



ACO Product Information

ACO pipe



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General Introduction to ACO

ACO is one of the World's leading drainage specialists with 60 years' experience gained across a wide range of sectors. Our passion for producing high performance products has led us to make major investments in research and development.

We are working in partnership with commercial facility owners, managers and operators. We are continuously developing our products and enhancing our expertise. We understand the critical role that drainage plays in a successful business.

Our product portfolio includes items which are fully compliant with the highest hygienic requirements. We also have a full understanding of the food industry's own standards such as HACCP and we work with bodies including the European Hygienic Engineering and Design Group (EHEDG).

ACO drainage is used in applications anywhere where hygienic, corrosion resistant and durable drainage performance is essential:

- Professional kitchens
- Food processing facilities
- Brewing, bottling and canning plants
- Chilled warehouses
- Laboratories
- Chemical industries
- Pharmaceutical industries
- Restaurants
- Schools
- Hospitals
- Hotels
- and others



Hygiene**First**

As one of the World's leading commercial drainage specialists, The ACO Group understands the critical role that drainage plays in a successful commercial food preparation business. We appreciate that food safety, hygiene and cost control are all vital factors, yet we also understand that for many, drainage is out of sight and out of mind.

As a result, many drainage systems are not designed well, which leads to inefficiencies, costly on going cleaning and maintenance. In worst case scenario it can result in food contamination, closure of a facility and even loss of a business. As the company that's driving the future of drainage, we are determined to change this by raising the profile of hygienic drainage and improving standards across every part of the process.

Our HygieneFirst philosophy represents our commitment to delivering products that provide ultimate hygienic performance. We design intelligent drainage solutions that minimize operational costs without compromising food safety.

ACO drainage system overview and benefits

ACO provides solutions which optimise food safety, employee 's health and safety and water protection. Every ACO product safely controls the water to ensure that it can be hygienically, economically and ecologically managed in a viable way.

ACO offers sustainable, integrated drainage systems which are designed to protect business, the environment and ultimately public health. Our aim is to constantly improve every aspect of safety, hygiene and functional performance.

We believe that our systems and services are truly unique, delivering unparalleled benefits to everyone involved in project delivery or subsequent operation.



Food safety

- ACO hygienic drainage fulfills hygienic requirements to prevent harmful bacteria contamination. We apply relevant hygienic design principles reserved for food contact surfaces as recommended by EHEDG.
- Our product design ensures minimal build-up of food particles and debris as well as a safe connection with the surrounding floor to minimise any opportunity for bacteria to grow throughout the drainage system.
- Sleek slope function and hygienically designed products ensure our system is fully drainable, eliminating the stagnant odour of waste water.

Cost control

- ACO drainage systems can be easily maintained, reducing associated cleaning costs, thanks to their functional design and cleaning recommendations which have been developed in partnership with premium cleaning agent suppliers.
- ACO's advanced manufacturing technologies ensure durability and our special surface treatment guarantees corrosion resistance. Our systems perform effectively at all times and keep business disruption to a minimum.
- We provide expertise in drainage system planning, correct installation and creating a safe connection with the surrounding floor to avoid unnecessary costs.

EHEDG

ACO hygienic drainage fulfills stringent hygienic requirements to prevent harmful bacteria contamination. We apply relevant hygienic design principles that are reserved for food contact surfaces EN 1672, EN ISO 14159 and EHEDG documents No. 8, 13 and 44 to the design of our drainage products.





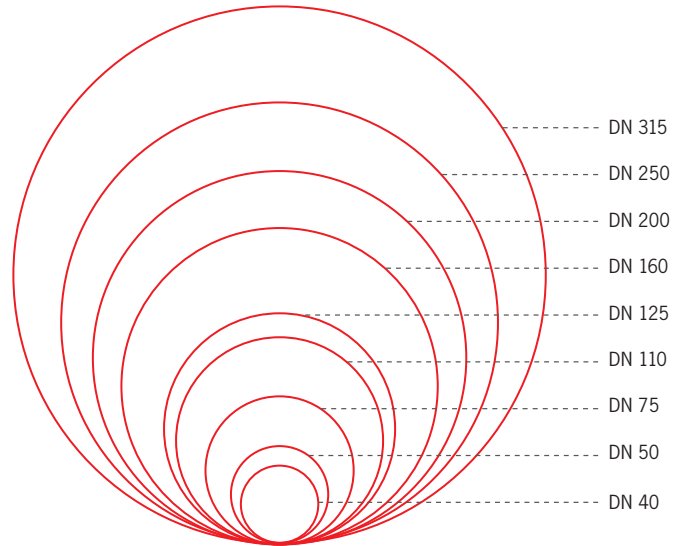
Introduction to ACO pipe

ACO pipe is reliable, lightweight and durable push-fit pipe work system, designed, produced and tested for soil, waste, rainwater and industrial wastewater drainage applications as well as for maritime waste water drainage and vacuum systems.

ACO pipe portfolio

The portfolio consists of pipes and fittings with socket and lip sealing ring included. It is available in 40, 50, 75, 110, 125, 160, 250 and 315 mm pipe diameter sizes.

Straight pipes are available in lengths from 150 to 6000 mm. To see the whole portfolio, please visit the ACO building drainage online catalogue for more information



Together with the other products of ACO building drainage it creates a perfect system and offers a sustainable drainage solution with unique advantages to the customers. Especially with the ACO gully and ACO stainless steel channel systems provide a unique system for building drainage. The push-fit system ensures quick and easy assembly for a reliable installation for gravity and vacuum drainage.

The wide range of fittings available utilizes advanced cold forming techniques, thereby reducing the manufacturing cost and minimizing the amount of welded components, to provide the ultimate in system reliability. Stainless steel pipe systems are particularly suited to applications subject to thermal shock.

ACO pipe stainless steel pipe work systems offer all the key features found in traditional metal waste water systems but with the additional benefits unique to stainless steel material and the push-fit system.

Push-fit advantages

- Easy to assemble
- Time saving
- Cost saving
- Tight connection



ACO pipe portfolio overview

Straight pipes



Bends



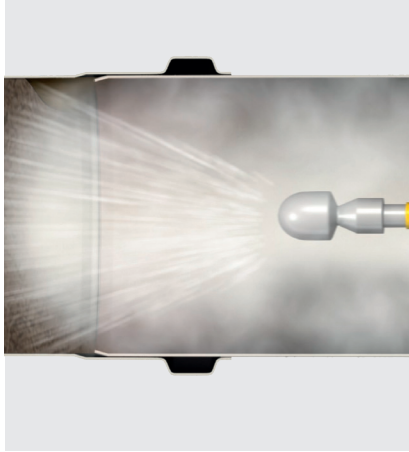
Branches



Accessories

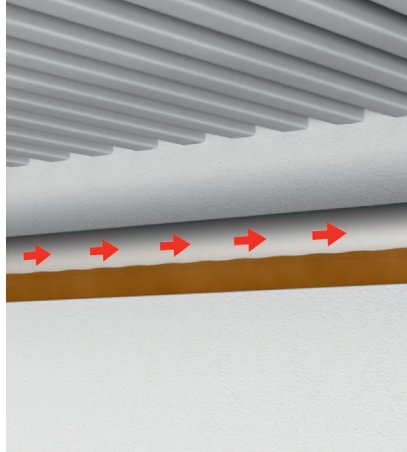


6 advantages of ACO pipe



1

ACO pipe is made from resilient stainless steel, which is the most suitable material for hot water jet cleaning. It expands and contracts less than plastic alternatives and thanks to the ACO push-fit connection, our pipes can compensate for reasonable amounts of material expansion.



2

ACO stainless steel pipe is strong enough to withstand the effects of gravity, yet lightweight enough to need fewer anchor point supports than other heavier pipes.



3

ACO pipe is classified and certified as a non-combustible product because it is manufactured in compliance with EN1124, parts 1 & 2, which classifies the ACO pipe system as Class A1 fire resistant

It requires no additional fire collars to be installed and produces no toxic fumes in the event of fire.



4

The utilisation of ACO stainless steel drainage features an effective and complex protection against unwelcome guests.

Stainless steel itself cannot be chewed through by rodents and when the ACO foul air trap and ACO rat-stop are used together in the gully, they create an impenetrable barrier for any rodent.



5

ACO pipe is made from stainless steel, which is a durable, yet flexible material. When it's exposed to dynamic shock, it bends but doesn't break, preventing its contents from spilling or leaking out.



6

ACO pipe is lightweight yet durable, so it can be installed quickly. This is beneficial especially on reconstruction and refurbishment projects where there is a need to keep production downtime to a minimum.



Material

ACO pipe stainless steel pipe work systems are manufactured from austenitic stainless steel in grades 1.4301 (AISI 304) and 1.4404 (AISI 316L). All products are chemically pickled and passivated for optimum durability and corrosion resistance.

Surface treatment by means of electro polishing or varnishing is available. Recognized for long service and its easily cleaned characteristics, stainless steel's hard, smooth surface provides efficient flow for water and waste products.

Thermal movement

ACO pipe stainless steel pipe work systems have a low coefficient of thermal expansion, of approximately 1 mm per 1000 mm under 60 °C of temperature change.

Seal material information

The ACO pipe socketed stainless steel pipe systems are fitted with a unique, double lip seal manufactured from EPDM, NBR or Viton®. The double lip seal arrangement provides added security for the ultimate in long term reliability.

EPDM (ethylene propylene diene monomer)

Black sealing rubber ring which is suitable for most applications where there are no oil or petrol residues in the waste water.

NBR (Nitrile Butane rubber)

Black sealing rubber ring is suitable for waste water applications where there are petrol or oil residues. NBR is not resistant to solvents and high temperatures.

FPM (Fluoroelastomer) – Viton®

Green sealing rubber ring is suitable for special applications where oil, solvents and strong acids are present in waste water and for applications with higher temperatures. Viton® seal has limited resistance to chemicals like acetone, methyl alcohol.







Standards & certificates

Reference standards

ACO pipe stainless steel pipe work systems are designed, manufactured, tested and checked under the standards EN 1124-1 and EN 1124-2 pipes and fittings of longitudinally welded stainless steel pipes with spigot and socket for waste water systems.

The following standards will assist the designer to select the correct size of pipe system for the particular application.

EN 12056 gravity drainage systems.

EN 752 drain and sewer systems.

Testing

ACO Pipe stainless steel pipe systems are tested for:

- Pressure & vacuum
- Noise
- Fire
- Tightness

Certificates quality & approval:

- ISO 9001
- ABS
- DNV
- Lloyd's Register
- SZÚ
- Bureau Veritas
- ETA
- Watermark

Resistance:

- Sitac
- CSI



SITAC



Installation

General information

The following standards will help designers to select the correct size of pipe system for a particular application: EN 12056: gravity

drainage systems inside buildings. EN 752: drain and sewer systems outside buildings. Installation should be in accordance with the

manufacturer's recommendations as well as with EN 12056-2, EN 12056-3 and EN 752.

Pipe cutting

If it is necessary to adapt or shorten pipe lengths where tools are used, the cut must be square, clean and chamfered. Suitable cutters are available from ACO. These tools are

designed to form the edge bevel on the male spigoted end of the pipe. Carbon steel cutting wheels are not suitable.



Pipe joining

The assembly of pipe joints is quick and straightforward requiring only a light application of lubricant available from ACO to the chamfered pipe end. Ensure that the matching ends of the pipes and fittings are

clean and free from contamination. Push-fit the pipe end into the socket, but do not push fully into the socket recess so as to allow for thermal expansion within the system



Vertical pipe stacks

The load applied with a fluid in the pipe is vertically down. Position the highest bracket adjacent to the top inlet of the pipe, and then mount brackets at 3 meter distance. At the bottom of the vertical pipe, use a bracket

within 200 mm of the bottom. Fit brackets at each change of pipework or direction or junction points. Pipework should be at least 30 mm from the wall to facilitate maintenance and painting.

Pipe weights

Engineers should be aware of minimum and maximum weights when designing vertical stack and horizontal pipe run systems. Generally, when the pipe is completely full of water, then the vertical deflection of the pipe

between brackets should not exceed 1,5 mm. The discretion of the installer should be applied in each instance to ensure that the pipe is adequately supported.



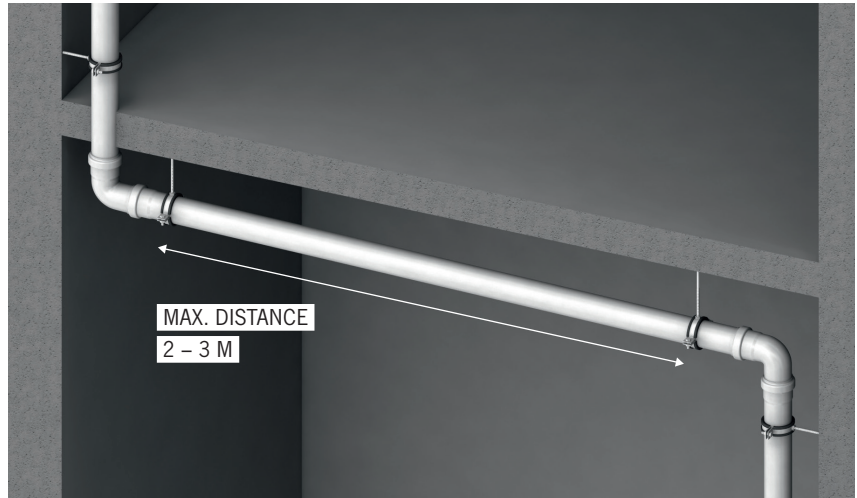
Horizontal pipe runs

As a guide, use the table below for bracket spacing on horizontal pipes.

Pipe diameter bracket spacing

Pipe ø [mm]	Length [m]
40	2.0
50	2.0
75	2.3
110	2.5
125	3.0
200	3.0
250	3.0
315	3.0

Recommended distances; for installation follow your local standards.



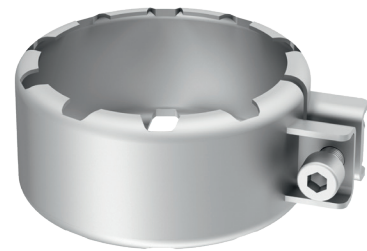
Horizontal pipework should be supported by pipe brackets in 3 meter intervals maximum. One bracket should be within 300 mm of the pipe joint and the other approximately at the midpoint of the pipe length, but not more than 3 metres from the next bracket (depending on the pipe diameter- refer to the upper table). Additional brackets should be used at changes

of direction and at junction points immediately downstream of the fitting. Horizontal pipe runs may be installed at a fall of 1 in 50 and feeder connections should be achieved using 45° branches. Where long pipe runs occur i.e. greater than 15 meters, a fixing arm should be attached to the bracket to prevent pendulum movement within the system.

Socket clamps

Drainage systems for waste water are gravity systems with free draining and should not be overloaded or blocked. The ACO pipe socketed systems have push-fit socket joints and consequently they will not be able to resist internal pressure unless precautions are made to ensure that the joints will not slide apart. Appropriate fixing to the structure can prevent

the joints from sliding apart in most cases, but if it is difficult or impossible to fix the pipes to the structure, the socket clamps (Art. No. 419134-7) can prevent the push-fit sockets and spigot ends from sliding apart if the system is overloaded or internal pressure is generated.



Working pressure

ACO pipe system is designed to withstand operation pressure in accordance to EN 1124-4.

Pipe diameter [mm]	Operating pressure [bar]	
	Without socket clamp	With socket clamp
40	0.5	2.5
50	0.5	2.5
75	0.5	2.5
110	0.5	2.5
125	0.5	2.5
160	0.5	1.5
200	0.5	1.5
250	0.5	1.0
315	0.5	0.7

Vacuum applications	
Pipe diameter [mm]	Operating pressure [bar]
40	-0.8
50	-0.8
75	-0.8
110	-0.8
125	-0.8
160	-0.8
200	-0.8
250	-0.8
315	-0.8

Full bore flow rate tables for varying gradients

For rainwater/storm drainage applications

Flow rates based on Colebrook-White formula.

Roughness coefficient $k_s = 0.6 \text{ mm}$

Gradient [%]	Pipe ø 40 mm		Pipe ø 50 mm		Pipe ø 75 mm		Pipe ø 110 mm		Pipe ø 125 mm	
	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]
10.0	1.44	1.28	2.74	1.52	8.40	2.01	23.81	2.60	33.61	2.83
7.5	1.25	1.11	2.38	1.31	7.28	1.74	20.62	2.25	29.11	2.45
5.0	1.01	0.90	1.94	1.07	5.94	1.42	16.83	1.84	23.77	2.00
4.5	0.96	0.86	1.84	1.02	5.64	1.35	15.97	1.74	22.55	1.90
4.0	0.90	0.81	1.73	0.96	5.31	1.27	15.06	1.64	21.26	1.79
3.5	0.84	0.75	1.62	0.90	4.97	1.19	14.08	1.54	19.88	1.67
3.0	0.78	0.70	1.50	0.83	4.60	1.10	13.04	1.42	18.41	1.55
2.5	0.71	0.64	1.37	0.76	4.20	1.00	11.90	1.30	16.80	1.41
2.0	0.63	0.57	1.23	0.68	3.76	0.90	10.64	1.16	15.03	1.26
1.5	0.55	0.49	1.06	0.59	3.25	0.78	9.22	1.01	13.01	1.10
1.0	0.44	0.40	0.87	0.48	2.66	0.63	7.53	0.82	10.63	0.89

Gradient [%]	Pipe ø 160 mm		Pipe ø 200 mm		Pipe ø 250 mm		Pipe ø 315 mm	
	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]
10.0	64.15	3.31	116.89	3.83	218.31	4.45	401.51	5.15
7.5	55.56	2.87	101.22	3.32	188.95	3.85	347.54	4.46
5.0	45.36	2.34	82.65	2.71	154.13	3.14	283.52	3.64
4.5	43.03	2.22	78.40	2.57	146.17	2.98	268.90	3.45
4.0	40.57	2.10	73.92	2.43	137.77	2.81	253.45	3.25
3.5	37.95	1.96	69.14	2.27	128.82	2.63	236.99	3.04
3.0	35.13	1.81	64.01	2.10	119.20	2.43	219.31	2.82
2.5	32.07	1.66	58.43	1.92	108.74	2.22	200.09	2.57
2.0	28.68	1.48	52.26	1.71	97.18	1.98	178.83	2.30
1.5	24.84	1.28	45.26	1.48	84.05	1.71	154.70	1.99
1.0	20.28	1.05	36.95	1.21	68.48	1.40	126.07	1.62

Note:

The flow rates shown above assume an unrestricted discharge from the pipe. For installations without an unrestricted discharge, the flow rate will be affected by the downstream throttle.

For shallow gradients, the Colebrook-White formula underestimates flow rates (because when gradient tends towards zero %, velocity also tends to zero). For level or nearly level installations (slope < 1 %), spatially varied flow tables should be used.

For soil/foul water drainage applications

Flow rates based on Colebrook-White formula.

Roughness coefficient $k_s = 0.6 \text{ mm}$

Gradient [%]	Pipe ø 40 mm		Pipe ø 50 mm		Pipe ø 75 mm		Pipe ø 110 mm		Pipe ø 125 mm	
	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]
10.0	1.21	1.08	2.30	1.27	7.14	1.71	20.45	2.23	28.97	2.44
7.5	1.04	0.93	1.99	1.10	6.19	1.48	17.71	1.93	25.09	2.11
5.0	0.85	0.76	1.63	0.90	5.05	1.21	14.46	1.58	20.49	1.72
4.5	0.81	0.72	1.54	0.85	4.79	1.14	13.72	1.50	19.43	1.64
4.0	0.76	0.68	1.46	0.80	4.52	1.08	12.94	1.41	18.32	1.54
3.5	0.71	0.64	1.36	0.75	4.23	1.01	12.10	1.32	17.14	1.44
3.0	0.66	0.59	1.26	0.70	3.91	0.93	11.20	1.22	15.87	1.34
2.5	0.60	0.54	1.15	0.64	3.57	0.85	10.23	1.12	14.49	1.22
2.0	0.53	0.48	1.03	0.57	3.19	0.76	9.15	1.00	12.96	1.09
1.5	0.46	0.42	0.89	0.49	2.77	0.66	7.92	0.86	11.22	0.94
1.0	0.37	0.34	0.73	0.40	2.26	0.54	6.47	0.71	9.16	0.77

Gradient [%]	Pipe ø 160 mm		Pipe ø 200 mm		Pipe ø 250 mm		Pipe ø 315 mm	
	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]	Flow rate Q [l/s]	Velocity v [m/s]
10.0	55.61	2.87	101.81	3.34	206.87	4.22	382.95	4.92
7.5	48.16	2.49	88.17	2.89	177.84	3.62	329.47	4.23
5.0	39.32	2.03	71.99	2.36	143.52	2.93	266.21	3.42
4.5	37.30	1.93	68.30	2.24	135.71	2.77	251.81	3.23
4.0	35.17	1.82	64.39	2.11	127.46	2.60	236.59	3.04
3.5	32.90	1.70	60.23	1.98	118.69	2.42	220.42	2.83
3.0	30.46	1.57	55.76	1.83	109.29	2.23	203.07	2.61
2.5	27.80	1.44	50.90	1.67	99.10	2.02	184.25	2.37
2.0	24.87	1.28	45.53	1.49	87.86	1.79	163.50	2.10
1.5	21.53	1.11	39.43	1.29	75.18	1.53	140.05	1.80
1.0	17.58	0.91	32.19	1.06	60.25	1.23	112.42	1.44

Note:

The flow rates shown above assume an unrestricted discharge from the pipe. For installations without an unrestricted discharge, the flow rate will be affected by the downstream throttle.

For shallow gradients, the Colebrook-White formula underestimates flow rates (because when gradient tends towards zero %, velocity also tends to zero). For level or nearly level installations (slope < 1 %), spatially varied flow tables should be used.

Below ground installation

Back-filling

Back-filling around the pipe can only start when the position of the pipe has been checked and approved.

Compression

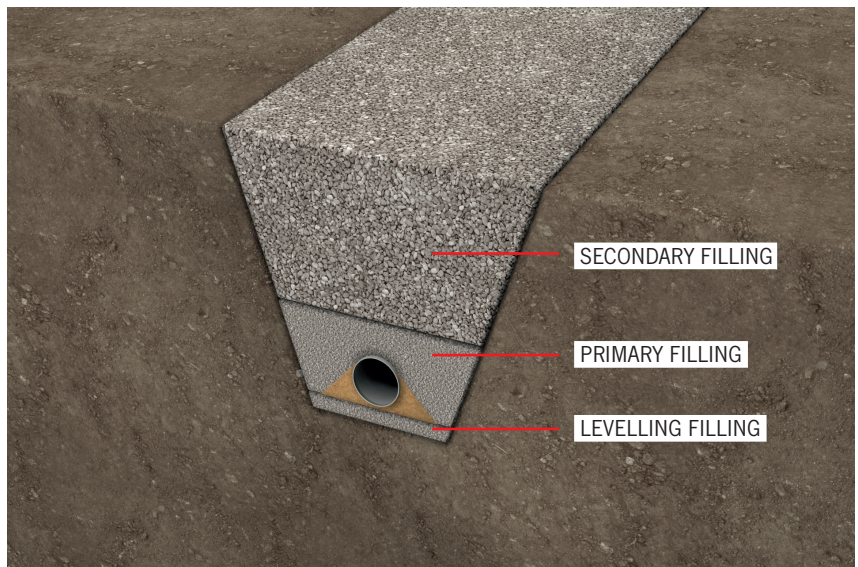
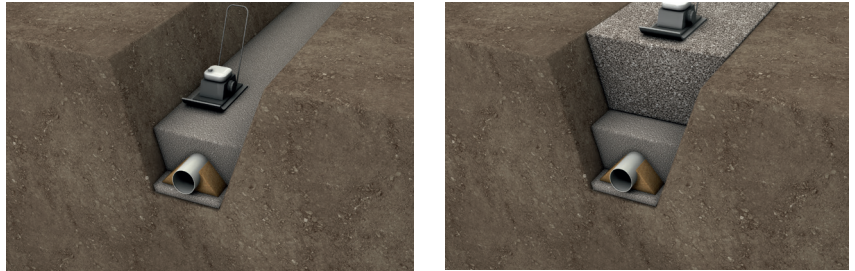
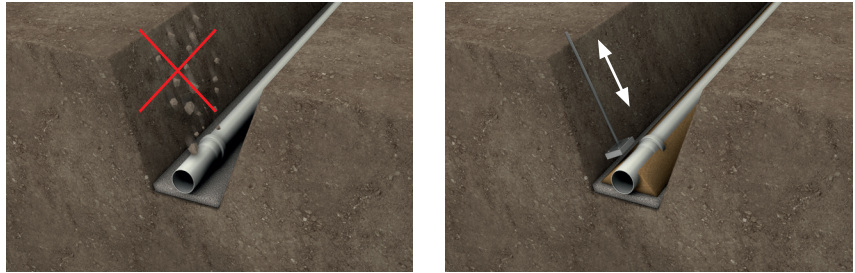
Care should be taken to avoid distortion of both the pipe run and the pipe itself during back-filling and compaction. Avoid tipping backfill material directly onto the pipe system. If mechanical compaction is used, the weight and resultant compressive force must be taken into account to avoid distortion. Back-fill materials should be compacted to a minimum of 93%.

Filling in the excavation

Soil from the excavation can be used for filling, but larger stones and blocks should not be used. Compression of the filling material outside reinforced areas is not necessary if the settling will not cause problems or damage.

Local standards

It is recommended to install pipes according to local standards.



Care and maintenance

Cleaning methods

Stainless steel is easy to clean. Washing with soap or a mild detergent and warm water followed by a clear water rinse is usually quite

adequate for many applications. An enhanced aesthetic appearance will be achieved if the cleaned surface is finally wiped dry.

Precautions

If all the suggestions and actions in the table below have been attempted, stainless steel has the facility to be mechanically cleaned

by specialists on site. Please contact ACO Industries for further assistance.

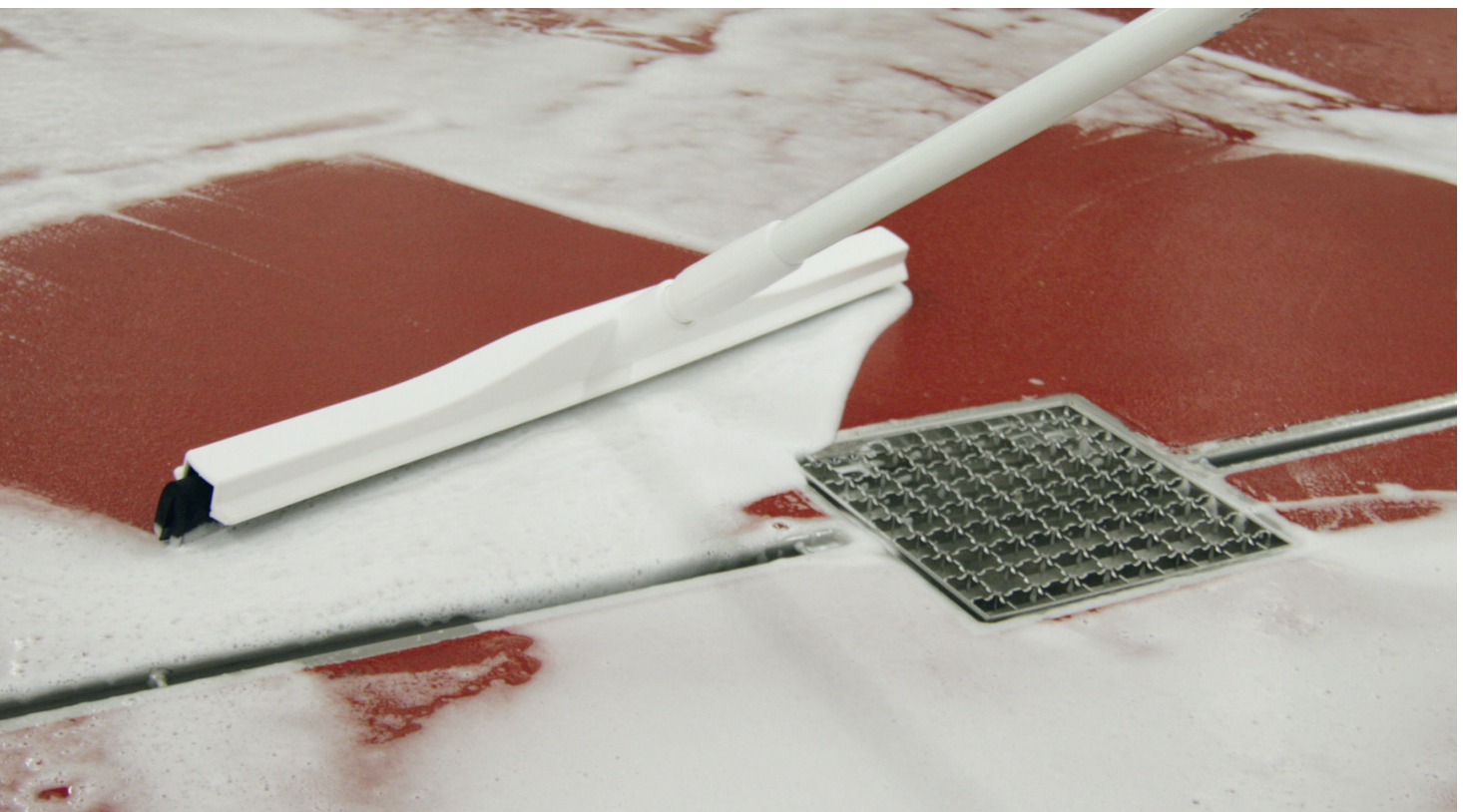
Problem	Cleaning agent	Comment
Routine cleaning, all finishes.	Soap or mild detergent and water (such as washing up liquid).	Sponge, rinse with clean water, wipe dry if necessary.
Fingerprints, all finishes.	Soap or warm water or organic solvent (e.g. acetone, alcohol).	Rinse with clean water, wipe dry if necessary.
Stubborn stains and discolouration.	Mild cleaning solutions (e.g. Jif, Goddard stainless steel care).	Rinse well with clean water and wipe dry.
Oil and grease marks, all finishes.	Organic solvents (e.g. acetone, alcohol, trichlorethylene).	Clean after with soap and water, rinse with clean water and dry.
Rust and other corrosion products.	Oxalic acid. The cleaning solution should be applied with a swab and allowed to stand for 15–20 minutes before being washed away with water. May continue using Jif to give final clean.	Rinse well with clean water (precautions for acid cleaners should be observed).
Scratches on brush (satin) finish.	Household synthetic fibre scouring pads (e.g. Scotch Brite fibre pad). For deeper scratches; apply in direction of polishing. The clean with soap or detergent as per routine cleaning.	Do not use ordinary steel wool (iron particles can become embedded in stainless steel and cause further surface problems).

Drainage is a critical component affecting the hygienic performance of commercial food preparation business. Effective drainage helps to mitigate hazards from the external environment and is central to the safe and hygienic operation internally. Within the food production facility, surface liquids represent potential hazard of microbiological contamination. Liquids may be part of the cleaning process, or may originate from specific equipment discharge points, or be simply the result of an accidental spillage. Quite often the liquids contain other components – organic matter being

predominant. Floor drainage components cater for these situations through three core functions interception, conveyance of fluids, and ability to act as a barrier.

Effective cleaning of drainage in commercial food preparation business reduces risk of contamination and spoiling of food during preparation, processing, and storage. The main objective of cleaning is to remove soil to obtain clean surface and thereby reduce number of microorganisms. A further reduction of microorganism can be obtained by disinfection step.

The principles of cleaning involve combination of thermal, kinetic and chemical energy. The cleaning processes are always combination of these factors and time of these to work. The key point to highlight is that all equipment – including drainage – in food processing plant should have hygienic design, which is easy to clean and disinfect. Otherwise the cleaning process is time and energy consuming and not cost effective. All surfaces of ACO stainless steel drainage are hygienically designed – no sharp corners, edges, dead spaces and crevices. ACO drainage is easily accessible for cleaning and visual inspection.



Transport & handling

ACO pipe straight pipes are packed on pallets with wood frame and inserts, protected by cardboard and stretch foil. Fittings are packed in cardboard boxes and stacked on pallets.

It is strongly recommended to transport and store the pipes and fittings in their original packaging to avoid their damage. Pipes should be stored and supported on a flat surface to avoid deformation. Handle the pipes and fittings with care. Any care less handling (like dumping off the truck...) can cause deformation or damage to pipes. Contact with carbon steel can cause corrosion on the stainless steel.

- Maximum transport length of straight pipes pallets is 6 080 mm and width 820 mm.
- Straight pipes are packed on framed/ non framed long pallets, protected by wooden inserts and supports.
- Articles are either wrapped in cardboard or stretch or PE foil. Fittings are packed in cardboard boxes and stacked on foiled EUR pallets.
- It is strongly recommended to transport and store the pipes and fittings in their original packaging to avoid damage and/or the loss of parts. Store preferably on dry and flat surface.
- Handle the pipes and fittings with care. Any rough handling (like dragging along the ground, dumping off the truck...) can cause deformation and potentially cause product malfunctions.
- Contact with carbon steel may cause stainless steel corrosion.

Material resistance

1 = Very good service to operating limit of material 2 = Moderate service 3 = Limited or variable service 4 = Unsatisfactory	AISI 316 L Stainless	AISI 304 Stainless	EPDM	NBR	FPM
	Acetone	1	1	1	4
Acetic acid (diluted) 30%	1	1	1	2	2
Acetic acid 100%	1	1	1	3	3
Acetic acid anhydride	1	1	2	3	4
Aluminium chloride	4	4	1	1	1
Aluminium sulfate	1	4	1	1	1
Ammonium carbonate	1	1	1	4	2
Ammonium chloride	2	3	1	1	1
Ammonium hydroxide	1	1	1	4	2
Amyl chloride	1	1	4	4	1
Anilin	1	1	2	4	3
Anilin hydrochloride	4	4	2	2	2
Barium chloride	2	2	1	1	1
Barium hydroxide	1	1	1	1	1
Benzaldehyde	1	1	1	4	4
Benzene	1	1	4	4	1
Benzoic acid	1	1	4	4	1
Borax	1	1	1	2	1
Boric acid	1	1	1	1	1
Bromine	4	4	4	4	1
Bromine chloride acid	4	4	1	2	1
Bromine hydrogen acid	4	4	1	4	1
Bromoethylene	1	1	-	-	-
Butanol	1	1	4	1	1
Butyl acetat	1	1	2	2	4
Butyric acid	1	1	2	4	4
Calcium bisulfate el sulfite	1	1	4	1	1
Calcium chloride	2	2	1	1	1
Calcium hydroxide	1	1	1	1	1
Calcium hypoklorite	2	3	1	3	1
Carbon disulfide	1	1	4	4	1
Carbon tetrachloride	1	1	4	3	1
Chloracetic acid (mono)	4	4	2	4	4
Chloride	4	4	-	-	-
Chloril acid	4	4	1	4	-
Chlorine (dry)	1	1	1	2	1
Chlorobenzene	1	1	4	4	1
Chloroform	2	2	4	4	1
Chlorosulfonic acid	2	3	4	4	3
Copper chloride	2	2	1	1	1
Copper nitrate	1	1	1	1	1
Copper sulfate	1	1	1	1	1
Ether	1	1	3	4	3
Ethyl chloride	1	1	1	1	1
Fatty acid	1	1	4	2	1
Fluorine (dry)	1	1	-	-	-
Fluorine hydrogen acid	4	4	2	4	1
Formaldehyde	1	1	1	2	1
Formic acid	1	1	1	2	3
Furfural	1	1	2	4	4
Gallic acid	1	1	2	2	1
Hydrochloric acid	4	4	1	4	1
Hydrogen peroxide	1	1	3	4	2
Iodine (wet)	4	4	2	2	1
Lead acetate	1	1	1	2	4

Note:

Concentration levels and length of exposure have a direct influence on the resistance of stainless steel to certain chemicals. Each application should therefore be carefully reviewed to determine the suitability of stainless steel.

Assumptions:

Data presented are used as a guide only, for detailed information please contact our Sales/Technical department.

1 = Very good service to operating limit of material 2 = Moderate service 3 = Limited or variable service 4 = Unsatisfactory	AISI 316 L Stainless	AISI 304 Stainless	EPDM	NBR	FPM
	Magnesium chloride	2	2	1	1
Magnesium sulfate	1	1	1	1	1
Mercury	1	1	1	1	1
Methanol	1	1	1	1	3
Methyl chloride	1	1	3	4	1
Methylene chloride	2	2	4	4	2
Natphalene	1	1	4	4	1
Nickel chloride	2	2	1	1	1
Nickel sulfate	1	1	1	1	1
Nitric acid	3	3	3	4	1
Oxalic acid	3	3	1	2	1
Perchloric acid	4	4	2	4	1
Phosphoric acid	1	1	2	4	1
Picric acid	1	1	2	2	1
Potassium bromide	1	1	1	1	1
Potassium carbonate	1	1	1	2	1
Potassium chlorate	1	1	1	1	1
Potassium cyanide	1	1	1	1	1
Potassium hydroxide	1	1	1	2	2
Potassium nitrate	1	1	1	1	1
Potassium permanganate	1	1	1	3	1
Potassium sulfate	1	1	1	1	1
Potassium sulfide	1	1	1	1	1
Potassiumchloride	2	2	1	1	1
Propylene dichloride	1	1	4	4	1
Sal ammoniac	2	3	1	1	1
Silver nitrate	1	1	1	2	1
Soda (ash)	1	1	1	1	1
Sodium acetate	1	1	1	2	4
Sodium bicarbonate	1	1	1	1	1
Sodium bisulfate	1	3	1	2	1
Sodium bisulfite	1	1	1	1	1
Sodium bromide	2	2	1	3	1
Sodium chlorate	1	1	1	2	1
Sodium chloride	4	4	1	1	1
Sodium cyanide	1	1	1	1	1
Sodium fluoride	1	1	1	1	1
Sodium hydroxide	1	1	1	2	2
Sodium hypochlorite	4	4	2	2	1
Sodium nitrate	1	1	1	2	2
Sodium sulfate	1	1	1	1	1
Sodium sulfide	1	1	1	1	1
Sodium sulfite	1	1	1	1	1
Stannous chloride	2	3	2	1	1
Sulfur	1	1	1	4	1
Sulfur chloride	1	1	4	3	1
Sulfur dioxide	1	2	1	4	1
Sulfuric acid	4	4	2	4	1
Sulfurous acid	1	3	2	2	1
Tionyl chloride	1	1	4	4	1
Toluene (toluol)	1	1	4	4	1
Trichloroethylene	1	1	4	3	1
Turpentine	1	1	4	1	1
Xylene (xylol)	1	1	4	4	2
Zinc sulfate	1	1	1	1	1

Note:

Concentration levels and length of exposure have a direct influence on the resistance of stainless steel to certain chemicals. Each application should therefore be carefully reviewed to determine the suitability of stainless steel.

Assumptions:

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Fire resistance and sound insulation

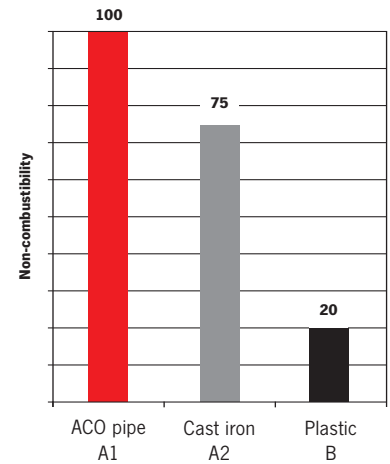
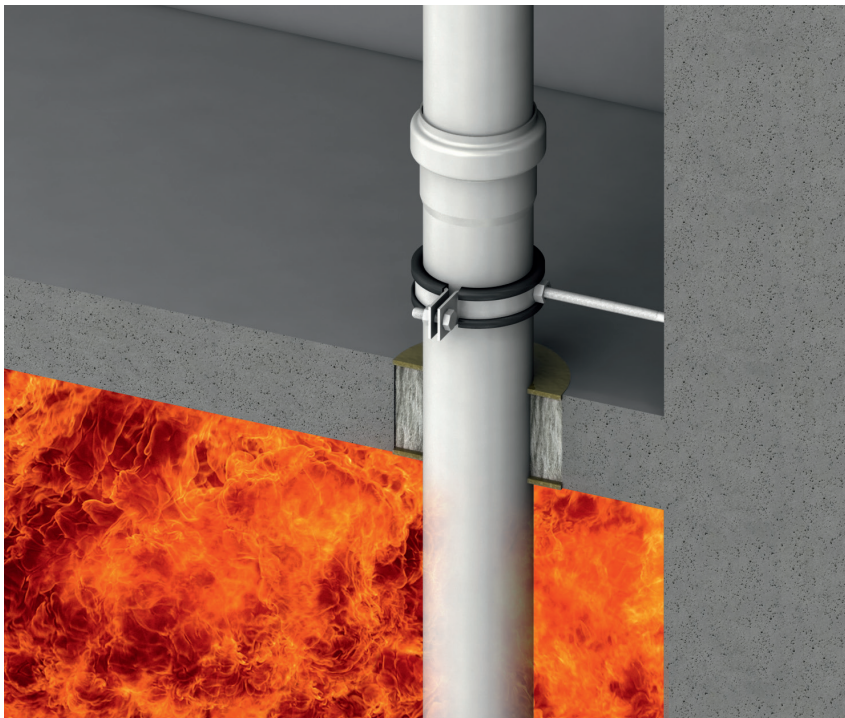
ACO pipe push-fit system is classified and certified as a non-combustible product (as it is manufactured in compliance to EN 1124, part 1 & part 2). This standard classifies the ACO pipe systems as class A1 fire resistant (highest rating).

ACO pipe systems are certified also by SITAC authority as fire resistant (cert. no. 0410-01). Special certificate of fire resistance for coated pipes (no. CSI PK-13-083) is available.

Fire certificates from marine authorities are available.

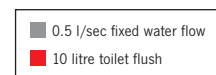
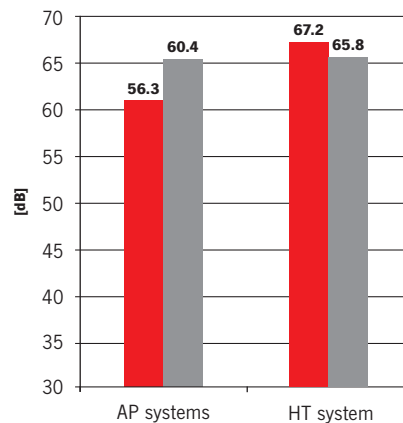
Non combustibility:

- Non combustible
- No additional fire collars needed at installation
- No toxic fumes emitted in case of fire
- EN 1124



Sound insulation

- Comparison of two pipe work systems
- ACO pipe – DN 110
- HT system – DN 110
- Simulation of water fall from 1st floor through ground floor to basement of house stainless steel has better results in comparison with HT system and comparable to all other materials



Sealing material information

EPDM (ethylene propylene diene monomer)

Black sealing rubber ring, which is suitable for most applications where there are no oil or petrol residues in the waste water.

FPM (fluoroelastomer) – Viton®

Green sealing rubber ring which is suitable for special applications where oil, solvents and strong acids are present in waste water; and for applications with higher temperatures. Viton® seal has limited resistance to chemicals like acetone, methyl alcohol.

NBR (acryl nitrile-butadiene rubber)

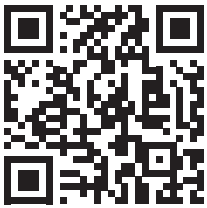
Black sealing rubber ring which is suitable for waste water applications where there are petrol or oil residues. NBR is not resistant to solvents and high temperatures.

TPEV (thermoplastic elastomer vulkanized)

Sealing rubber with excellent heat resistance, physical and mechanical properties. Suitable for pharmaceutical, medical, food and beverage applications. TPEV has limited resistance in oil or petrol residues in waste water.

Rubber type	Sealing materials		
	EPDM	NBR	FPM (Viton®)
Colour	black	black	green
Temperature range	-50 / +130 / +150 °C	-30 / +80 / +100 °C	-20 / +200 / +300 °C
Resistance			
Water	excellent	good	good
Chemicals			
Acids	good	fair	excellent
Bases	good	fair	excellent
Benzene/Petrol	unsatisfied	excellent	excellent
Oils			
ASTM Oil No. 1	unsatisfied	excellent	excellent
ASTM Oil No. 3	unsatisfied	excellent	excellent
Ozone & weather stresses	good	limited	good

Viton® is a registered trademark for fluoroelastomer by DuPont Performance Elastomers L.L.C. Please contact ACO in case of any doubts regarding this topic.



*Learn more about ACO pipe
at ACO Building Drainage website*

ACO. The future of drainage.

www.aco-buildingdrainage.com