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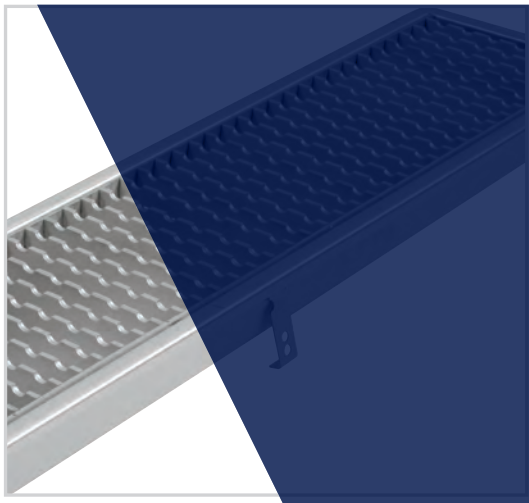
Technical Information BLÜCHER®

Stainless Steel Drainage Systems



BLÜCHER®

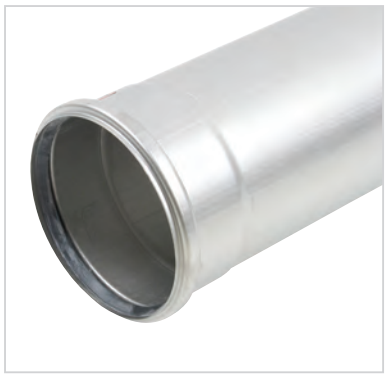
A WATTS Brand

Technical Information on BLÜCHER® Stainless Steel Drainage Systems

- Stainless Steel Characteristics
- Material Properties of Stainless Steel
- Chemical Resistance
- Material Properties of Rubber Seals
- Load Classes
- Approval, Maintenance, Production
- Installation

Stainless steel






Long product life
Fire resistant
Lightweight
Hygienic

Long product life
- Corrosion resistant
- Resistant to impact damages
- Resistant to temperature variations

Fire resistant
- Non combustible
- No need for special fire insulation
- No toxic fumes are released in case of fire

Light-weight
- Low weight - high strength
- Weight only one third of cast iron
- Large pipes are easily handled by one man

Hygienic
- Low surface roughness
- High flow capacity
- Smooth surface prevents bacterial growth
- Smooth surface prevents blockages

Available in stainless steel AISI304/EN 1.4301 or AISI316L/EN 1.4404

Material properties of stainless steel

What is stainless steel?
The designation stainless steel covers a wide range of alloys with different properties. One property common to all stainless steels is that they contain at least 12% chromium.

The stainless steels can be divided into three main groups and a few mixed types according to the structure of the steel:
– Austenitic stainless steel
– Ferritic stainless steel
– Martensitic stainless steel

Austenitic stainless steel is the most important, representing approx. 90% of total stainless steel consumption. Austenitic steel is also the only stainless steel suitable for drainage installations, and it is, of course, the type used by BLÜCHER.

Importance of alloying elements
Austenitic stainless steel contains at least 18% chromium and 8% nickel – thus the well-known designation »18/8« steel. Corrosion resistance generally increases with increasing content of chromium. In alloys with 12-13% chromium, the passive layer is strong enough to prevent the steel from corroding in normal or mildly aggressive media. The main effect of the alloying element nickel is on the structure of the steel and its mechanical properties. The steel's structure is austenitic with an adequate content of nickel. In contrast to the pure chromium steels (ferritic stainless steel), this results in significant changes in the mechanical properties, such as increased workability and ductility, better resistance to thermal stress and improved weldability. The austenitic structure also results in a change in the physical properties of the steel. For example, the steel is not magnetic and has higher thermal conductivity.

Nickel also increases resistance to corrosion caused by certain media. Molybdenum has the same effect on the structure as chromium, but it also has a strongly positive influence on corrosion resistance. Molybdenum-containing steel is normally designated »acid-resistant« because of the resistance of these steels to certain types of acids. But acid-resistant stainless steel will also have limited resistance to some media such as chlorine-containing media (see table of resistance).

Why is steel »stainless«?
The addition of chromium to the steel results in the formation of a passivating oxide film with a high content of chromium oxides.
This oxide film protects the surface of the steel against oxygen in air and water. An outstanding property of stainless steel is that the chromium oxide film automatically regenerates if the surface of the steel is exposed.
This restitution of the oxide film can only occur if the surface of the steel is completely clean and free of tempering agents and slag from welding processes and residues from tools made from ordinary carbon steel.
If this surface contamination is not removed, the steel may ultimately corrode. To prevent this, the steel surfaces should be cleaned after welding and processing, e.g. by means of so-called acid pickling of the stainless steel.
The pickling effectively removes all impurities from the surface of the steel and permits the reestablishment of a strong, uniform chromium oxide film. The pickling bath normally consists of 0.5-5% v/v HF (hydrofluoric acid) and 8-20% v/v HNO_3 (nitric acid) at a temperature of 25-60°C. This acid bath removes residues, the existing chromium oxide film and traces of iron, leaving the clean steel surface. The restitution of a strong chromium oxide film starts in the subsequent rinsing in water.

Material Specification

Material	AISI 316 L 1.4404	AISI 304 1.4301
Analysis		
Carbon (C %)	Max. 0,03	Max. 0,07
Chromium (Cr %)	16,5 - 18,5	17,0 - 19,0
Nickel (Ni %)	11,0 - 14,0	8,5 - 10,5
Molybdenum (Mo %)	2,0 - 2,5	-
Manganese (Mn %)	Max. 2,0	Max. 2,0
Silicium (Si %)	Max. 1,0	Max. 1,0
Sulphur (S %)	Max. 0,030	Max. 0,030

Physical Properties

Structure	Austenitic (nonmagnetic)	Austenitic (nonmagnetic)
State	Non-annealed	
Specific gravity (g/cm³)	7,98	7,9
Melting point (°C)	Ca. 1400	Ca. 1400
Decortication temperature in air (°C)	800 - 860	800 - 860
Expansion coefficient 20 - 100 °C (m/m · °C)	$16,5 \times 10^{-6}$	$16,5 \times 10^{-6}$
Specific resistance (20° C) (Ohm · mm²/m)	0,75	0,73
Heat conductivity (20°C) (W/°C-m)	15	15
Specific heat (J/g · k)	0,5	0,5

Mechanical Properties

Ultimate tensile strength (Rm) (N/mm²)	490 - 690	500 - 700
Yield point (Rpo2) (N/mm²)	190	195
Modulus of elasticity (E) (20° C) (N/mm²)	$2,0 \times 10^5$	$2,0 \times 10^5$
Hardness Brinell (HB) (N/mm²)	120 - 180	130 - 180

CHEMICAL RESISTANCE TABLE

The table is based on laboratory experiments with chemically pure sub-stances. The values should therefore be regarded as for guidance only.

A = Very good service to operating limit of material B = Moderate service C = Limited or variable service D = Unsatisfactory	AISI 316 L Stainless	AISI 304 Stainless	EPDM	NBR	FPM
Acetone	A	A	A	D	D
Acetic acid (dilute.) 30% or 50%	A	A	A	B	B
Acetic acid 100%	A	A	A	C	C
Acetic anhydride	A	A	B	C	D
Aluminium chloride	D	D	A	A	A
Aluminium sulfate	A	D	A	A	A
Ammonium carbonate	A	A	A	D	-
Ammonium chloride/salmiac	B	C	A	A	-
Ammonium hydroxide	A	A	A	D	B
Amyl chloride	A	A	-	-	-
Aniline	A	A	B	D	C
Anilin hydrochloride	D	D	B	B	B
Barium chloride	B	B	A	A	A
Barium hydroxide	A	A	A	A	A
Benzaldehyde	A	A	A	D	D
Benzene	A	A	D	D	A
Benzoic acid	A	A	-	-	A
Borax/sodium borat	A	A	A	B	A
Boric acid	A	A	A	A	A
Bromine	D	D	-	-	A
Bromine chloride	D	D	A	B	A
Bromoethylene/vinyl bromide	A	A	-	-	-
Butanol	A	A	D	A	A
Butyl acetat	A	A	B	-	D
Butyric acid	A	A	-	-	-
Calcium bisulfate	A	A	D	A	A
Calcium chloride	B	B	A	A	A
Calcium hydroxide	A	A	A	A	A
Calcium hypochlorite	B	C	A	C	A
Carbon disulfide	A	A	-	-	-
Carbon tetrachloride	A	A	D	C	A
Chloroacetic acid (Mono)	D	D	B	-	-
Chlorine (dry)	A	A	-	-	A
Chlorobenzene	A	A	D	D	A
Chlorosulfonic acid	B	C	D	D	C
Copper chloride	B	B	A	A	A
Copper nitrate	A	A	-	-	-
Copper sulfate	A	A	A	A	A
Ether	A	A	-	-	-
Ethyl chloride	A	A	A	A	A
Fatty acid	A	A	D	B	A
Fluorine (dry)	A	A	-	-	-
Hydrofluoric acid	D	D	B	D	A
Formaldehyde	A	A	A	B	A
Formic acid	A	A	A	B	C
Furfural	A	A	B	D	D
Gallic acid	A	A	B	B	A
Hydrobromic acid	D	D	A	D	A
Hydrochloric acid	D	D	A	D	A
Hydrogen peroxide	A	A	C	D	B
Iodine (wet)	D	D	-	-	-
Kloroform	B	B	D	D	A
Lead acetate	A	A	A	B	-
Magnesium chloride	B	B	A	A	A
VALUES TO BE REGARDED AS FOR GUIDANCE ONLY					

A = Very good service to operating limit of material B = Moderate service C = Limited or variable service D = Unsatisfactory	AISI 316 L Stainless	AISI 304 Stainless	EPDM	NBR	FPM
Magnesium sulfate	A	A	A	A	A
Mercury	A	A	A	A	A
Methanol	A	A	A	A	C
Methyl chloride	A	A	C	D	A
Methylene chloride	B	B	D	D	B
Natphalene	A	A	D	D	A
Nickel chloride	B	B	A	A	A
Nickel sulfate	A	A	A	A	A
Nitric acid	C	C	C	D	A
Oxalic acid	C	C	A	B	A
Perchloric acid	D	D	B	-	A
Phorsphoric acid	A	A	B	D	A
Picric acid	A	A	B	B	A
Potassium bromide	A	A	-	-	-
Potassium carbonate	A	A	-	-	-
Potassium chlorate	A	A	-	-	-
Potassium cyanide	A	A	A	A	A
Potassium hydroxide	A	A	A	B	B
Potassium nitrate	A	A	A	A	A
Potassium permanganate	A	A	-	-	-
Potassium sulfate	A	A	A	A	A
Potassium sulfide	A	A	-	-	-
Potassium chloride	B	B	A	A	A
Prophylene dichloride	A	A	-	-	-
Silver nitrate	A	A	A	B	A
Soda (ash)/sodium	A	A	-	-	-
Sodium acetate	A	A	A	B	D
Sodium bicarbonate	A	A	A	A	A
Sodium bisulfate	A	C	-	-	-
Sodium bisulfite	A	A	A	A	A
Sodium bromide	B	B	-	-	-
Sodium chlorate	A	A	-	-	-
Sodium chloride	D	D	-	-	-
Sodium cyanide	A	A	A	A	A
Sodium fluoride	A	A	-	-	-
Sodium hydroxide	A	A	A	B	B
Sodium hypoklorite	D	D	B	B	A
Sodium nitrate	A	A	A	B	-
Sodium sulfate	A	A	A	A	A
Sodium sulfide	A	A	-	-	-
Sodium sulfite	A	A	-	-	-
Stannous chloride/tin chloride	B	C	B	A	A
Sulfur	A	A	A	D	A
Sulfur chloride	A	A	D	C	A
Sulfur dioxide	A	B	A	D	A
Sulfuric acid	D	D	B	D	A
Sulfurous acid	A	C	B	B	A
Thionyl chloride	A	A	D	-	A
Toluene/toluol	A	A	D	D	A
Trichloroethylene	A	A	D	C	A
Turpentine	A	A	D	A	A
Xylene/xylol	A	A	-	-	-
Zinc sulfate	A	A	-	-	-
VALUES TO BE REGARDED AS FOR GUIDANCE ONLY					

Assumptions: 20°C room temperature

References

Corrosion Data Survey, 1969 Edition, Nace
Corrosion Tables, Stainless Steels, 1979, Jernkontoret
Chemical Resistance of Plastic Piping Materials, Cabot Corporation, 1979

PLEASE NOTE!

Concentration level, length of exposure, temperature and in particular the combination of several chemicals 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.

In particular, be careful with the use of hydrous cleaning agents containing compounds of chlorine.

Material properties of rubber seals

Rubber types

International designation	EPDM	NBR	FPM	SI	CR
Rubber type	Ethylene propylene	Nitrile	Fluorine (Viton®)	Silicone	Chloroprene
Nominal hardness IRHD	60 (+/-5)	60 (+/-5)	60(+/-5)	57(+/-5)	55 (+/-5)
Colour	Black	Black/yellow dot	Purple (new: green)	Red	Black
Tensile strength MPa	≥ 10 N/mm²	≥ 10 N/mm²	≥ 8 N/mm²	≥ 5,5 N/mm²	≥ 10 N/mm²
Elongation at rupture %	≥ 300%	≥ 300%	≥ 230%	≥ 250%	≥ 250%
Max. temperatur range	-40/+100° C -40/+212° F	-30/+80° C -22/+176° F	-25/+200° C -13/+392° F	-50/+230° C	-30/+110° C

Resistance

Wearability	2	2	2	2	3
Resistance to mineral oil	5	1	1	3	2
Resistance to vegetable oil	2	1	1	1	2
Resistance to gasoline	5	1	1	5	2
Resistance to aromatic compounds and hydrocarbons	5	2	1	3	3
Resistance to ketones	1	5	4	3	5
Resistance to ordinary diluted acids and alkalines	1	1	1	2	2
Resistance to ozone and weather stresses	1	3	1	1	1
Resistance to air diffusion	4	3	1	2	2

1 = Very good **2** = Good 3 = Moderate 4 = Limited service 5 = Low

BLÜCHER sealing rings are available in five different rubber qualities.

EPDM This sealing ring is black and made of ethylene propylene rubber. This is BLÜCHER's standard sealing ring and it is suitable for all rainwater and waste water installations where there is no oil or no petrol residues in the waste water.
The EPDM lip seal is a good all-round rubber quality suitable for a wide range of applications.

NBR This sealing ring is black with a yellow spot and made from nitrile rubber and is the sealing ring to be used where there are petrol or oil residues on the waste water (e.g. in association with oil and petrol separators at service stations, garages etc.).
The NBR lip sealing ring should not be used where there is a risk of temperatures above 80°C. NBR is not resistant to solvents.

FPM This sealing ring is purple (new: green) and made from fluorine rubber (Viton®).
This is BLÜCHER's sealing ring for special applications. The material is particularly heat-resistant and resistant to oil, solvents and strong acids. However, the FPM seal has only limited resistance to e.g. butyl acetate, acetone and methyl alcohol.

For advice regarding the suitability of the different rubber qualities, consult BLÜCHER.

SI This sealing ring is red and made from silicone rubber (VMQ). This is the BLÜCHER sealing ring used for fire safety. The SI sealing ring is only used in BLÜCHER´s special fire resistant pipe penetrations.

CR This sealing ring is black and made from chloroprene rubber. This is the BLÜCHER standard sealing for Marine drains. The material is flame retardant and has good heat resistance, mechanical and abrasion properties. It is resistant to most inorganic chemicals, except for oxidizing acids and halogens. Moderate resistance to oil residues.

Load classes

Gratings and Access Covers

BLÜCHER **GRATINGS FOR INDOOR USE** are tested and classified according to EN 1253 "Gullies for buildings"				BLÜCHER **GRATINGS FOR OUTDOOR USE** are tested and classified in accordance with EN 1433 "Drainage channels for vehicular and pedestrian areas". BLÜCHER **ACCESS COVERS** are tested and classified in accordance with EN 124 "Gully tops and manhole tops for vehicular and pedestrian areas".			
	H 1,5	(150 kg)	No load areas				
	K 3	(300 kg)	Barefoot areas				
	L 15	(1.500 kg)	Pedestrian and light traffic		A 15	(1.500 kg)	Pedestrian and light traffic
	R 50	(5.000 kg)	Light traffic and light industrial areas				
	M 125	(12.500 kg)	Traffic and industrial areas		B 125	(12.500 kg)	Car parking areas
	N 250	(25.000 kg)	Heavy traffic and heavy industrial areas		C 250	(25.000 kg)	Along roads
	P 400	(40.000 kg)	Extra heavy traffic and industrial areas		D 400	(40.000 kg)	Light industrial areas
					E 600	(60.000 kg)	Heavy traffic and industrial areas
					F 900	(90.000 kg)	Airports, container and industrial areas

Non-slip gratings

Gratings are non-slip tested according to DIN 51130

Approvals

BLÜCHER has own testing facilities and coorporates with internationally recognized independent institutes. At BLÜCHER we also play an active part in setting international standards.

The functionality of our products has been documented by test reports and approvals from international institutes such as Sitac (SE), LGA (DE), BBA (UK), VTT (FI), ETA (DK) etc.

All pipes and channels are CE marked.

For a complete list of all current product approvals we refer to www.blucher.com.

Furhermore, we use approved institutes for fire and sound testing, for instance DTI (DK) and Fraunhofer Institut (DE)

All production is carried out in Denmark in accordance with ISO 9001.

Maintenance

BLÜCHER stainless steel drainage products require only a minimum of maintenance.

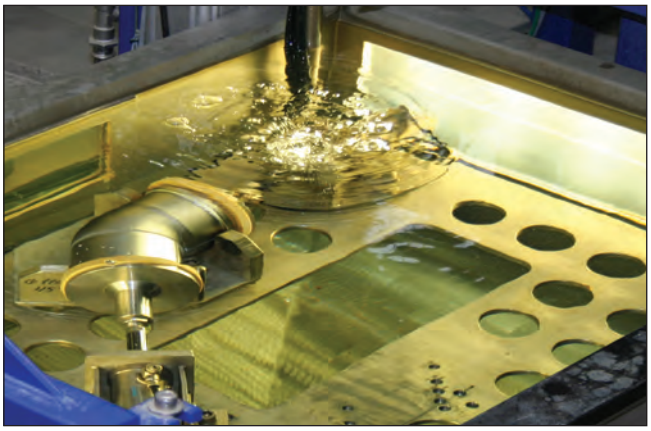
The smooth, acid-pickled surface retains its uniform matt silver finish in most environments such as wet rooms, bathrooms and kitchens. However, in particularly demanding environments such as the food industry, laboratories, the chemical industry and agriculture, it may be necessary to clean the installation to avoid formation of coatings which can cause subsequent corrosion.

Cleaning can for instance be done by means of high pressure flushing. In some cases it may be necessary to use diluted citric acid. After use take care to rinse with plenty of water.

Please also notice that particularly aggressive and hazardous substances should be collected in containers and disposed of in another way and not through the drainage system.

Production

Excellent workmanship, common sense and the most sophisticated production technology are combined to ensure the highest quality in our products.



All BLÜCHER® products are tested for leakages before leaving the factory

The most modern piping machinery in Europe

Installation videos at www.blucher.com

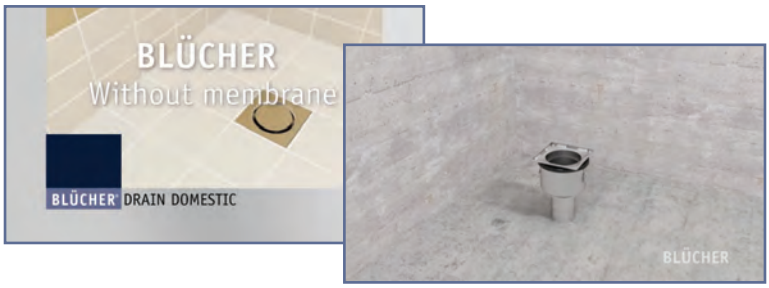
As a supplement to the printed installation instructions for the BLÜCHER® products, installation videos are available at www.blucher.com (select the tab "Installation"). These comprise, among others:

BLÜCHER® EuroPipe

Introduction to use and applications

BLÜCHER® Drain Domestic

Light-duty shower drains



BLÜCHER® Drain Industrial

Heavy-duty floor drains

BLÜCHER® Channel

Linear drainage

BLÜCHER® Roof Drainage System

Introduction to use and installation instructions

BLÜCHER® EuroPipe

BLÜCHER® Channel

BLÜCHER® Drain

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