, Nederman has developed a control system that offers considerable savings in energy consumption and maintenance costs as well as an improved work place.

Nederman Control System

The Nederman Control System includes a combination of tools to optimise the extraction system. If the fan speed is reduced when fewer inlets are used the energy consumption can be radically decreased. A fan speed reduction of 20 % on average, can lead to a reduced energy consumption of 50%.

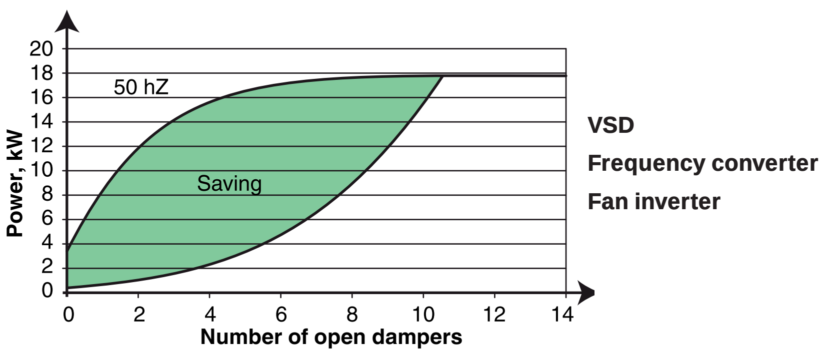


Fig.1 Diagram showing energy saving when using variable fan speed.

When closing dampers the airflow and consequently the noise level rise if the fan capacity is not reduced.. Automatic controlled dampers at the extraction point in combination with frequency controlled fans bring down the noise level. Lower noise level provides a good working environment. In order to create a comfortable temperature in the working premises air must be heated or cooled. The Nederman Control System minimizes the extracted air volume and makes huge energy savings possible.

SAVE MONEY
ON REGULAR MAINTENANCE

Regular service and maintenance of the extraction system will ensure effective extraction and low operation cost. Make sure to always check and when required change filters, hoses, nozzles and manifolds when needed.

Automatic Dampers

The efficiency of a multi-extraction point system can also be improved if the fan only extracts air from the extraction points that are in use. The automatic dampers close unused extraction points. If a fan inverter is installed the pressure in the duct is obtained. The fan capacity is reduced according to consumption In welding applications the dampers can be activated via a sensor clamp attached to the earth cable of welding equipment or a switch in the hood.

Fig. 3 Automatic damper.

Fig. 2 Nederman Fan Inverter.

Fan inverter

The Nederman Fan Inverter senses alterations in pressure drop within the extraction system and adjusts the fan speed immediately. This ensures the correct airflow for any given combination of extractors in use which reduces both the extraction of conditioned air and the noise levels that would otherwise occur if the system were running in full capacity.

For more detailed information always contact your local Nederman Sales Company.

Fan Timer

The built-in Fan Timer controls start and stop of the fans as required. Working hours can also be easily programmed into the timer, which controls the Fan Inverter.









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