Nederman

Vehicle Exhaust System Design 101

Varitec Solutions

Vehicle Exhaust System Design

Equipment Selection Including

1. Product Selection
2. Required Airflow & Hose Diameter
3. Fan & Duct Sizing

VE System Design

CFM REQUIREMENTS			
TYPE OF VEHICLES	CFM REQUIRED	RECOMMENDED HOSE DIA.	HOSE TEMP RATING
Cars	250 to 300	4”	300 F
Large pickup trucks	300 to 400	4 & 5”	300 to 600 F
Transit Buses	600 to 700 *	6”	600 to 1200 F
Full size Trucks	600 to 700 *	6”	600 to 1200 F
Large Military & Construction equipment	800 and above **	6” and above	600 to 1500 F

*Depending on the type of engine. CNG and LNG require the higher cfm to compensate for higher exhaust temperatures.
**Additional information required for large Military and construction type equipment.

Product Selection

Critical Factors for selecting proper equipment

- Length & Dia. of hose required
- Mounting Height
- Tailpipe Configuration
- Overhead Crane
- Other obstacles
- For special applications like Regen and Dyno's, please consult the Factory

Hose Reels
Spring or Motorized retraction

Presentation Subject

Design Worksheet for Vehicle Exhaust

Design Worksheet for Vehicle Exhaust

Private Passenger Cars:

Type of vehicle, check all that apply: ☐ Cars ☐ Vans ☐ Pick-up Trucks ☐ High Performance O t h e r _____

Make & Model of Vehicles: _____

_____

Please check if Dynamometer testing is performed: ☐ Yes ☐ No

If Yes, is it: Engine Dyno ☐ Chassis Dyno ☐ Single Exhaust ☐ Dual Exhaust ☐

Special Configurations (See Section #4) NOTE: Hose Reels not recommended for Dyno's

Commercial and Industrial Vehicles

Type of vehicle check all that apply: ☐ Truck ☐ Bus ☐ Construction Eqmt. Military Vehicle Other_____

Make & Model of Vehicles: _____

_____

Please check if Dynamometer testing is performed: If Yes, is it: ☐ Yes ☐ No ☐ Engine Dyno ☐ Chassis Dyno

Are Natural Gas Vehicles Incorporated: ☐ Yes ☐ No

Type of Exhaust Pipe, check all that apply: ☐ Single Exhaust ☐ Dual Exhaust ☐ Horizontal Exhaust ☐ Rain cap ☐ Curved Stack ☐ Straight Stack

Special Exhaust Configurations (See Section #4)

Section - 2

Engine Data:

Please Check, Whichever Best Describes: Diesel ☐ Gas ☐ 2 Cycle ☐ 4 Cycle ☐

Engine Mfg. _____ Model # _____ C.I.D or Liters _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

Are Engines Turbocharged? Yes ☐ No ☐ If Yes, what is the Maximum Boost Pressure?_____p.s.i.

Maximum Rated RPM of Engine_____ Maximum Operating RPM of Engine _____

Section - 3

BUILDING CONSIDERATIONS

The building construction is: New Structure ☐ Existing ☐ Type _____

Number of Bays _____

Overhead Crane? ☐ Yes ☐ No

Electrical Requirements _____/_____/_____

Other Potential Obstructions: _____

_____

_____

Section - 4

PLEASE SKETCH ANY SPECIAL REQUIREMENTS BELOW OR SUGGESTED DESIGN OR INCLUDE A DRAWING ALONG WITH THIS WORKSHEET

Spring Hose Reels

Spring Hose Reel

- Designed so that the Operator can easily reach the hose for usage
- Perfect for low mounting height applications
- Excellent for Car dealerships, Motorcycle shops, Repair facilities and more.
- Standard length of hose – 33 feet

Spring Hose Reels

Stop Bar

Hose Stop (included with reel)

The hose stop controls how much hose hangs down from the reel. When the hose stop hits the stop bar the hose will stop winding up on the drum. The stop can be positioned any place on the hose. It Is held in place by two hose clamps included with the stop.

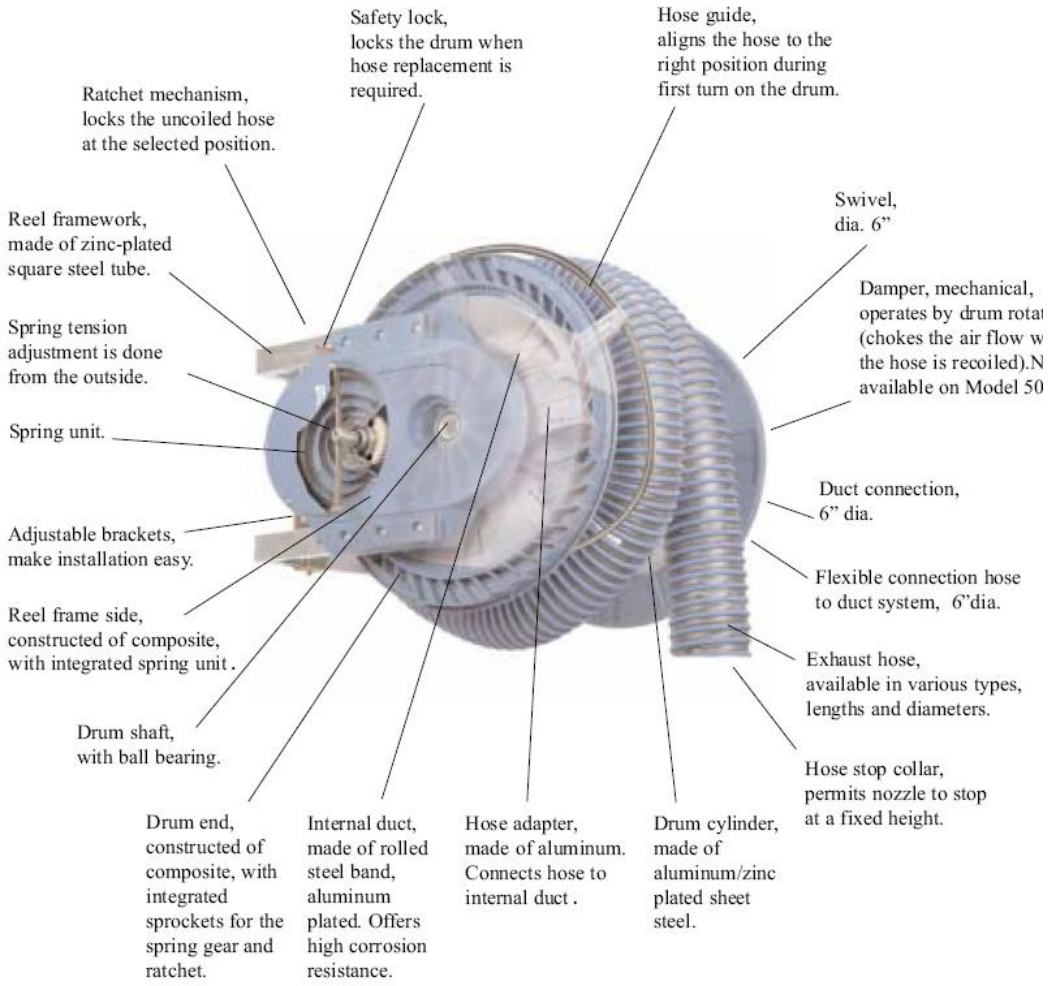
Features & Benefits of 865 Spring Reel

Adjust spring tension without turning drum and the drum safety lock make the reel very safe.

Light weight construction makes the install easier and quicker.

Mounting brackets make for easy installation and less labor costs.

Automatic mechanical damper on 865SD makes the reel more efficient.

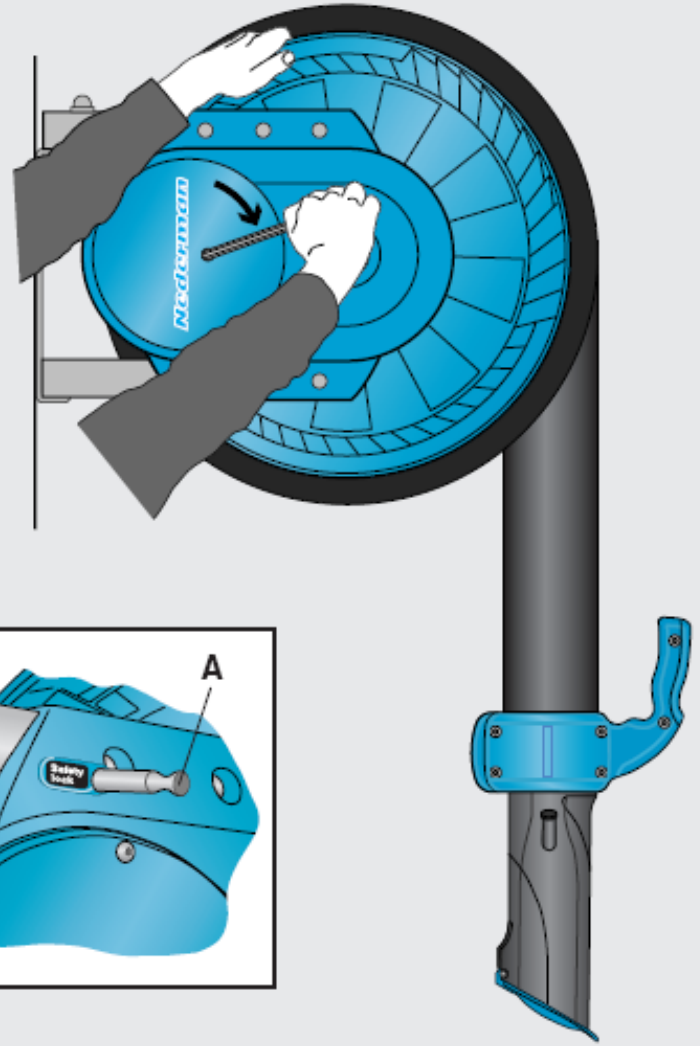


Spring gear and ball bearings provide maximum spring power and low internal friction. This results in low uncoiling forces and reliable coiling of the hose.

Adjusting Spring Tension

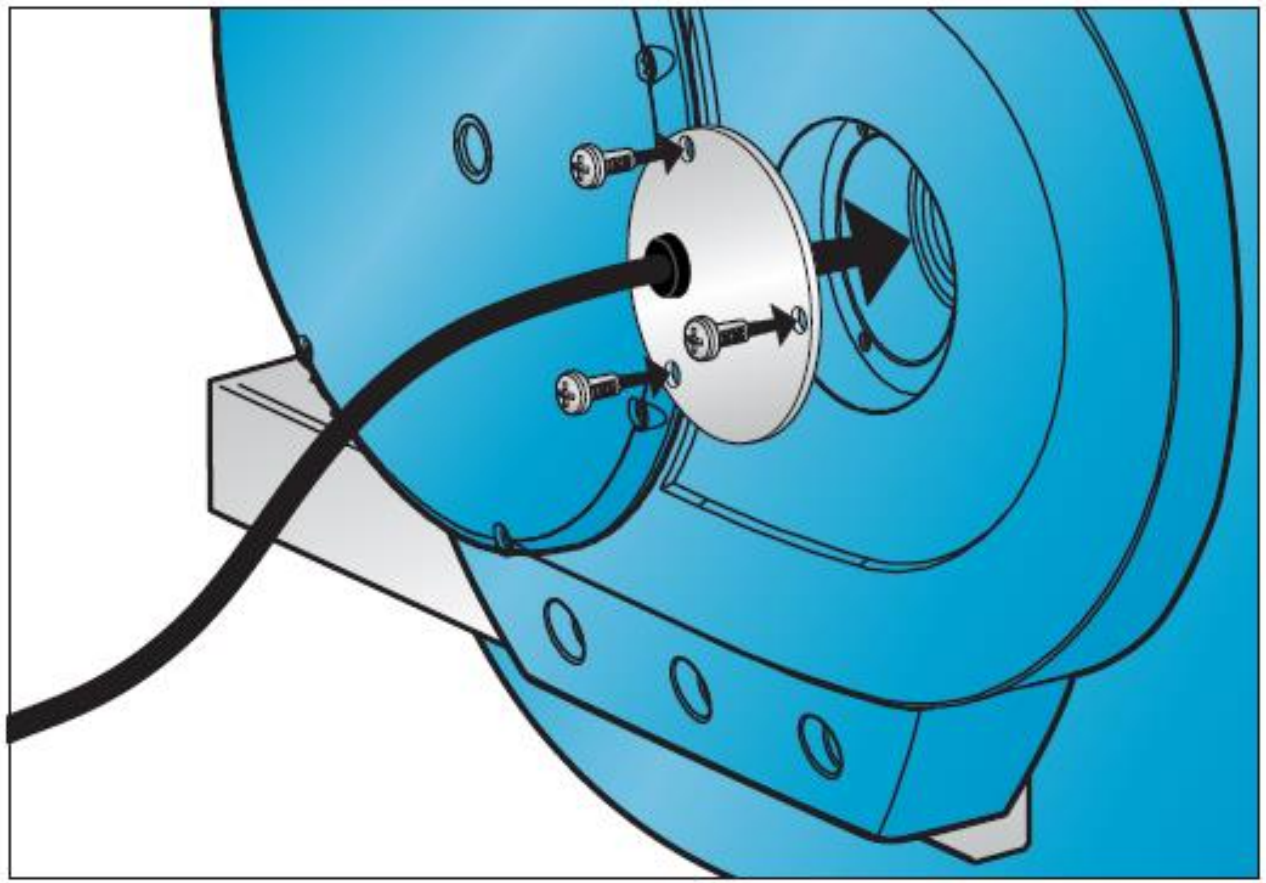
Adjustment of spring tension

The wrench used to adjust the spring tension comes with each reel.



The drum can be locked in place while adjusting the spring tension. Push in the drum locking pin. When finished pull the pin out.

Optional Micro Switch for the 865 Spring Reel



The micro switch can be used to start and stop the fan automatically.
It will require electrical control box with fan contactor
and transformer.

865SD Spring Reel with Automatic Damper

- Integrated automatic damper
- Damper opens when hose is pulled down
- Damper shuts when hose is retracted
- Damper can save energy allowing fan to be sized for maximum number of reels being used at one time

Automatic Damper

Motorized Hose Reels

Motorized Hose Reel

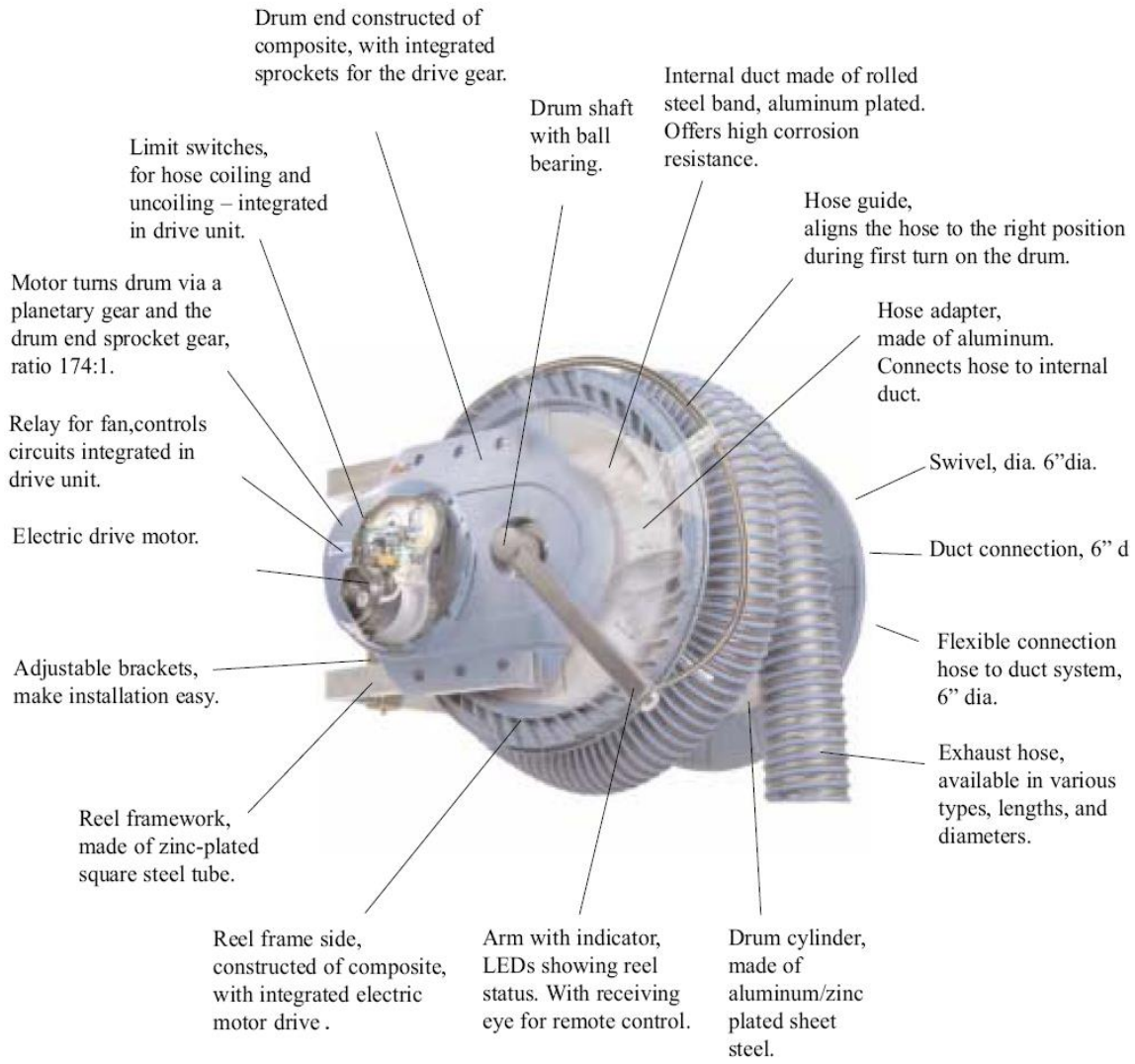
- Applications where hose can not hang down low enough to reach because of Overhead Crane or other obstacles.
- High Ceiling mount applications.
- Vertical stack vehicles.
- Customer's preference.

Features & Benefits of 865M Motorized Reel

Integrated Limit Switches are Controlled from the ground by the pendant switch – easy & quick to set or change

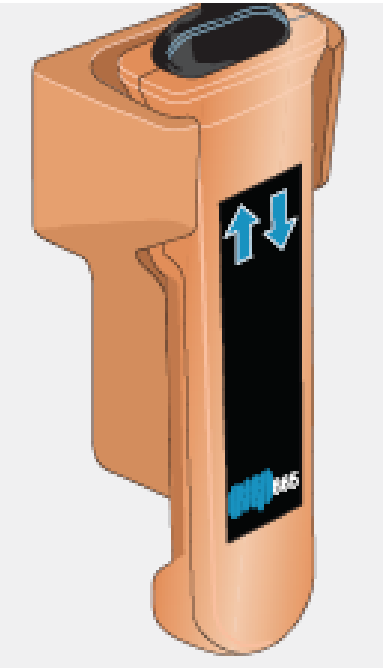
Integrated micro switch for fan control allows start stop of the fan with the up & down button on the pendant switch
Control box with contactor and transformer required.

You will not find the above features on the competitors motorized reels



865M Hose UP/DOWN Controls

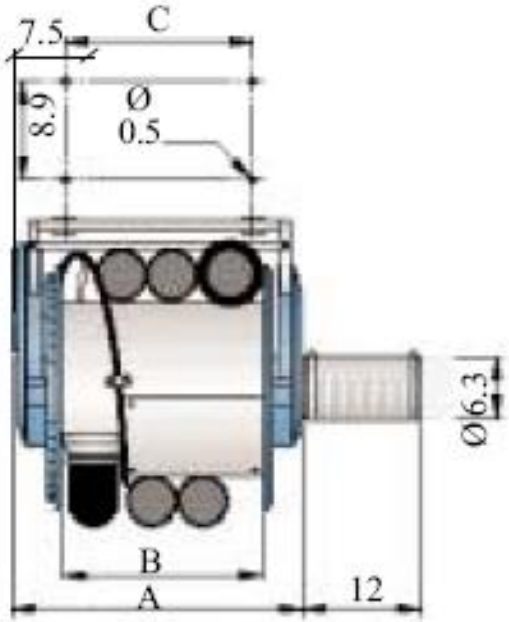
The pendant controls do not come with the reel and must be ordered separately.

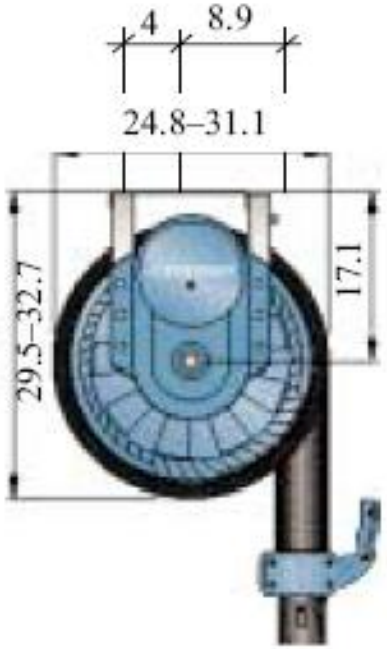


20373712 is the wired pendant

20373522 is the wireless pendant

Drum Storage Capacity





Short (narrow) Drum
A 28.5”
B 19.7”
C 14.6”

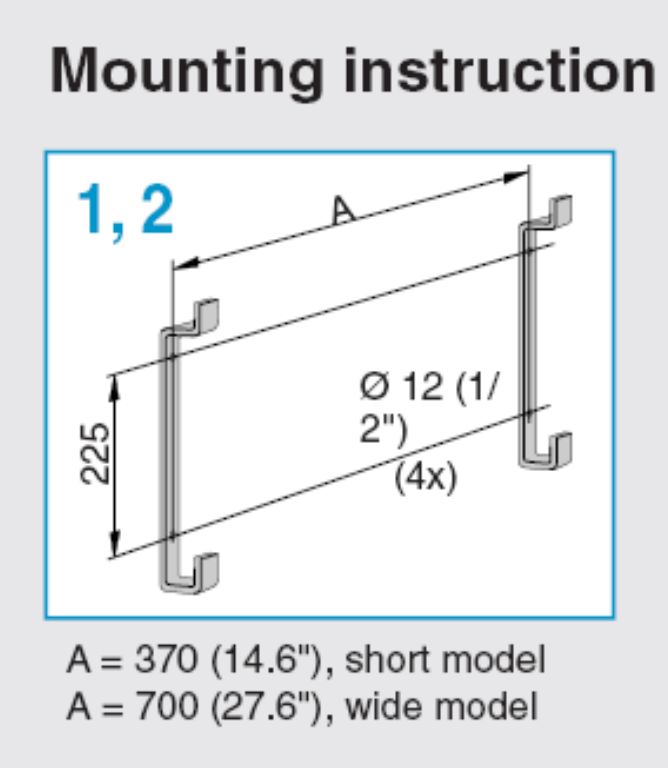
Wide Drum
A 41.5”
B 32.7”
C 27.6”

Hose Storage Capacity		
Hose Dia.	**Narrow Drum**	**Wide Drum**
4”	24’	39’
5”	19’	33’
6”	15’	29’
8”		23’

Motorized Hose Reels only available in Wide Drum

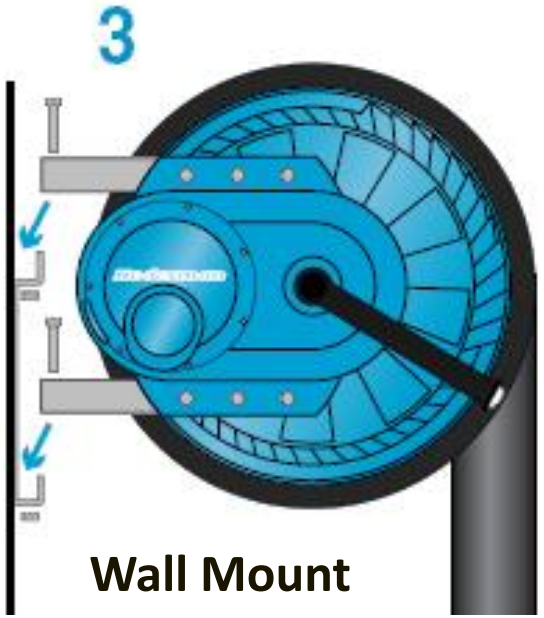
Direct Mount Fan

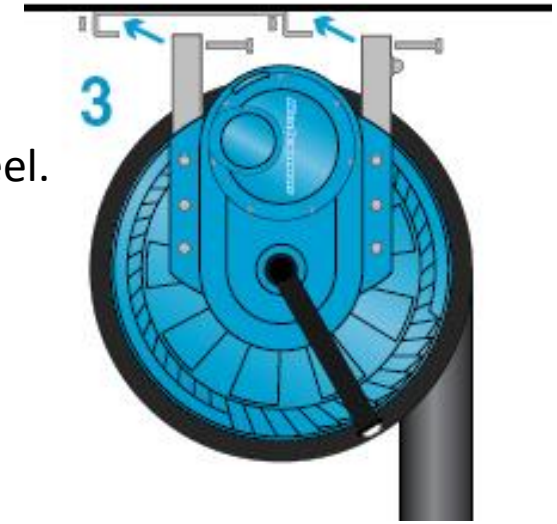
Mounting 865 Reels



Full Size Template with all hose reels.

Mounting brackets included with hose reel.

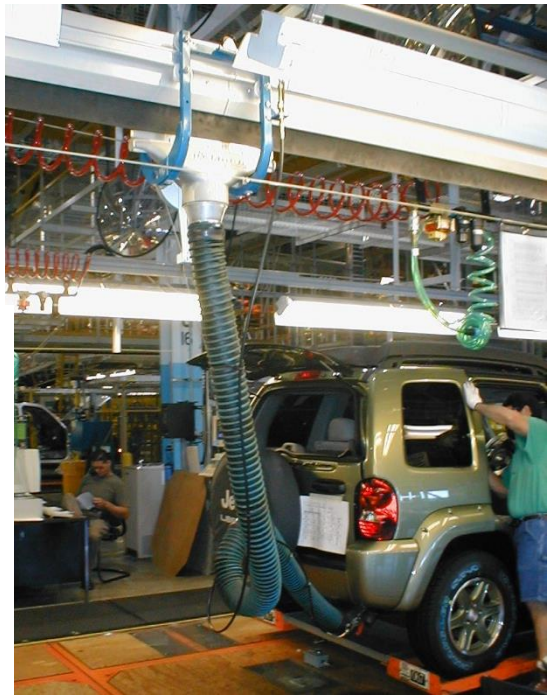


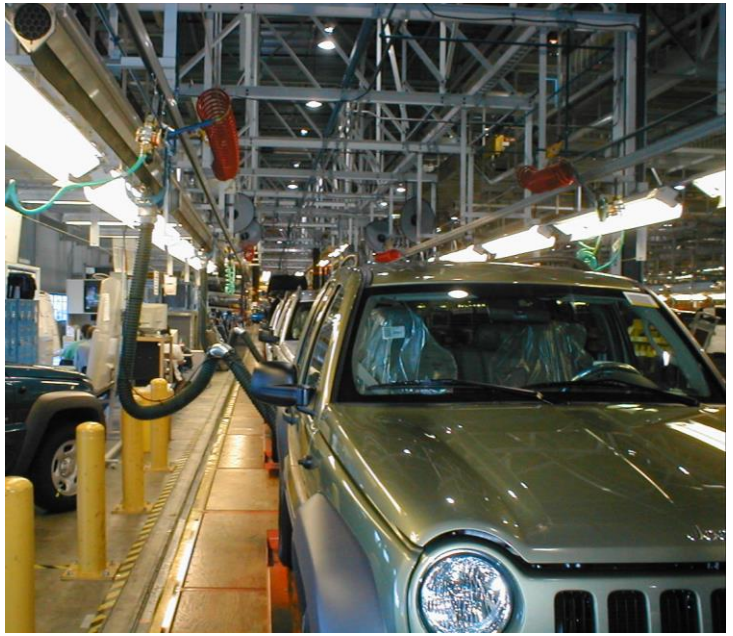


Ceiling Mount

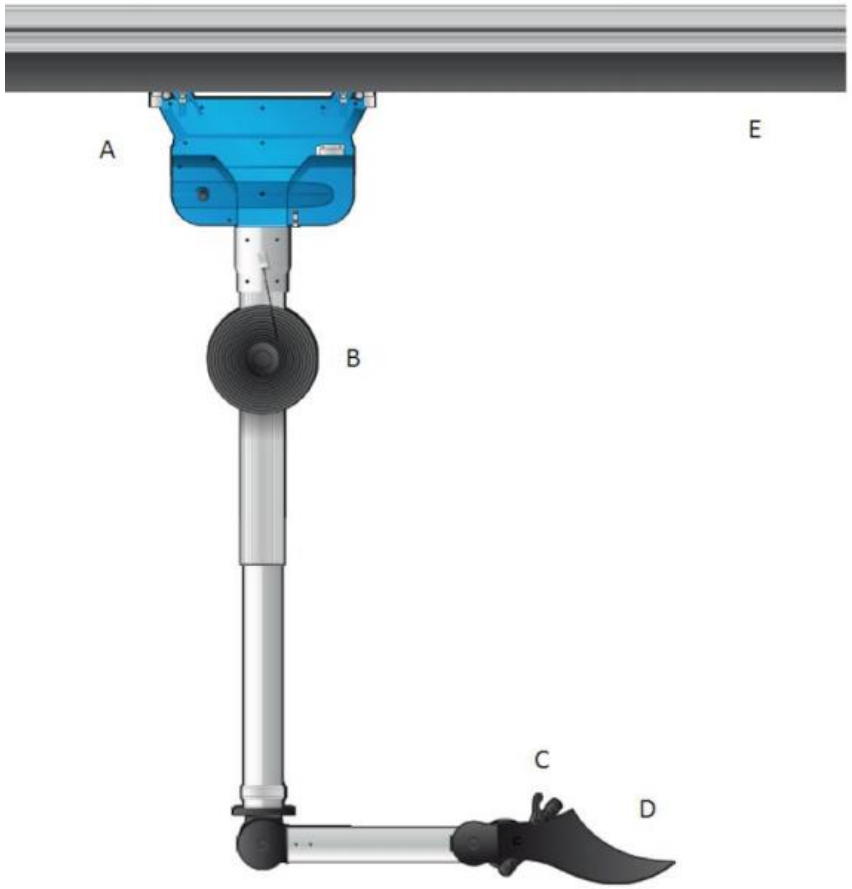
Hose Reels Mounting Options
Extension Arm Or Rail

Rail Options

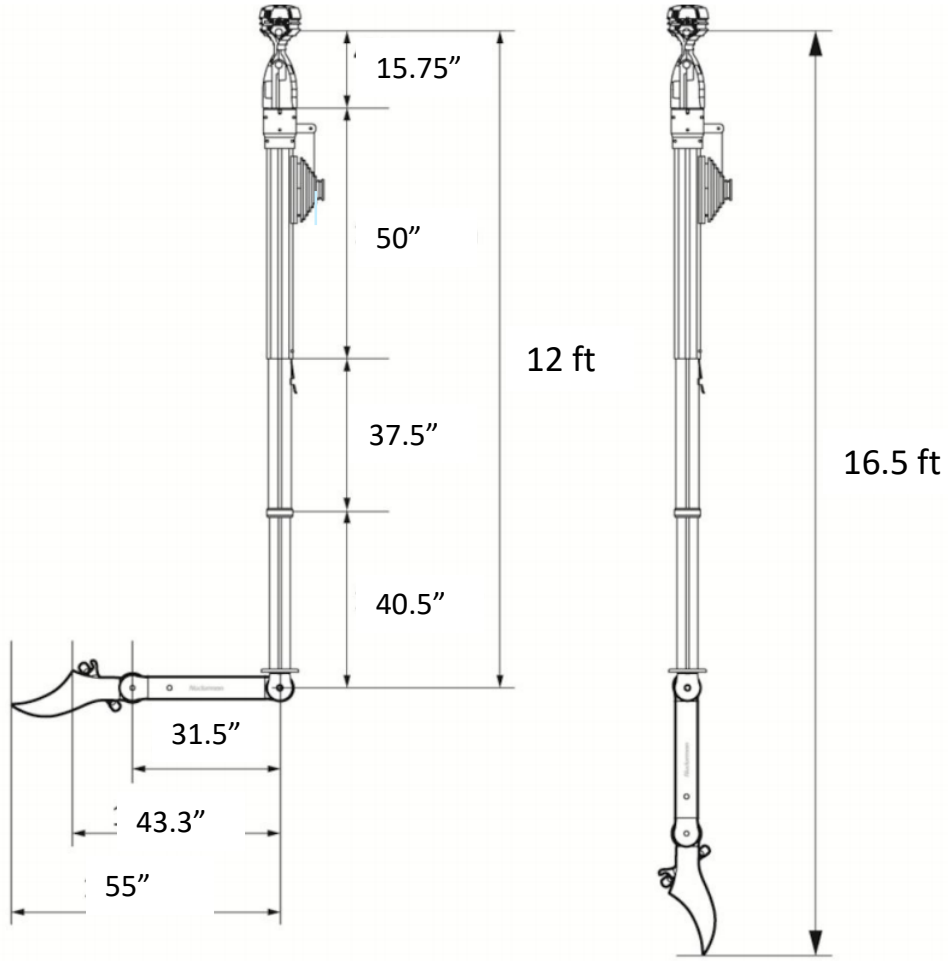


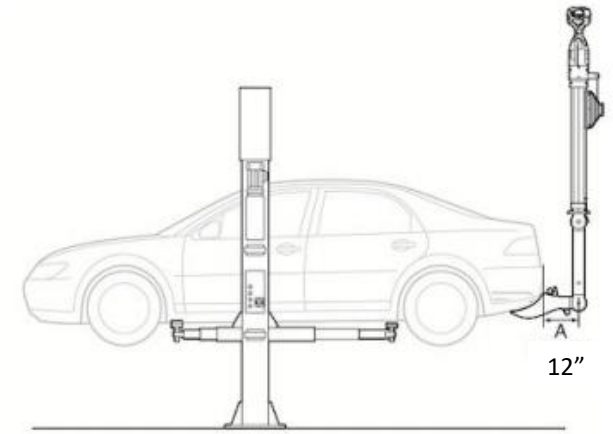


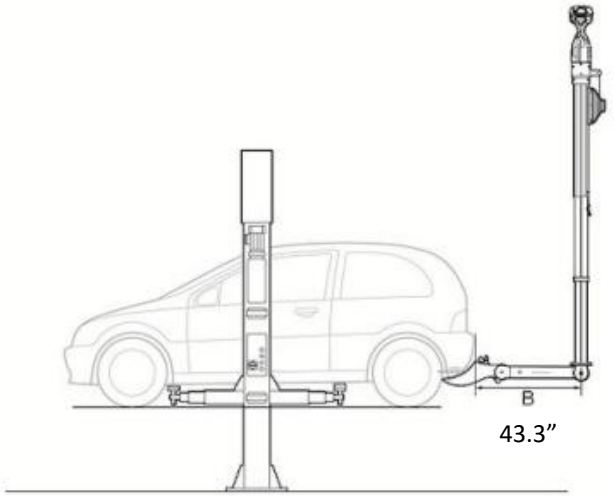
Rail – Touchless Exhaust Extraction System

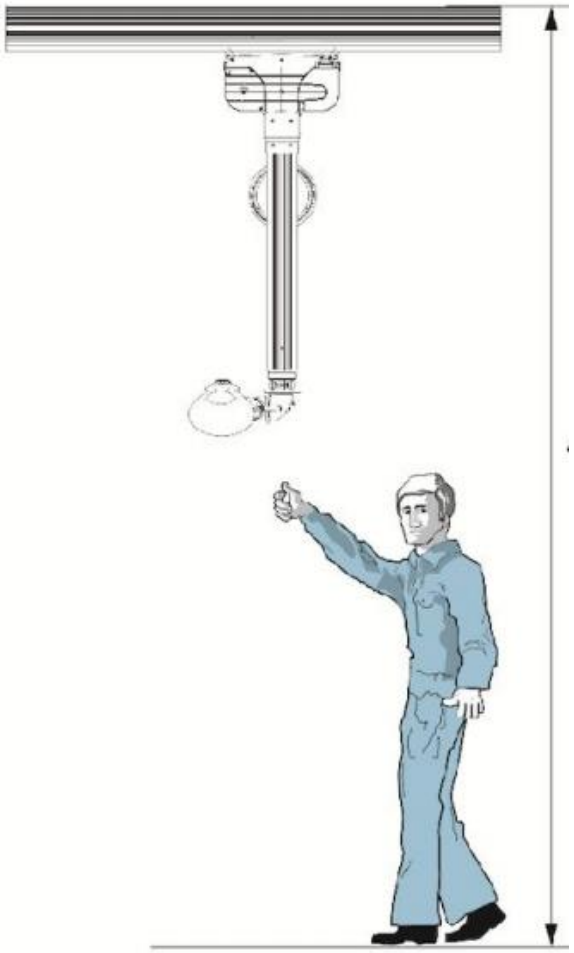


Rail – Touchless Exhaust Extraction System







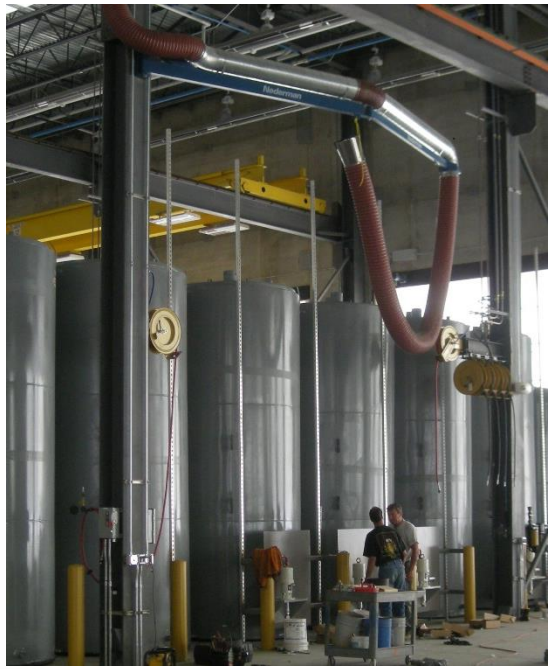


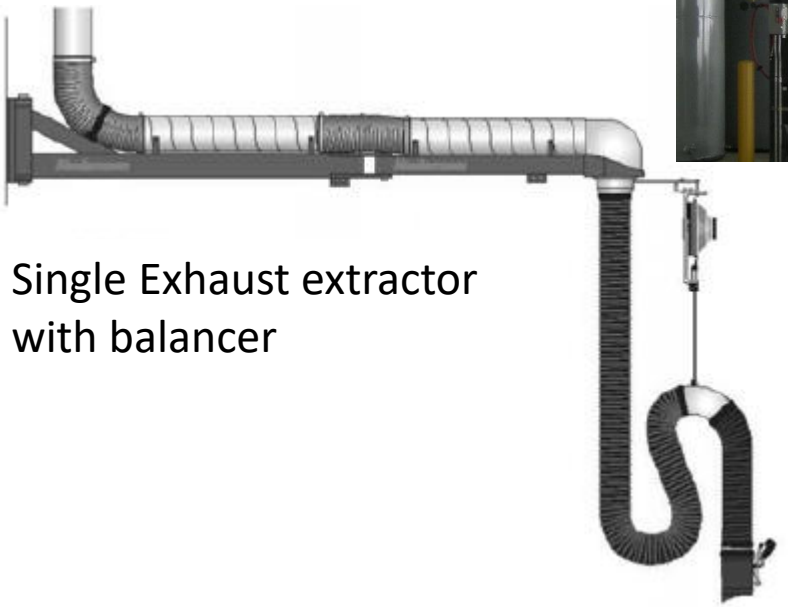
A = 300mm (The distance from the center of the rail to the back end of the longest car to be used) 12”
B = 1100mm (The distance from the center of the rail to the back end of the shortest car to be used) 43.3”

Rail – Touchless Exhaust Extraction System

Extension Arm Options

Spring Hose Reel can be mounted on a 14 or 20 ft Extension arm





Single Exhaust extractor with balancer

Single Extraction Options

- Easy to Install
- Less Expensive option

How to install

How not to install

Hose Options

	NR-CP	NFC 1.5	NFC 4.2	NFC 6.5	NFC 10
Material	Rubber with nylon helix Crush Resistant	Cloth with external steel helix Helix has plastic cover	Cloth with external steel helix		
Temp Rating	350 F	350 F	800 F	1200 F	2000 F
Application	Cars & small trucks	Cars & small trucks	Trucks & Buses	Large Trucks CNG Buses	Engines under load, large military & construction equipment
Hose Dia. CFM Application	4” or 5” 250 to 400 Cars & small trucks	4” or 5” 250 to 400 Cars & small trucks	6” or 8” 600 to 800 Trucks & Buses – short period of high rpm	6” or 8” 750 to 1200 Larger Trucks & Buses (CNG)	8” 1200 to 1600 Engines under load, Large construction equipment

Crush Resistant Hoses

Crush proof hose does not have a helix and tends to collapse when it gets hot. It can not be used on a hose reel. Commonly used for our Inground System.

Nylon Helix with Rubber cover

NR-CP hose is crush resistant with a nylon helix and can be used on a hose reel.

Hoses with Steel Helix - NFC

Steel Helix with plastic cover

NFC 1.5 has a plastic cover over the steel helix.

Steel Helix

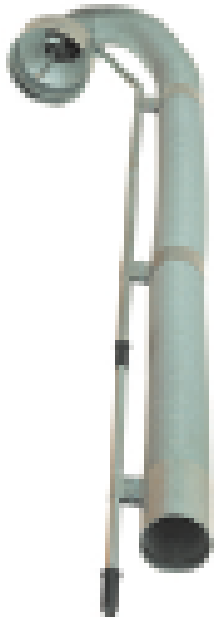
All NFC hoses above 700 F temperature rating do not have a plastic cover over the steel helix.

Combo Hoses

Nozzles

Nederman offers many different nozzles in rubber, aluminum and stainless steel. They are available with clamps, dampers, lifting sleeve and screens.

The exhaust cane is used with a clamping nozzle for vertical stacks.



Internal Grip Nozzle

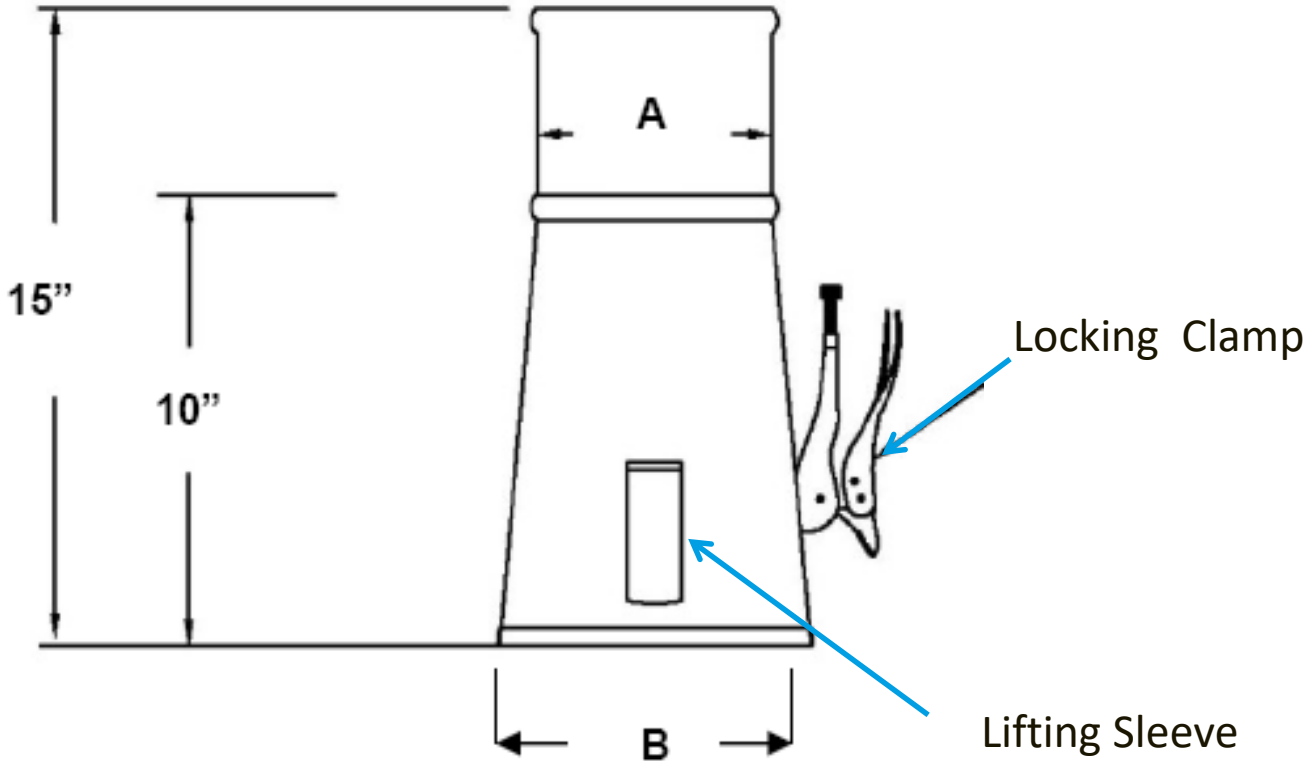
Clamps to the inside of the exhaust pipe. Will not scratch chrome pipes and works with newer cars that have integrated exhaust pipes.

Nederman is the only company mfg. a nozzle with internal clamping device.

Flush Exhaust Pipe

This type of exhaust on the Buick would require the internal grip nozzle.

Stainless Steel Nozzle



Vehicle Exhaust System Design

Duct Design

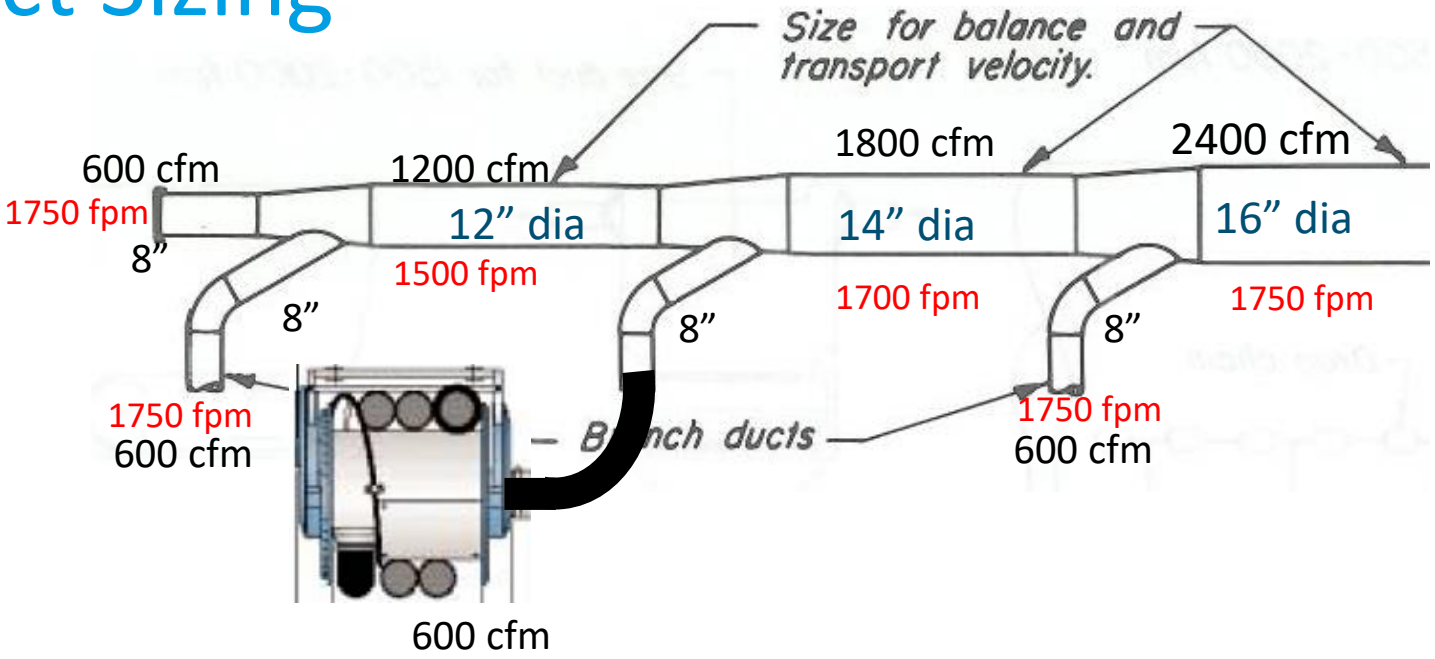
Duct Sizing

Based on maintaining proper conveying velocity

TABLE 3-2. Range of Minimum Duct Design Velocities*

Nature of Contaminant	Examples	Design Velocity
Vapors, gases, smoke	All vapors, gases, and smoke	Any desired velocity (economic optimum velocity usually 1000–2000 fpm)
Fumes	Welding	2000–2500
Very fine light dust	Cotton lint, wood flour, litho powder	2500–3000
Dry dusts & powders	Fine rubber dust, Bakelite molding powder dust, jute lint, cotton dust, shavings (light), soap dust, leather shavings	3000–4000
Average industrial dust	Grinding dust, buffing lint (dry), wool jute dust (shaker waste), coffee beans, shoe dust, granite dust, silica flour, general material handling, brick cutting, clay dust, foundry (general), limestone dust, packaging and weighing asbestos dust in textile industries	3500–4000
Heavy dusts	Sawdust (heavy and wet), metal turnings, foundry tumbling barrels and shake-out, sand blast dust, wood blocks, hog waste, brass turnings, cast iron boring dust, lead dust	4000–4500
Heavy or moist	Lead dusts with small chips, moist cement dust, asbestos chunks from transite pipe cutting machines, buffing lint (sticky), quick-lime dust	4500 and up

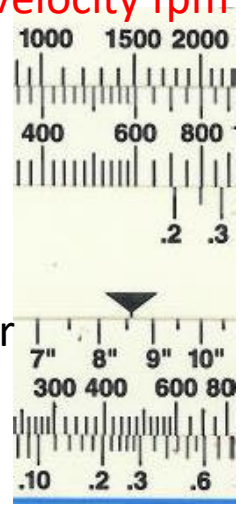
Duct Sizing



Velocity fpm

cfm

Duct diameter



Q = AV OR A = Q /V
Q = Cubic Feet per Minute
A = area of duct in square feet
V = velocity in Feet Per Minute

VFD

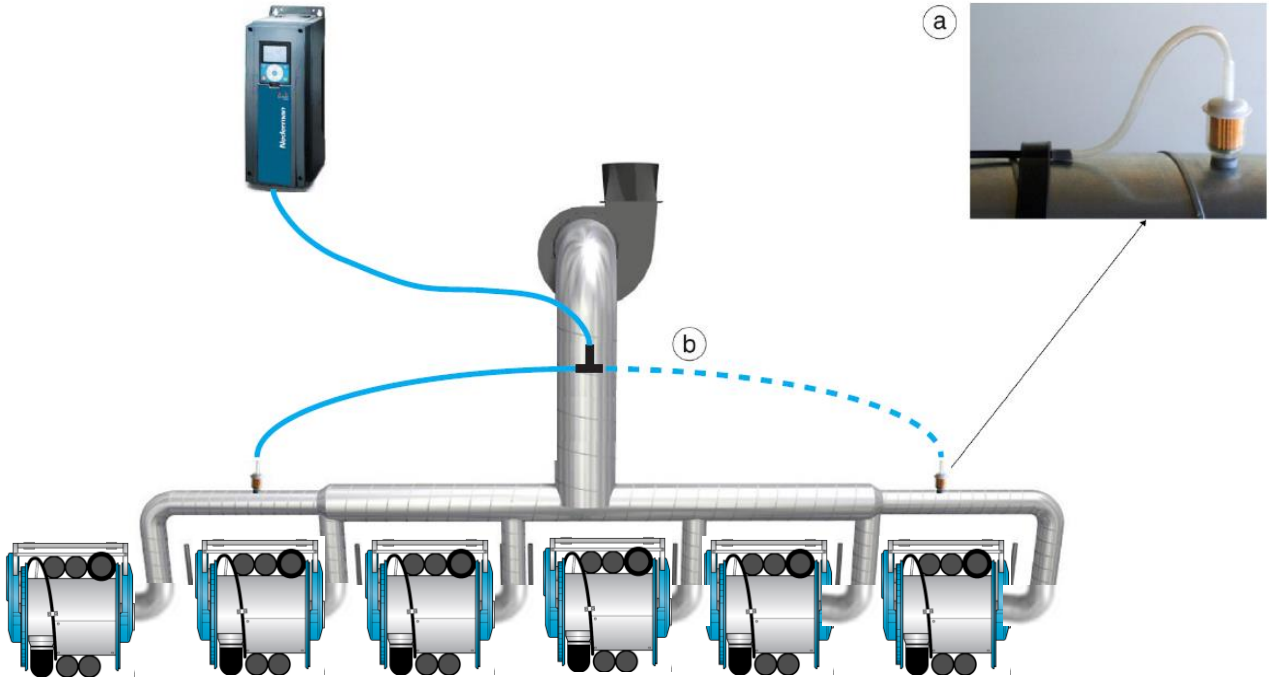
Variable Frequency Drives

Variable Frequency Drive
With Pressure Transducer

Programmed by Nederman

Most competitors do not offer this package

VFD with Pressure Transducer

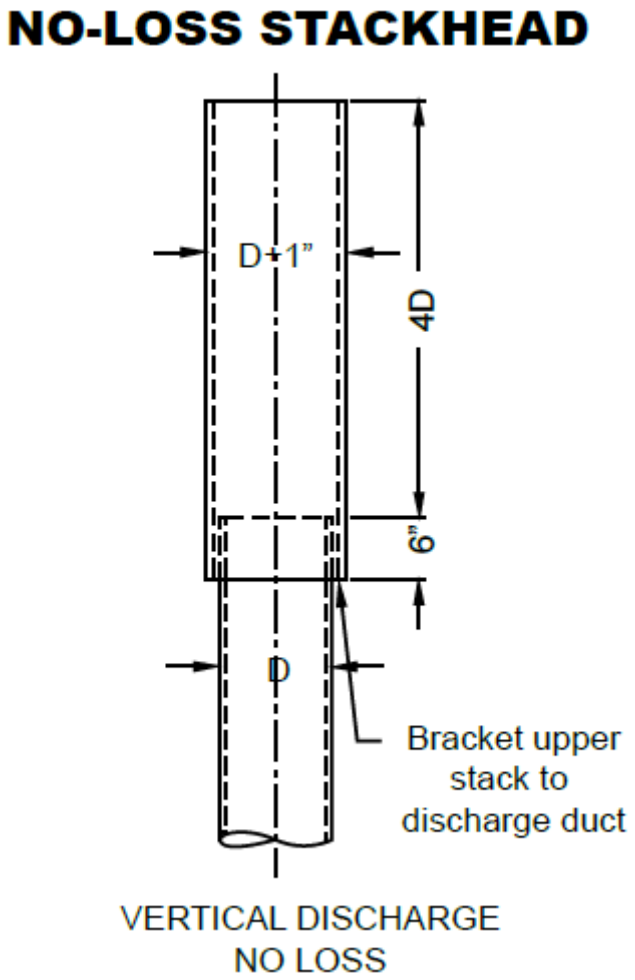


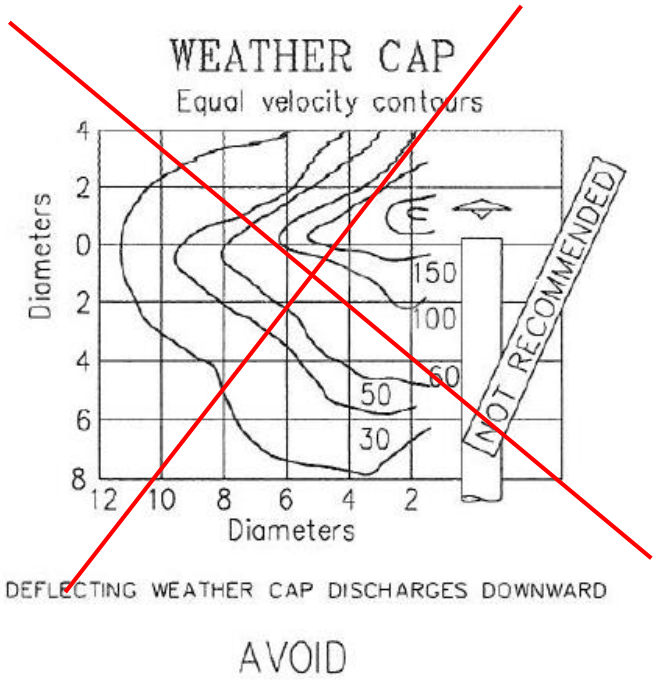
Duct Gauge

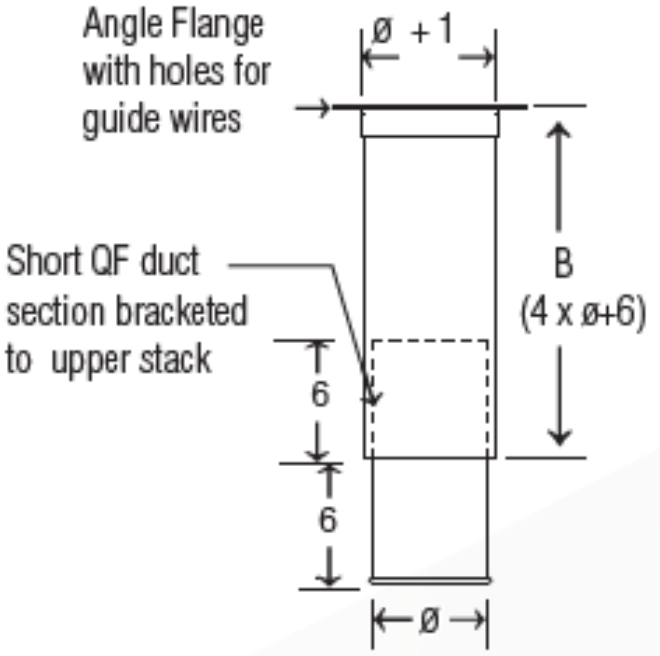
SMACNA – Sheet Metal & Air Conditioning Contractors National Association

TABLE 3-2B ROUND DUCT GAGE NEGATIVE PRESSURE						
MAX. DIA.	-2" w.g.		-4" w.g.		-10' w.g.	
	Spiral Seam	Long. Seam	Spiral Seam	Long. Seam	Spiral Seam	Long. Seam
6"	28	28	28	28	26	26
7"	28	28	28	28	26	26
8"	28	28	28	28	26	26
9"	28	28	28	26	26	24
10"	28	28	26	26	26	22
11"	28	26	26	24	26	22
12"	28	26	26	24	24	22
13"	28	26	26	24	24	20
14"	28	24	24	22	24	20
15"	28	24	24	22	22	20
16"	26	24	24	22	22	18
17"	26	24	24	20	22	18
18"	24	22	24	20	22	18
19"	24	22	24	20	22	18
20"	24	22	22	20	22	18

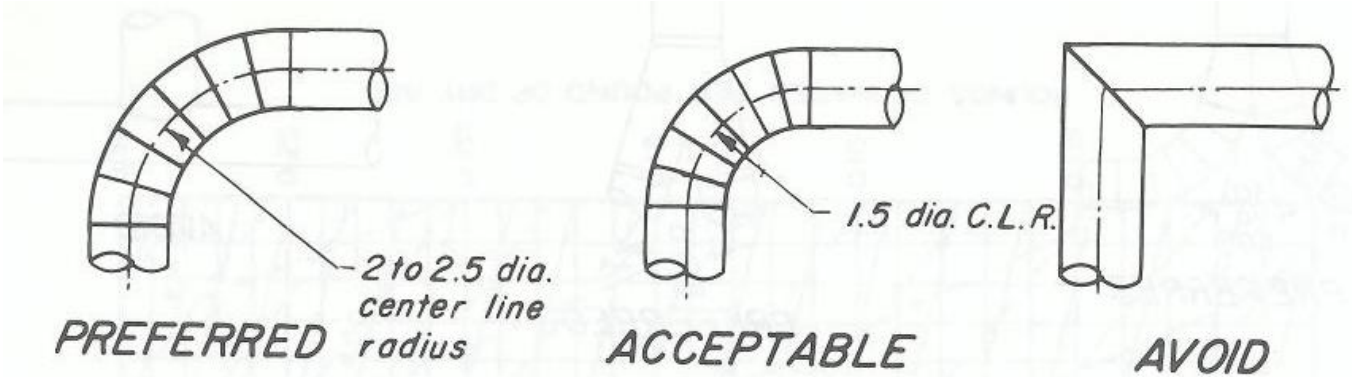
No-Loss Stack





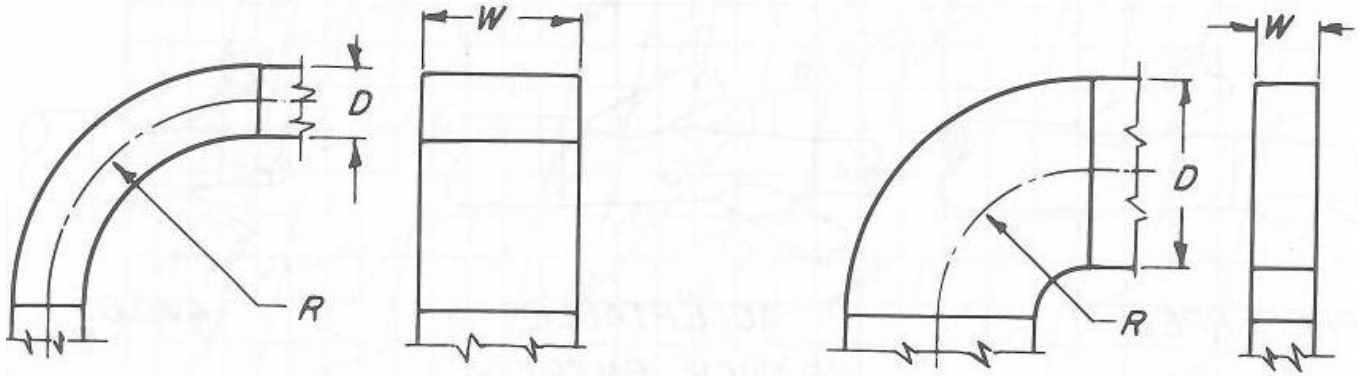


Elbows

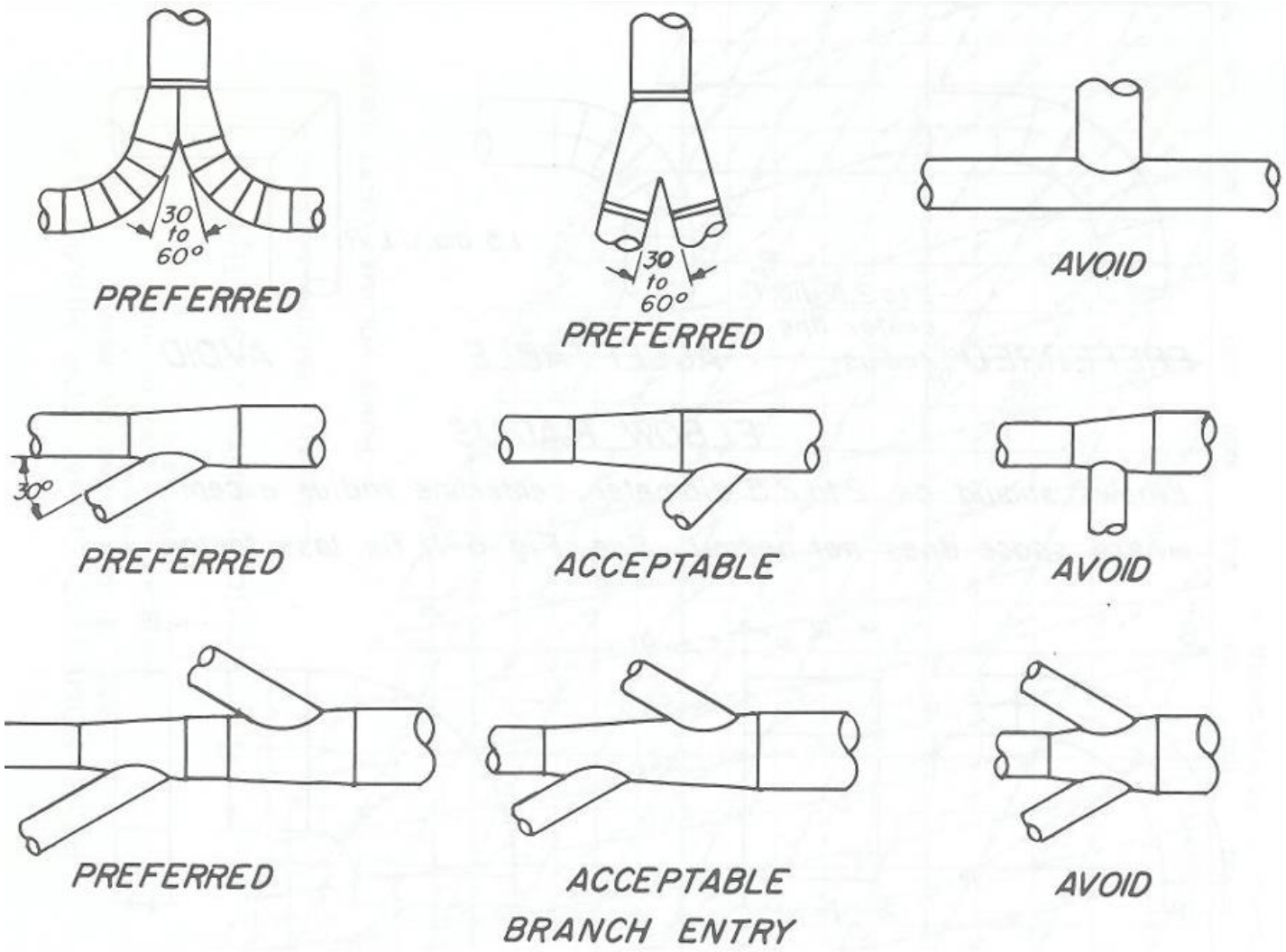


ELBOW RADIUS

Elbows should be 2 to 2.5 diameter centerline radius except where space does not permit. See Fig. 6-11 for loss factor.

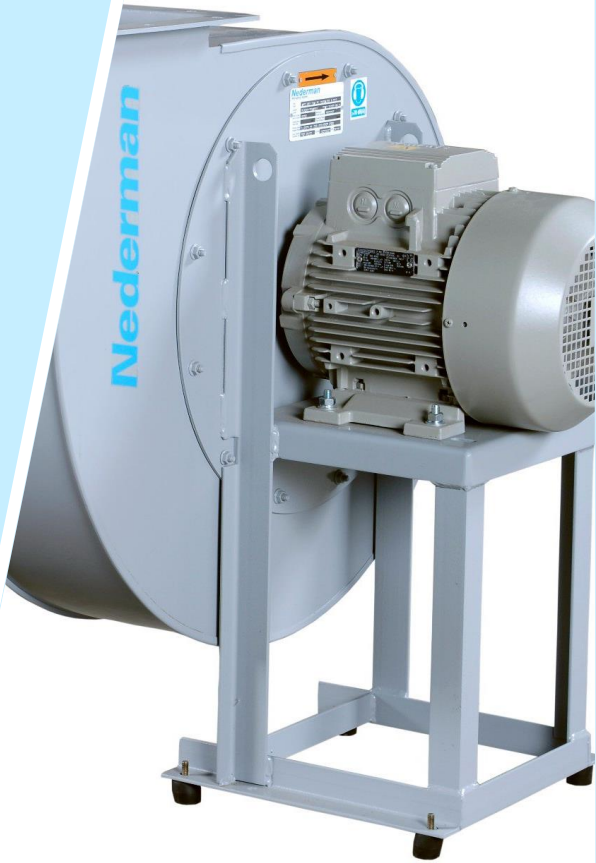


Branch Entry



Vehicle Exhaust System Design

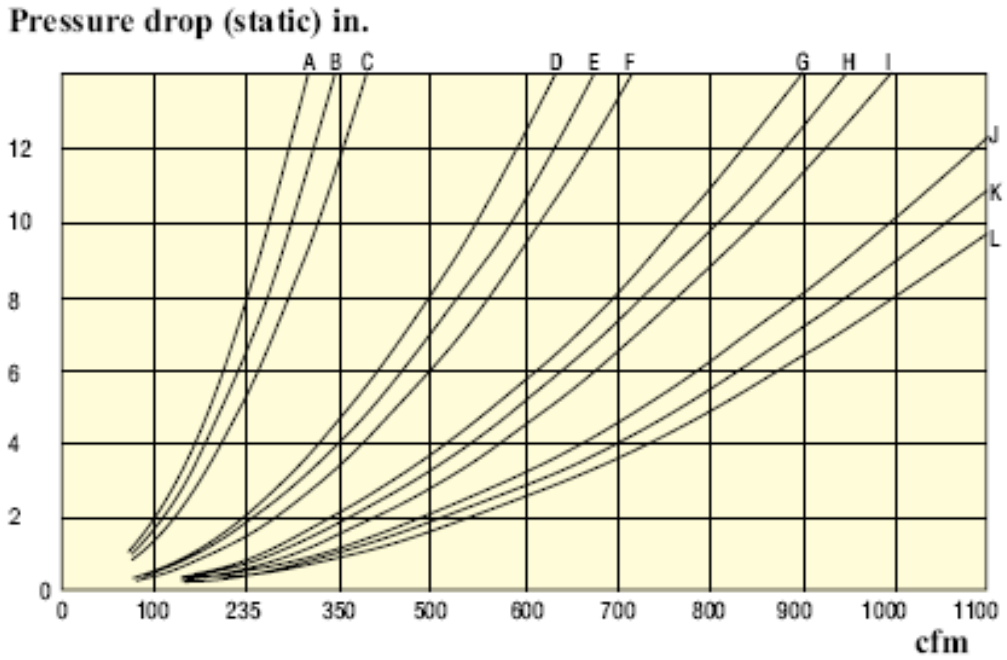
Fan Selection



Static Pressure Charts

Pressure drop diagram (pressure drop over reel when most of the hose is uncoiled)

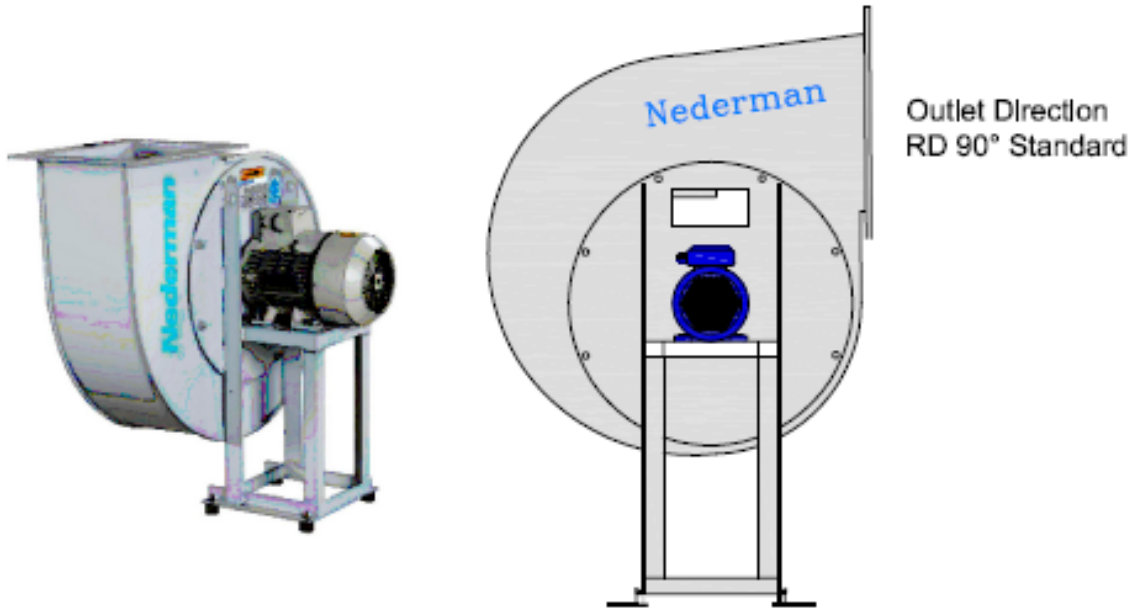
A. 3” X 33’	G. 5” X 33’
B. 3” X 25’	H. 5” X 25’
C. 3” X 16’	I. 5” X 16’
D. 4” X 33’	J. 6” X 33’
E. 4” X 25’	K. 6” X 25’
F. 4” X 16’	L. 6” X 16’

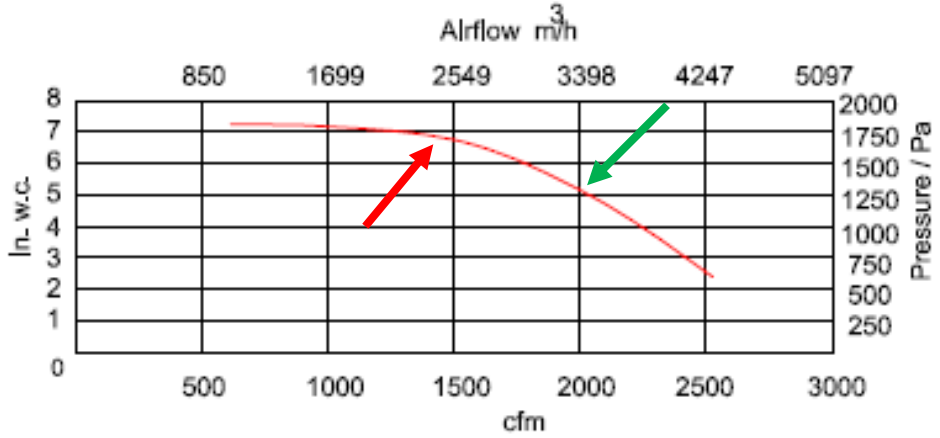


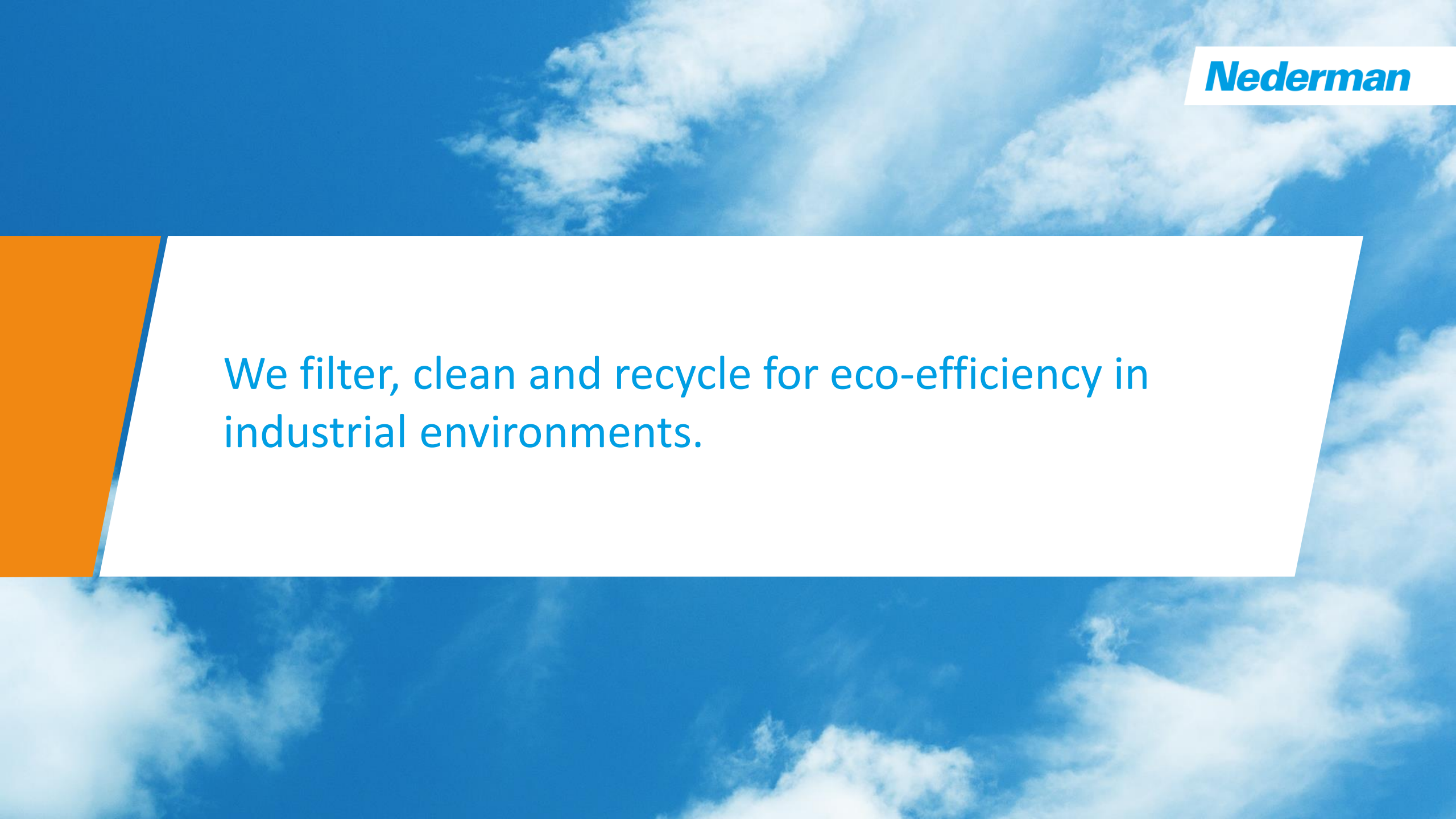
VE System Design – Fan Selection

NEDERMAN FAN NCF 30/15 - 230-460/3/60 V , 3HP RD 90

If the system requires 2000 cfm at 5” this is a good fan selection.
If the system requires 1450 cfm at 6.75” this is a poor fan selection. Stay away from the flat section of the fan curve.






Nederman
We filter, clean and recycle for eco-efficiency in industrial environments.

Thank you for attending.

For any future questions or if we can be of assistance, please feel free to contact us at

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Robert.Hotchkiss@Nederman.com