English

Piping Guide
Vacuum Piping Guide, Building

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Introduction

This manual is made for use by designers, engineers, plumbers and installers to show the main items for installation of a vacuum sanitary system in most types of buildings.

Information Disclaimer

Illustrations are intended to provide general assistance in installation. They do not supersede the information provided in approved product data sheets supplied with the installation upon purchase. Drawings and illustrations are representative only. Principles and information provided must be adhered to. For additional information contact an approved supplier.

All plumbing work is the responsibility of the customer. Jets Vacuum AS cannot be held liable for malfunctions in the system caused by incorrect pipeline design or construction. All local, state, federal and industry requirements must be adhered to when installing Jets Vacuum AS sanitary systems.

For specific product related installation information, please refer to the product specific data sheet.

Support

For support, please contact Jets Vacuum AS directly. All other inquiries, please contact either Jets Vacuum AS directly or you local Jets Vacuum AS representatives.

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Accumulating Tank

- Jets™ Accumulating tank increase volume in a piping system, enhancing vacuum power.

Atmospheric Pressure

- Air pressure at sea level. Any air pressure below atmospheric pressure, often described in percentages of total vacuum.

Backflow

- Any reversal of the flow of liquid from its intended direction back to a wastewater source.

Back Pressure

- Restriction of flow on the pressure side of the Vacuumarator™. Caused by friction in bends or pipes and lifting height.

Black Water

- Wastewater from toilets and urinals.

Branch Line

- Section of vacuum pipeline connecting a limited number of wastewater sources to the main vacuum line.

CVS™

- CVS™ - Constant Vacuum System- vacuum is maintained in the piping at all times. Pump starts any time vacuum level is below a predetermined level.

  Note: this manual is intended for CVS™ systems and is not applicable for VOD™ systems.

Discharge Point

- Location where the outlet piping from the Vacuumarator™ delivers wastewater to a sewage tank, processing unit or public sewer.

Grey Water

- Wastewater from kitchen sink, showers, hand basins, washing machines, etc., except wastewater from toilets, urinals etc. (black water).

Grey Water Tank / Interface Unit

- Also known as grey water interface tank. A tank used to interface and control the amount of grey water being released into the vacuum system from showers, sinks, wash basins etc. Fitted with a valve and level sensor for valve activation and quantity dispersal for tank discharge.

Gooseneck

- Fitting always to be used when joining upward running piping from toilets or grey water interface tank to a horizontal pipe. This is to eliminate return or backflow of fluids.

Main Run / Main Lines

- Vacuum pipes where wastewater from all wastewater sources and branch lines is collected before being delivered to a vacuum unit.

Non-return Valve

- A one-way valve installed to prevent back flow.

Pressure Side / Outlet Side

- All equipment and pipes between a vacuum unit and the discharge point (sewage tank, processing unit or public sewer).

Rodding Point

- A clean out access point in pipes. When transport pockets and longer stretches of piping is used, rodding points should be installed with suitable distances and sufficient access.

Shut-off Valve / Isolation Valve

- The shut-off valve is used to isolate or stop flow in areas of the vacuum system.

Slope

- Normally indicated as piping with a downward (decreasing or falling) angle towards the vacuum unit.

Slug

- A plug formed of wastewater, collected and reformed in transport pockets.

Vacuum Side

- All equipment and pipes on the vacuum side of the vacuum unit.

Transport Pocket/ Reforming Pocket

- A trap designed to collect wastewater within pipes in stages to reform wastewater to a slug. Required in order to facilitate more effective transportation over long horizontal pipe lengths. When a toilet on the same pipeline is flushed, the pressure difference in front of and behind the pocket will push the slug on to the next transport / reforming pocket.

Vacuum

- Any air pressure below atmospheric pressure. Often described in percentages of total vacuum.

Vacuum Unit

- A pre-built unit designed to create vacuum. Made up of one (1) or more Vacuumarator™ pumps.

Vacuumarator™ Pump

- A vacuum generator developed by Jets™ that creates vacuum, macerates and transports sewage in a single-pass operation. The Vacuumarator™ pump is a purpose-built design based on the Helivac™ pump principle.

Vertical Riser Pipe

- Piping running upward from wastewater source to overhead horizontal piping.

VOD™

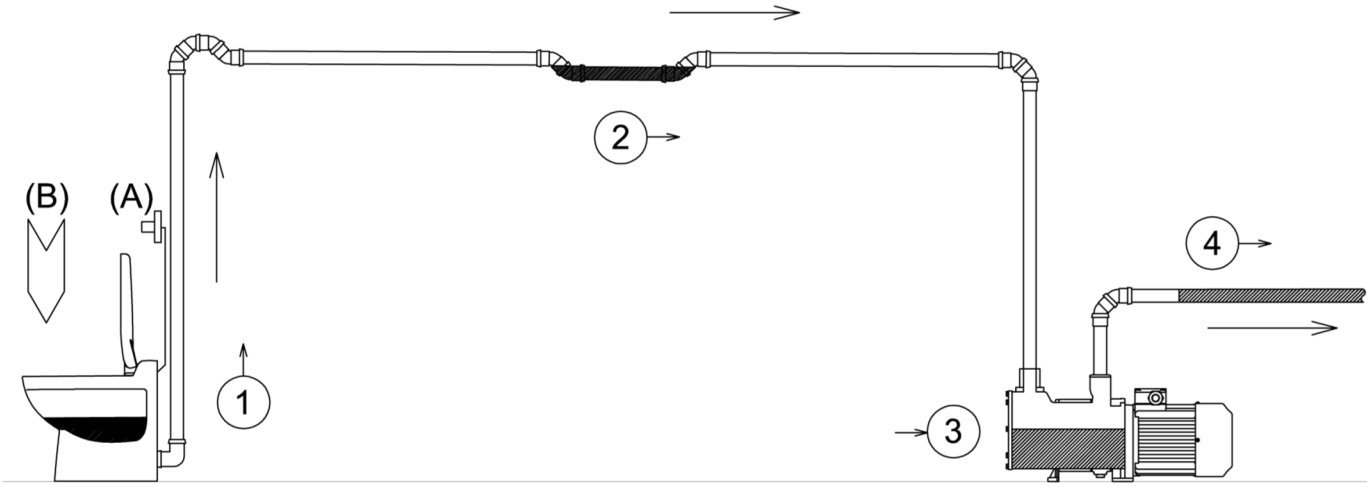
- Vacuum On Demand – A system whereby a pump creates a vacuum in the pipe system when a toilet or urinal is flushed or a grey water tank is emptied. Used in smaller systems with four or less wastewater sources.

Wastewater / Wastewater Source

- The effluent (wastewater) from wastewater sources such as toilets, urinals, etc.

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An introduction to how a Jets™ vacuum piping system functions.



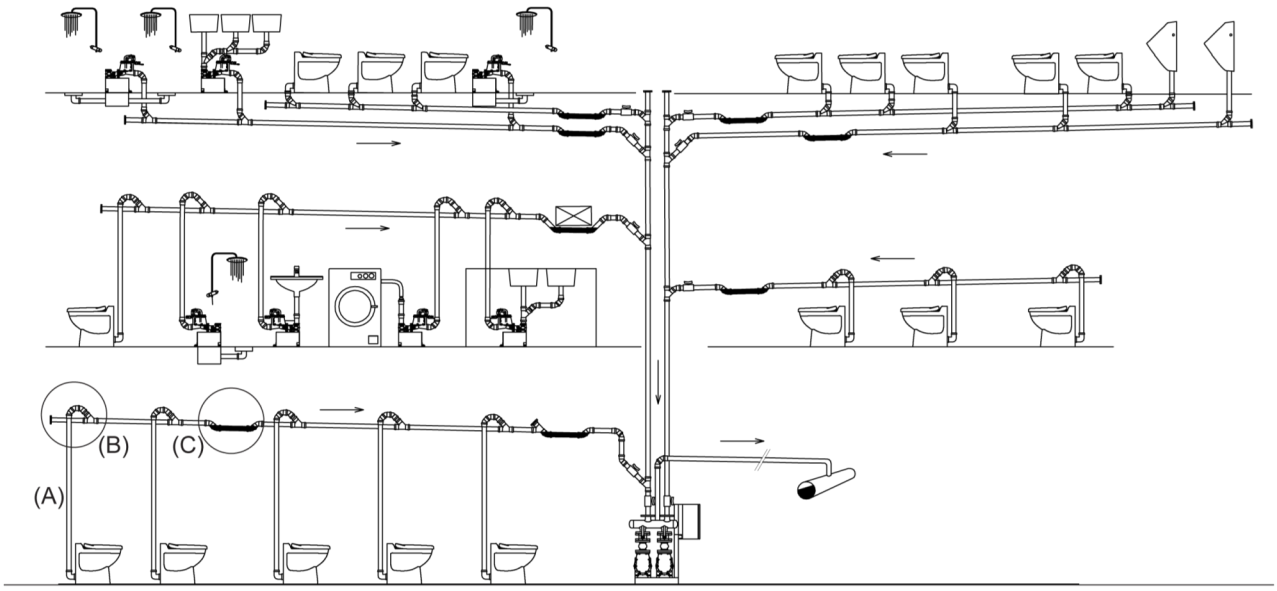
(A) - Release Button
(B) - Air In

1 - Vacuum pipes
2 - Transport pocket
3 - Vacuumarator™ pump
4 - To sewer/collecting unit

When the release button (A) is activated, the valve inside the toilet will open and air (B) will enter the valve. The air transports the wastewater (1) into the vacuum pipes. The transport will continue as long as the valve is open. After about 2 seconds the valve inside the toilet will automatically close. The transport of wastewater will then stop and the wastewater will create a slug in the nearest transport pocket (2).

When the release button is activated again, the toilet valve opens and air will bring new wastewater into the piping system. At the same time, depending on the length of the horizontal pipe and the number of transport pockets, it moves wastewater from transport pocket (2) to the Vacuumarator™ pump (3).

The wastewater will be macerated in the Vacuumarator™ pump and then transported to a discharge point (4), such as collecting tank or mains sewer.



The installation principles of piping in a vacuum system can, in most cases, be similar to those in a gravity piping system. However, vacuum piping systems have many benefits as opposed to gravity systems.

- Smaller diameter piping, such as Ø50mm from a toilet
- Possibility to run piping upward into ceilings (A)
- More alternatives for piping flexibility and a simpler design
- No need for a ventilation system above the roof of a building

Important Installation Information:

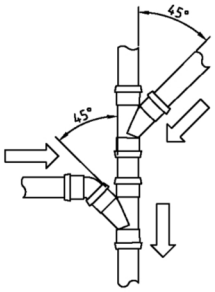
- The vacuum unit should always be placed at the lowest level of the piping system. This means at the same level or lower than the lowest wastewater source.

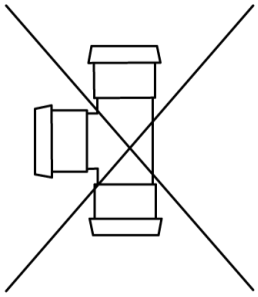
  Note: A high lifting height on the pressure side will reduce the capacity on the vacuum side.
- Goosenecks (B) must be used wherever there is upward piping from toilets.
- Horizontal piping should have transport pockets (C).

Branches and bends in piping will have a critical effect on the functions of a vacuum system. Use branches and bends with a maximum of 45°.

Branches

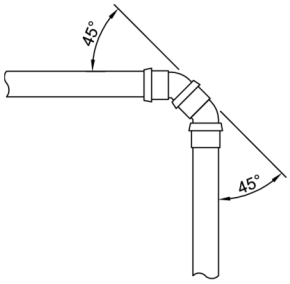
In a 90° change of direction, 1 x 45° branch and 1 x 45° bend are to be used.

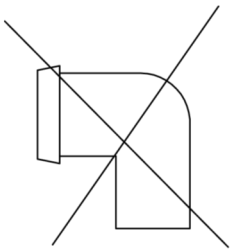




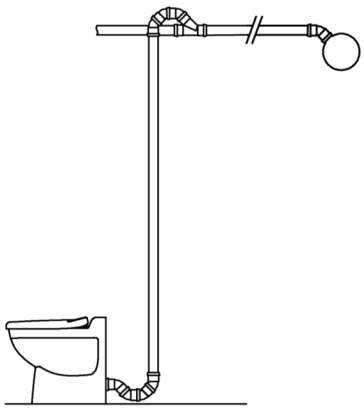
Bends

In a 90° change of direction, 2 x 45° bends are to be used.

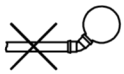




Joining a Branch to a Main Pipe

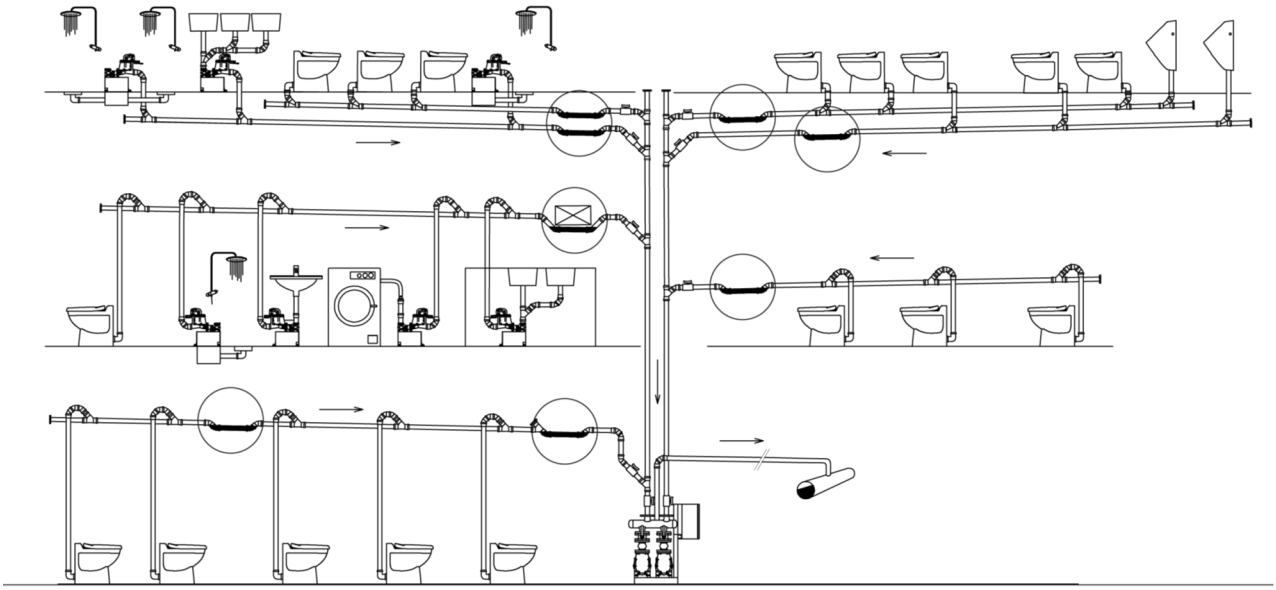






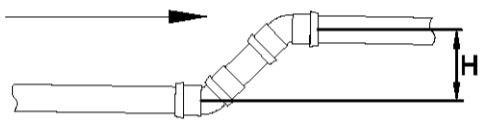
This view is taken along the pipe and shows the method of joining a branch pipe onto a main pipe. This will avoid a backflow of wastewater. The branch should be connected a minimum of 2/3 up on the pipe.

Transport pockets act as a collection point for effluent slugs and a staging point for reforming the slug during transportation through a vacuum pipe system. The slug remains in these transport pockets until the next time the vacuum pipe system is activated and air once again enters the pipes, moving the slug in the flow direction in the pipe system to the next transport pocket.



Note:

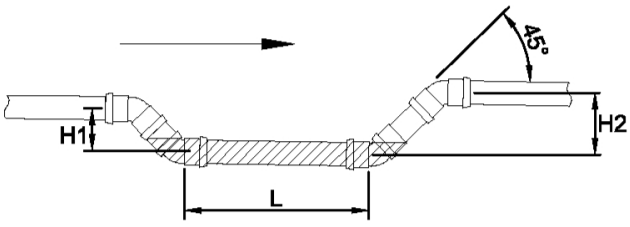
- Depending on the transport pocket type, horizontal piping should be installed with a slope of 1:50 or 1:100.
- Due to the slope in the horizontal pipes, transport pockets can be used to regain the piping height.
- The distance between the transport pockets in main pipes should be +/- 15 meters.



Option 1:

H = min. 50mm, max 500mm

Note: For this type of transport pocket use slope 1:50.



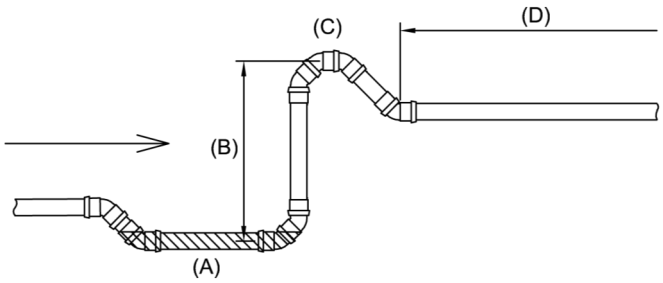
Option 2:

H1= min. 50mm, max. 300mm
H2= min. 50mm, max. 500mm

(L) Preferred length is 500mm, but max 1000mm
if needed.

Note: For this type of transport pocket use slope 1:100

Transport Pocket Design Solutions when the lift is more than 500mm



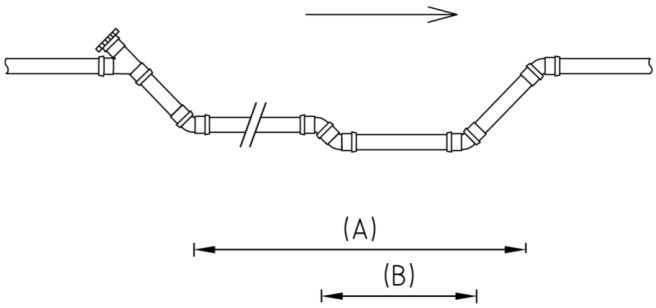
If the vacuum pipe has to be placed above obstructions, it is recommended to place a transport pocket (B) in front of the rising pipe.

(A) Transport pocket, max 300mm long
(B) Lift height, 500-1000mm
(C) Gooseneck
(D) If pipe length is over 2000mm add gooseneck (C)

Reforming pocket below obstruction

Always design and install a reforming pocket if the obstruction is longer than 1 m.

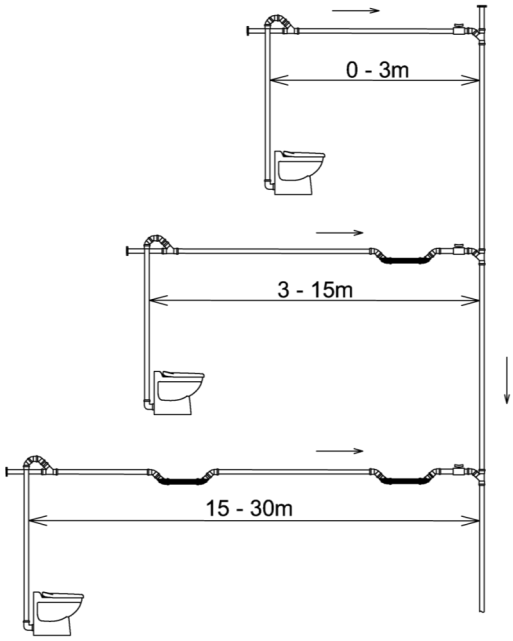
(A) - longer than 1000 mm
(B) - Max 500 mm

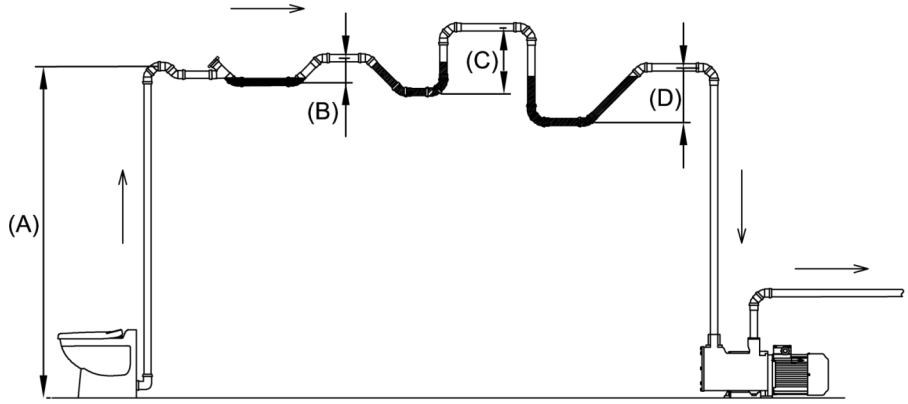


Distances between transport pockets in a branch line

The first transport pocket should always be placed at the end of the horizontal pipe, right before the connection to a vertical pipe.

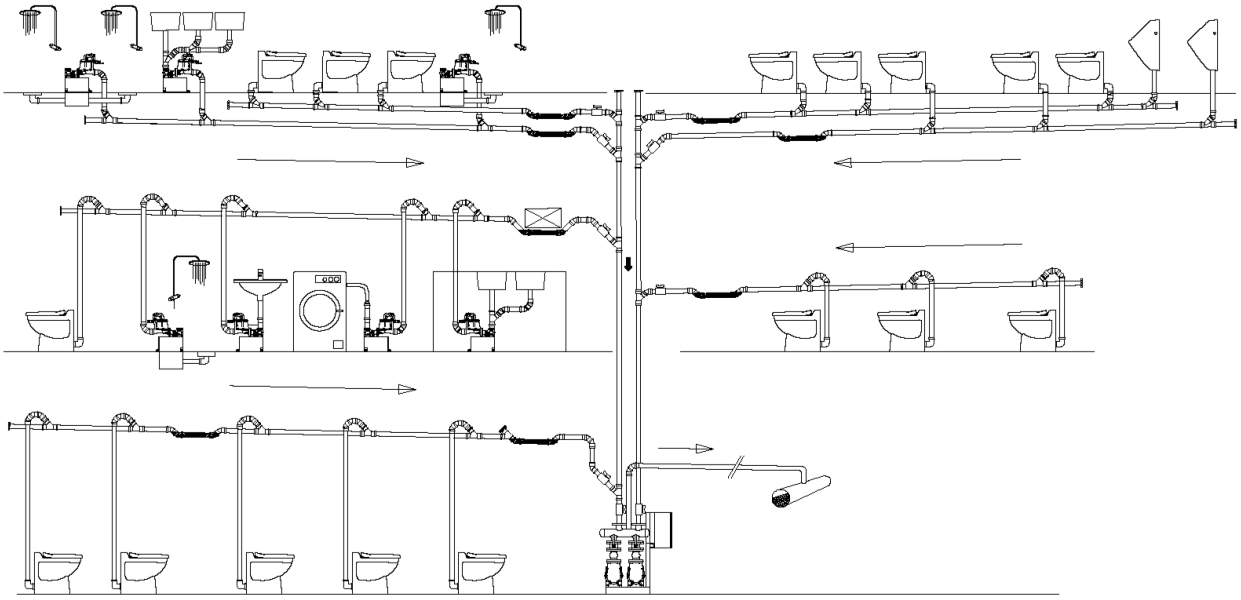
Vacuum piping can be installed even though there might be obstructions. If this is the case, follow the recommendations in our vacuum piping guidelines.





The sum of (A)+(B)+(C)+(D) must not exceed 6 metres.

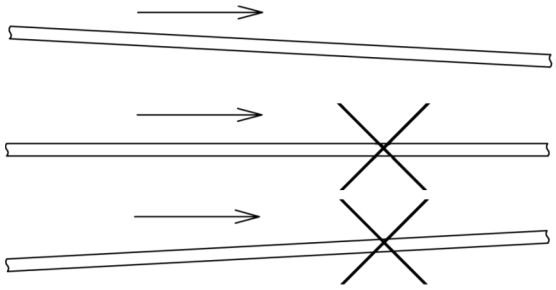
Here is an example of how to calculate total lift when bypassing obstructions:
(A) 3m, (B) 0,2m, (C) 0,9m, (D) 0,9m
= 5 m accumulative lift.

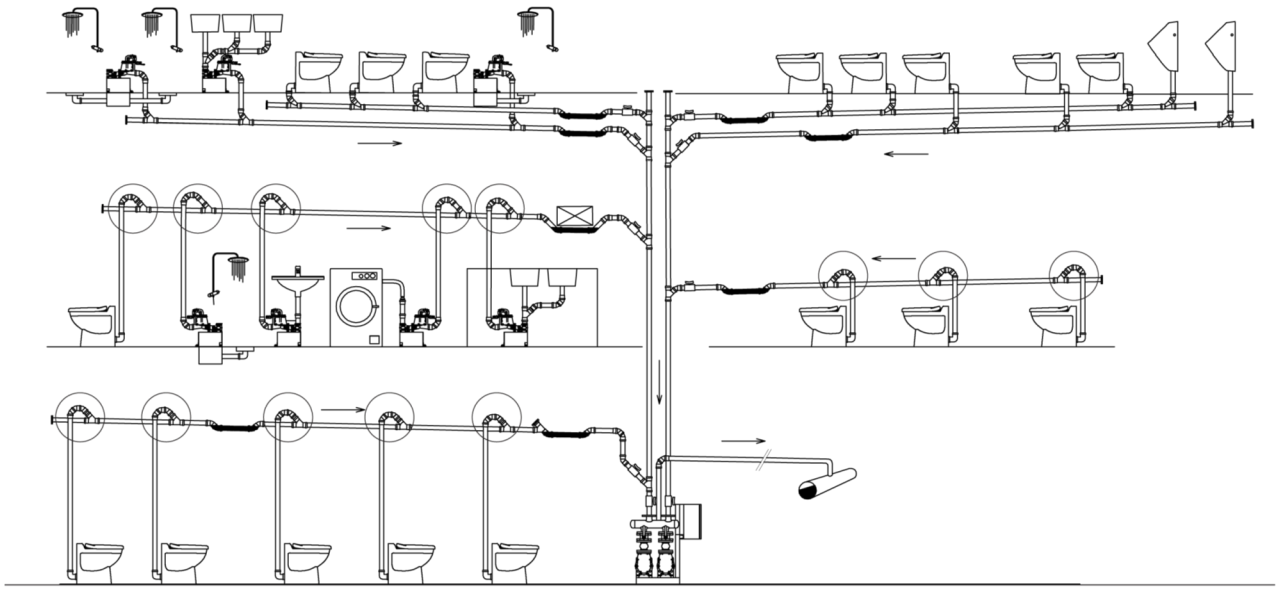


Use of slope or fall in horizontal piping will assist the movement of wastewater towards the Vacuumarator™ pump.

In vacuum piping it should be a minimum slope of 1:100.

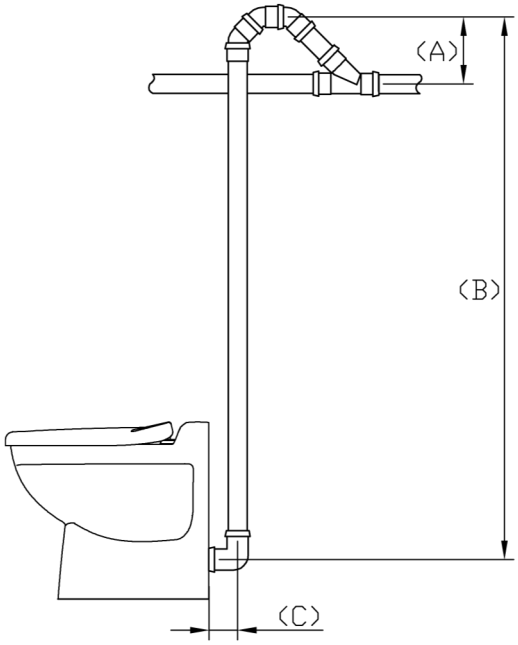
Horizontal pipes or pipes tilted upwards towards the Vacuumarator™ pump (as shown in the two bottom illustrations) are not allowed.

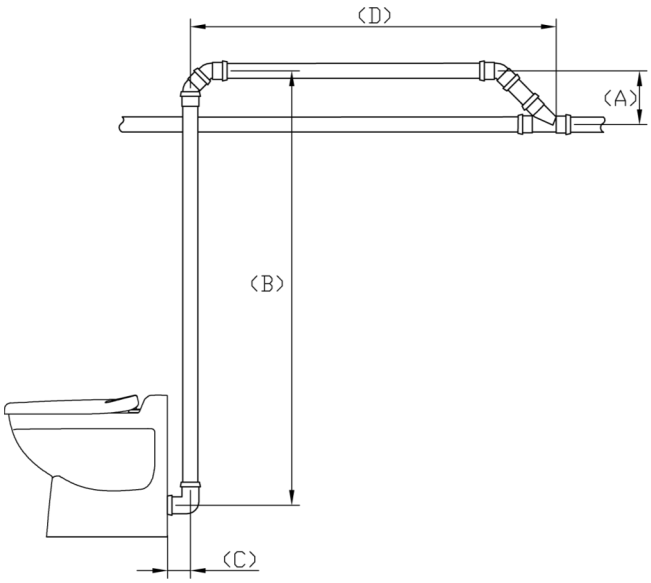




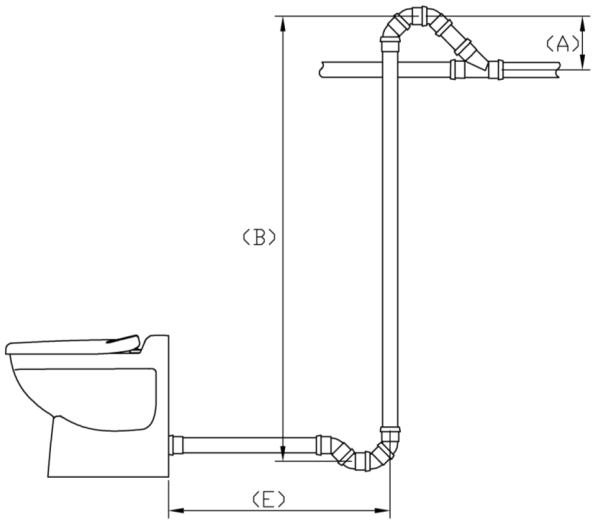
A gooseneck must always be used when joining upward installed piping from a wastewater source to horizontal pipes. This is to ensure that there will be no backflow of wastewater.

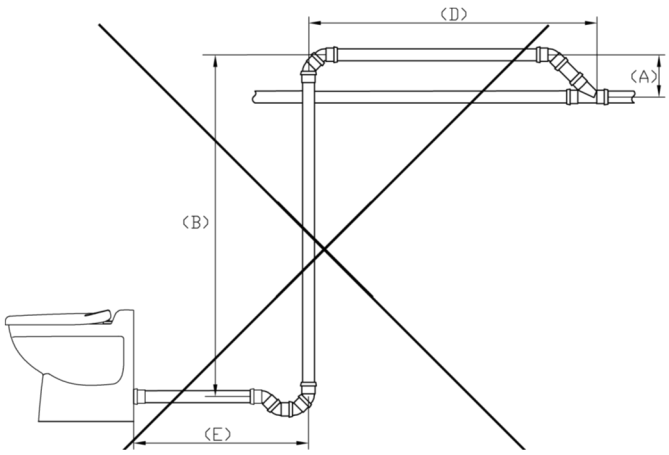
(A) - Minimum 150 mm
(B) - Maximum 3000 mm
(C) - Maximum 300 mm
(D) - Maximum 1000 mm
(E) - Maximum 1000 mm

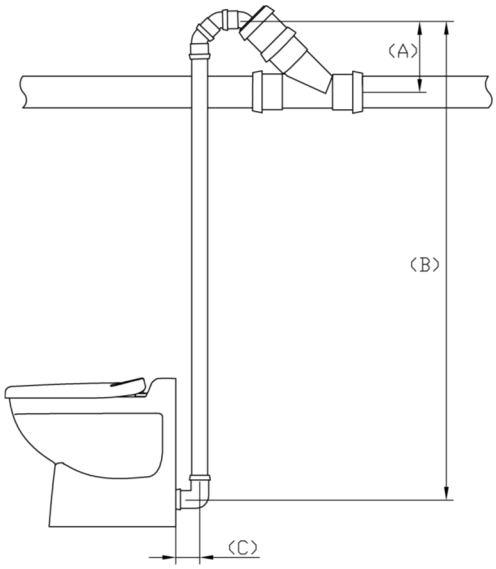


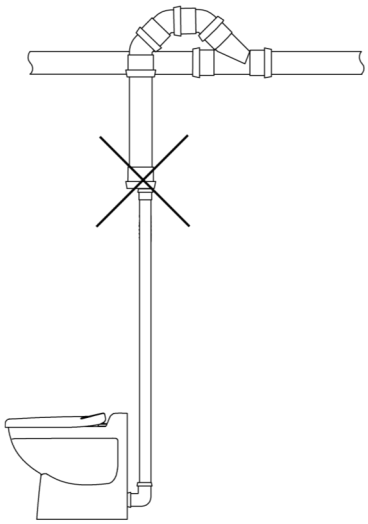


The combination below cannot be used for Jets™ equipment:



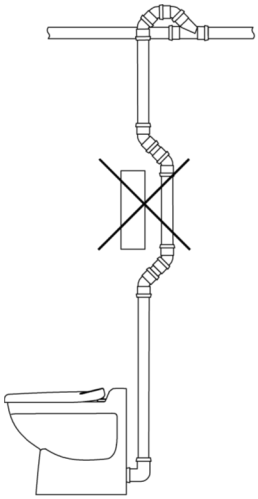


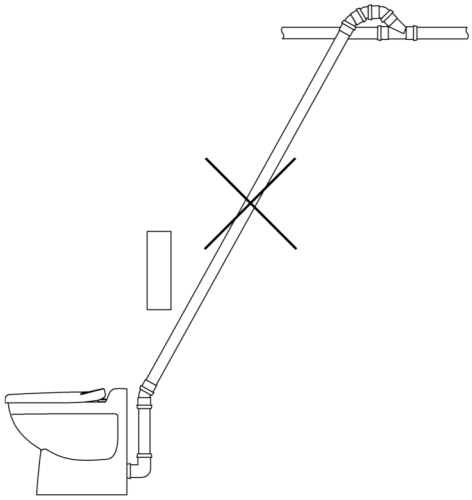




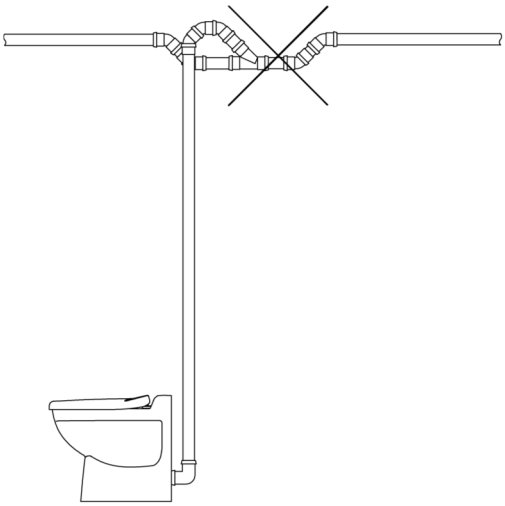
(A)-Minimum 150 mm (B)-Maximum 3000 mm (C)-Maximum 300 mm (D)-Maximum 1000 mm (E)-Maximum 1000 mm

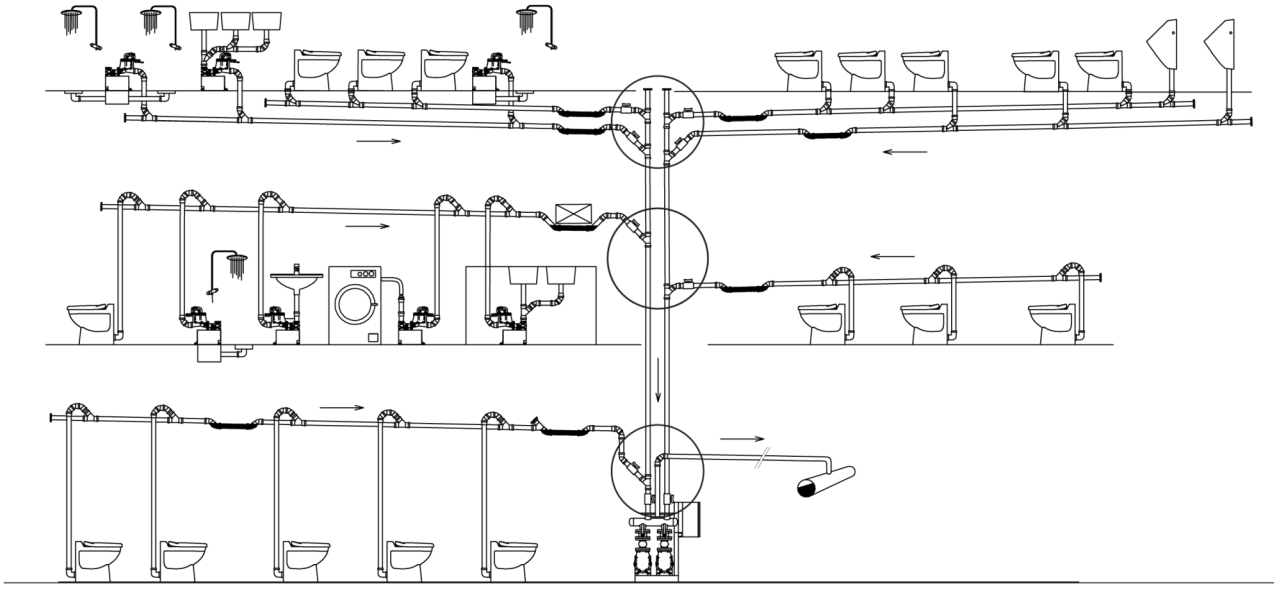
A change of direction in a vertical riser is not allowed.

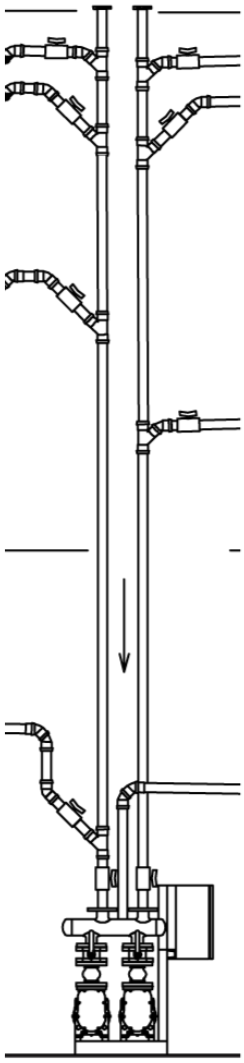




A pipe with an upward flow direction must never be joined to a lower point in a horizontal pipe.



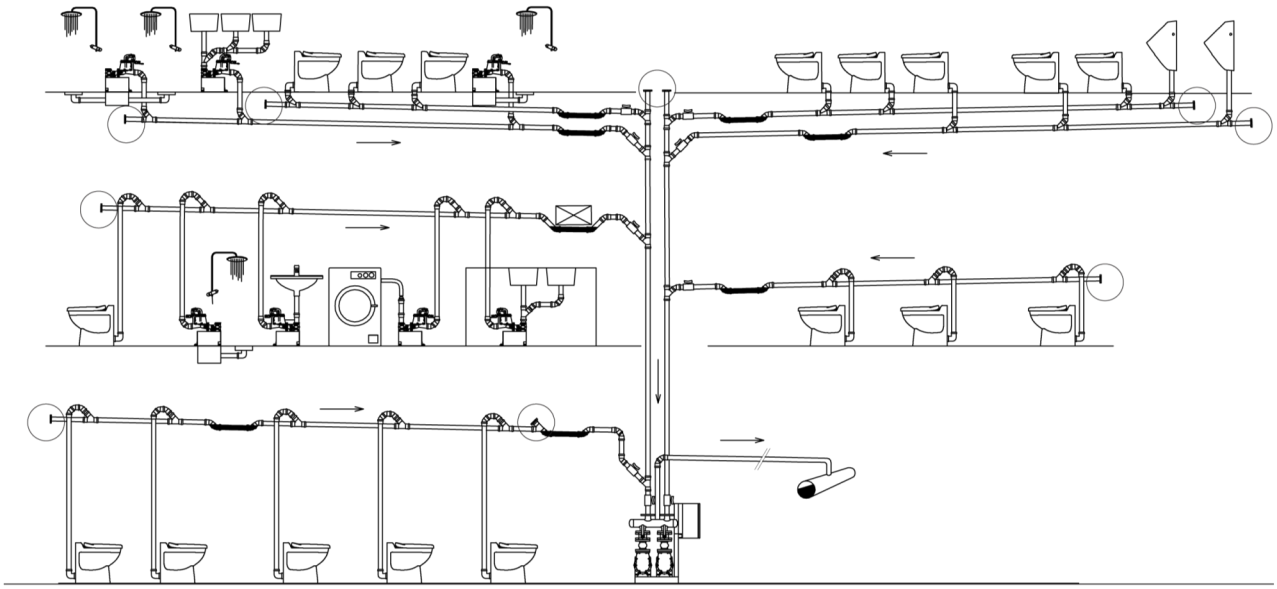




The illustration shows the location and minimum recommended number of shut-off valves. The shut-off valves are used to section out areas in the piping system, so that maintenance and possible search for leaks are easier.

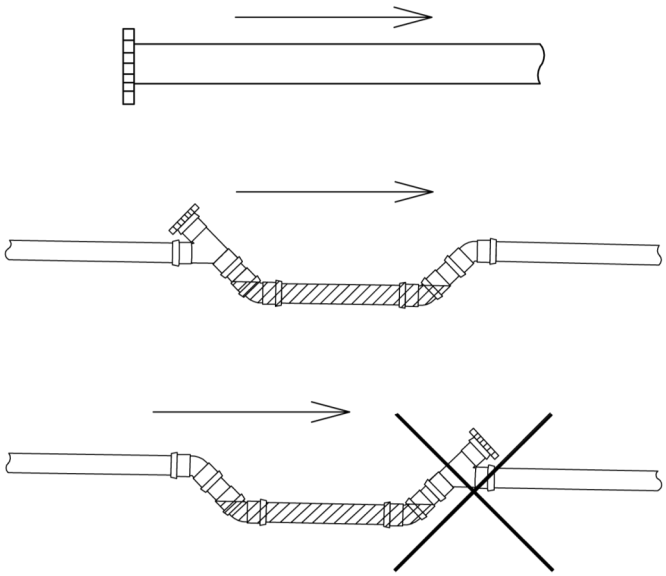
Important:

The inside diameter of the shut-off valves cannot be less than the inner diameter of the pipe. The shut-off valves must also be intended for use in sewage systems.



Various applications of rodding access designs. Note the installation with rodding access on a transport pocket.

(Arrow indicates flow direction)



Recommended clamp locations.

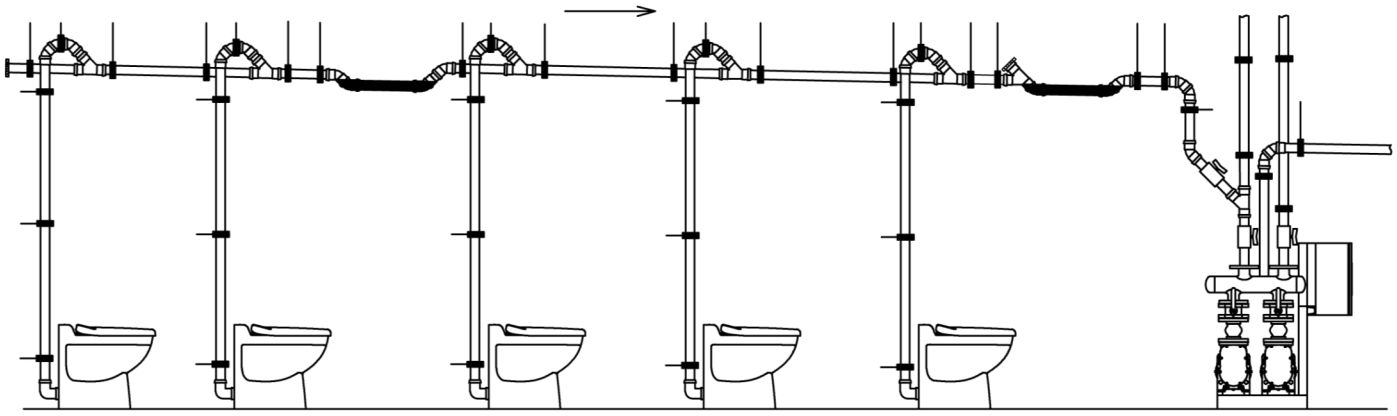
The best installation of vacuum piping will use clamps wherever necessary, both for support as well as for reduction of piping movement during flushing. Follow Jets™ instructions or local or national industry standards for vacuum piping.

NOTE: Clamps should be used both before and after any changes in direction.

Transport of liquid in a vacuum system has high speed with pulsating movements. This must be taken into considerations when clamping.

Important for clamping:

- Clamping both before and after all directional changes
- Type of clamps: steel with rubber inlays in all brackets

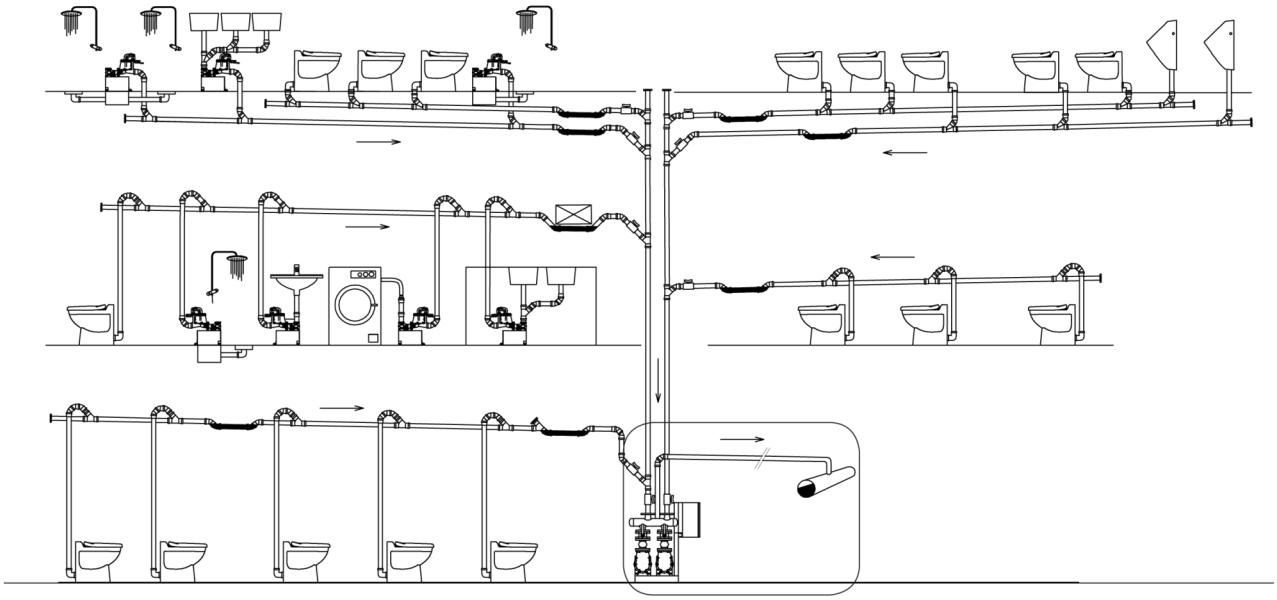


Normal distances between clamps for steel and plastic pipes:

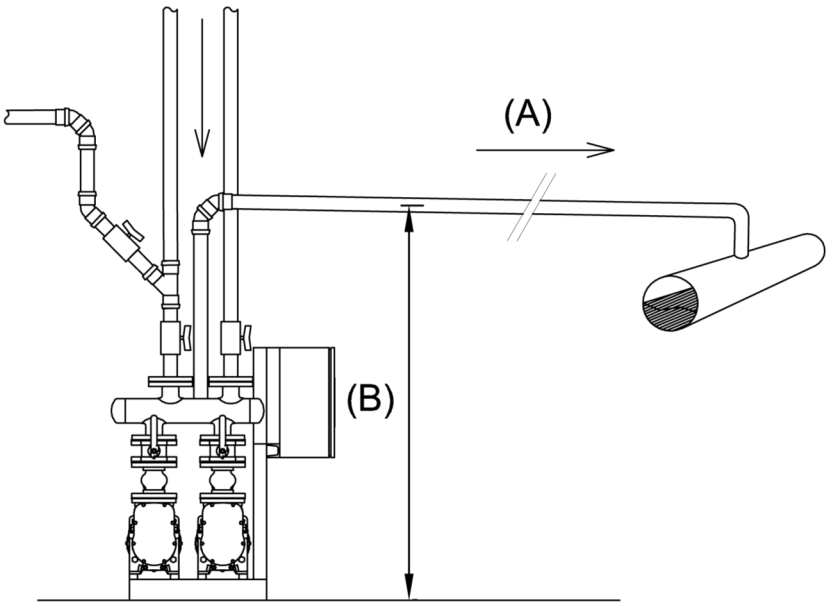
A	B		C	
	D	E	D	E
32 mm	0.50 m	1.50 m	1.90 m	1.90 m
50 mm	0.75 m	1.50 m	2.20 m	2.20 m
75 mm	1.10 m	2.00 m	2.50 m	2.50 m

(A) Nominal outer diameter
(B) Plastic pipe
(C) Stainless steel pipe
(D) Horizontal piping
(E) Vertical piping

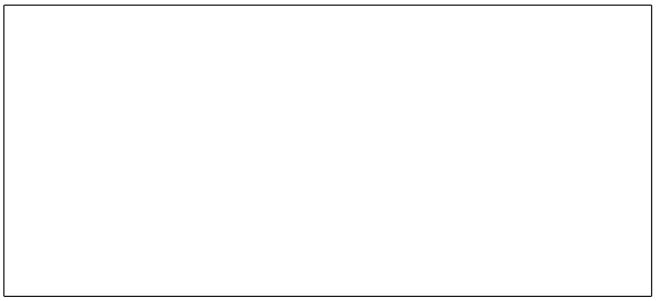
Note: All clamping should always follow the pipeline supplier's guidelines.



As most building projects are in developed areas the pressure side will normally discharge into public sewage systems.



On discharge side of the pump(s), the dynamic losses (A+B) of the pipe, must be less than 0,3 bar.



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