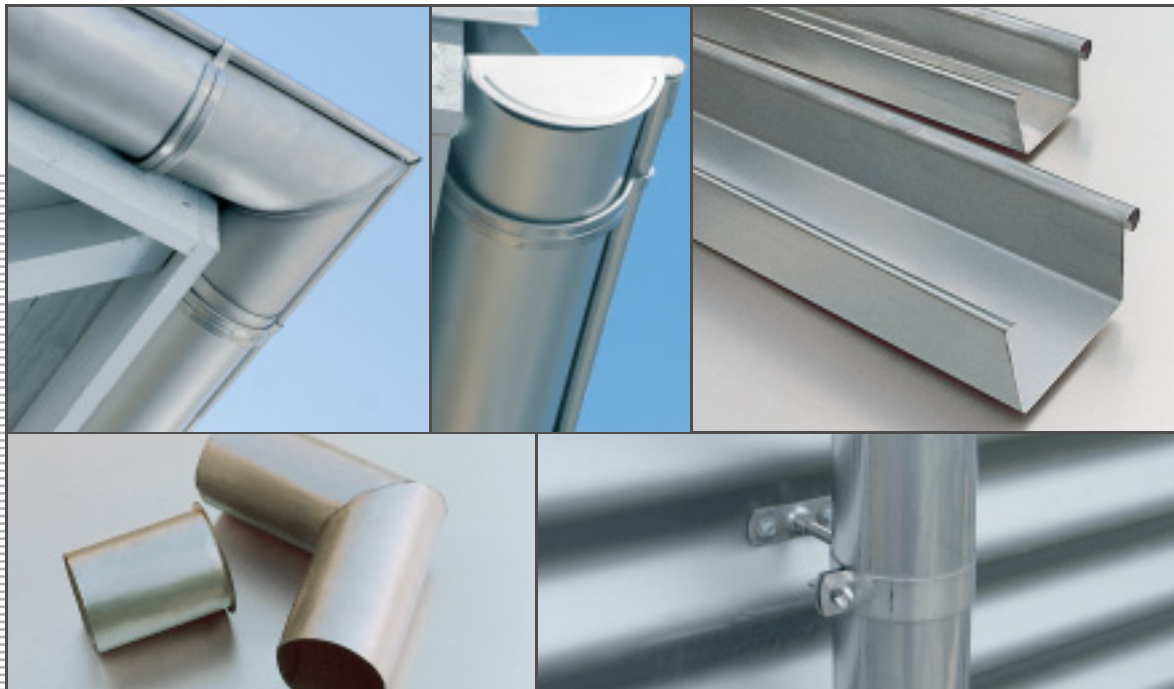


Stainless Steel for Rainwater Goods and Accessories



Euro Inox

Euro Inox is the European market development association for stainless steel.

The members of Euro Inox include:

- European stainless steel producers
- National stainless steel development associations
- Development associations of the alloying element industries.

A prime objective of Euro Inox is to create awareness of the unique properties of stainless steels and to further their use in existing applications and in new markets. To assist this purpose, Euro Inox organises conferences and seminars, and issues guidance in printed form and electronic format, to enable architects, designers, specifiers, fabricators, and end users, to become more familiar with the material. Euro Inox also supports technical and market research.

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1 Introduction

Every roof needs a drainage system. This is true for roofs with a steep or shallow pitch, and for flat roofs. Roof drainage systems comprise gutters and pipes – round or angular – and all the necessary accessories and fixings for fast and above all efficient channelling of rainwater or condensation from the surface of the roof.

The present publication is intended as a tool for choosing the most suitable type of material and surface finish. In each country, of course, consideration must be given to the national standards and trade practices.

Typical example of a stainless steel roof drainage system

- 1 Eaves flashings
- 2 Gutter
- 3 Outlet
- 4 Bend
- 5 Downpipe, round
- 6 Bracket
- 7 Sliding collar
- 8 Pipe cover
- 9 Groundpipe

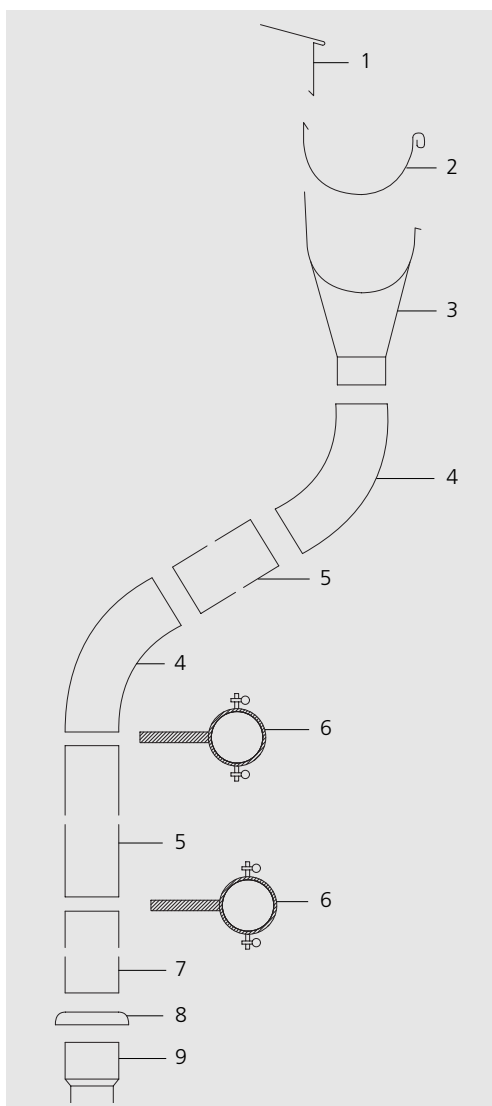


Diagram:
Brandt Edelstahldach GmbH,
Cologne

1.1 Functional aspects of roof drainage

Faulty roof drainage systems can cause considerable damage to a building. This may arise due to poor fitting, corrosion or material ageing. Rainwater escaping from the drainage system is a typical culprit in a range of problems, such as:

- Wet or rotting rafters due to defective eaves flashings and gutters
- Damage to underlying structures from leaks
- Serious damage to the support structure and facings from defective internal gutters
- Façades seriously affected by malfunctioning interlocking sleeves, bends and pipes.
- Unsightly patches and loose render.

Leaks are not always noticed immediately. It can sometimes be a matter of years before evidence of damp emerges. By that time the additional damage caused – often hidden – can be considerable and, costly to put right.

The causes of such damage can be largely eradicated by the use of higher-quality materials in combination with professional workmanship. Because of its superior durability, stainless steel is particularly suited for roof drainage systems. In aggressive environmental conditions, the cost benefits of stainless steel become especially evident, as the material is highly resistant to ageing.

In roof renovations, stainless steels have an added attraction in that they can be used regardless of what other building materials are already in place. Bituminous materials such as waterproof sheeting, for example, do not cause corrosion in stainless steel through direct contact or run-off water – something that other materials cannot provide.

1.2 Roof drainage systems as an architectural feature

Roof drainage systems are by no means solely practical. They are often treated as an architectural feature, too. In terms of choice of materials and style of system, stainless steel can meet all the design requirements of both client and architect.



Photos: Binder und Sohn GmbH, Ingolstadt (top),
ULG – Facultés des Sciences Appliquées, Bureau d'études
Greisch, Liège, Jean-Luc Deru, DAYLIGHT s.p.r.l., Liège (left)

The strong vertical lines of the rainwater downpipe contrast with and compliment the free-form appearance of the standing seam cladding.

Stainless steel gutters and downpipes match the visual qualities of classic façade materials like wood or brick.

1.3 Environmental qualities

Stainless steel is also a very environmentally-friendly product. Many home-owners nowadays collect run-off water in rainwater barrels, sumps or underground containers to use it for watering flower beds, lawns or topping up fish ponds. Due to its special homogeneous passive layer, stainless steel does not contaminate the run-off water. As it does not react with other media, it is not subject to material degradation that could produce polluting corrosion products.

The environmental effects of building materials are increasingly accepted as a criterion of material selection. In some countries National Standards require environment and health information to be provided for building products. Some regional authorities have already restricted the use of certain classic building metals because they may leach undesirably high amounts of metal ions into the runoff water and consequently into the water table. With stainless steel, environmental safety criteria are comfortably met. This has again been demonstrated in a recent 4-year field exposure trial and accompanying laboratory tests on grades 1.4301

and 1.4401¹⁾. The results confirm the proven neutrality of these standard stainless steels, which are also used in many other applications, where neutrality is of key importance, e.g. in food processing, the pharmaceutical industry, drinking water preparation and storage, skin contact applications and surgical implants²⁾.

Sustainability is a key issue in material selection. The cycle of production, use and recycling should be a closed loop system, whose environmental impact must be as low as possible. The recycled content of stainless steel produced today is as high as 60%³⁾. At the end of their useful life, stainless steel roofing materials and roof drainage components are 100% recyclable. The durability of stainless steel is an environmental asset in itself: the service life of a stainless steel roof can be as long as that of the entire building.

Stainless steel is safe for the workers who handle it. As it has no negative effects during its service life, stainless steel is the environmentally responsible choice.

¹⁾ D. Berggren et al, Release of Chromium, Nickel and Iron from Stainless Steel Exposed under Atmospheric Conditions and the Environmental Interaction of these Metals. A Combined Field and Laboratory Investigation, Brussels (Eurofer) 2004

²⁾ P.-J. Cunat, Stainless Steel – The Safe Choice, Luxembourg (Euro Inox) 2000 (Environment and Human Health Series, Vol. 1)

³⁾ See the presentation "The Recycling of Stainless Steel", available on the Euro Inox Website www.euro-inox.org or on CD-ROM

2 Choice of material

Stainless steel is available in over a hundred different types⁴⁾. However, for normal drainage systems only a handful of grades need to be used. The selection is determined by

the atmospheric conditions at the location in question. National traditions can also play a part.

2.1 Chromium stainless steels

Chromium stainless is used in roofing. Grade 1.4510 is a 17% chromium ferritic steel, to which a small amount of titanium has been added. For roofing purposes, it is then coated with a layer of tin. Ferritic stainless steels are easy to distinguish from the austenitic steels, because they are magnetic. Extensive long-term studies of the performance of chromium steel indicate good corrosion resistance in low-pollution areas, such as may be found in the countryside and in small towns.



Photo: Marianne Heil, Munich

Grade 1.4510 tin-coated stainless steel in a rural setting

2.2 Chromium-nickel stainless steels

A popular grade of chromium-nickel steel is 1.4301. This steel is an alloy of chromium and nickel, has an austenitic structure and is non-magnetic. Commonly called 18/8 or 18/10⁵⁾, this grade of steel is by far the most frequently used stainless steel. It is used in a

wide variety of applications, evidenced by the fact that it accounts for around 70% of the world market in stainless steel. The nickel content in chromium-nickel steel makes this type of steel more resistant to corrosion in acid media than ferritic steels. In addition, it

⁴⁾ See Tables of Technical Properties, Luxembourg: Euro Inox, 2004 (Materials and Application Series, Vol. 5), also available at www.euro-inox.org as an online database.

⁵⁾ The standard stainless steel grade 1.4301 is often referred to as "18/8" or "18/10", because the alloy contains 18 to 19.5 of chromium and 8 to 10.5 % of nickel. However, there are several grades within that range of chromium and nickel content. As they may be quite different in terms of other alloying elements and carbon content, they may also vary in their technical properties. These popular terms are not adequate for proper identification of a particular type. To avoid misunderstandings and complaints, the material numbers or names set out in EN 10088 should always be used.

greatly facilitates welding operations and complex shaping processes. Chromium-nickel steel, too, is suitable for use in urban and rural areas, and in a normal industrial atmosphere. A wide range of surface finishes is available.

Performance of grade 1.4301 in a normal industrial atmosphere



Photo: Spengler Direkt, Ermatingen

A roof drainage system in grade 1.4436 stainless steel used in a coastal environment, on an island in the North Sea.



Photo: Gert Brühl, Cologne

2.3 Chromium-nickel-molybdenum stainless steels

Adding 2 to 2.5% molybdenum to the alloy produces grades like 1.4401 or its low carbon variety 1.4404. This family also includes grade 1.4571 steel which has been additionally stabilised with titanium (although this is only of minor significance in the market for roof drainage systems). Chromium-nickel-molybdenum stainless steels are considerably more corrosion-resistant than standard varieties, which makes them the best choice for drainage systems in atmospheres with a high chloride content (e.g. near the sea, or in heavily industrialised areas). If required, grades like 1.4436/1.4432 or stainless steels with an elevated molybdenum range can be discussed⁶⁾.

⁶⁾ The exact chemical compositions of the usual stainless steels, their mechanical and physical properties can be seen in the "Tables of Technical Properties", as per footnote 4.

3 Surface finishes

Stainless steel is by no means available in only a restricted range of surface finishes. Quite the opposite – the choice is extremely wide, from a glossy, almost mirror-like finish, to matt, textured and coloured⁷⁾. The following are the surface finishes most commonly

found among prefabricated roof fittings and in the trade.

As a rule, smoother and brighter surfaces help to reduce the adherence of dirt particles and, they are easier to keep clean.

3.1 Standard mill finishes

The standard bright mill finish is generally referred to as a 2B finish, which is often used for the manufacture of roof drainage systems. In appearance the surface effect can be described as a slightly milky gloss, which harmonises well with modern buildings. Its dull counterpart is called 2D.

In contemporary architecture a roof drainage system made of stainless steel with a standard, bright mill finish sets up an interesting visual contrast when used in combination with colour-glazed roof tiles or glass. This gloss is characteristic of stainless steel, and

can be achieved by no other material. As steel with a standard bright mill finish undergoes no further treatment after rolling, it is a finish that also represents a particularly cost-effective solution.



Roof drainage systems made of standard mill finishes: 2B bright (right) and 2D dull (left).

Photos:
Spengler Direkt, Ermatingen (left),
Gert Bröhl, Cologne (right)

⁷⁾ For a definition of the standardised finishes according to EN 10088, refer to the Guide to Stainless Steel Finishes, Luxembourg: Euro Inox 2000 (Building Series, Vol. 1), also available on the Euro Inox website.

3.2 Standard matt finishes

A matt effect can be achieved on standard mill-finished steel by

- additional passes on textured rolls, or by
- abrasion blasting with glass beads or glass grit.

The desired matt-grey finish is then fixed from the start – it undergoes no further changes over time. In the trade, this type of finish is generally provided on grades 1.4301 and 1.4404.

A matt finish used for the drainage system of the canopy of a hotel in Helsinki, Finland

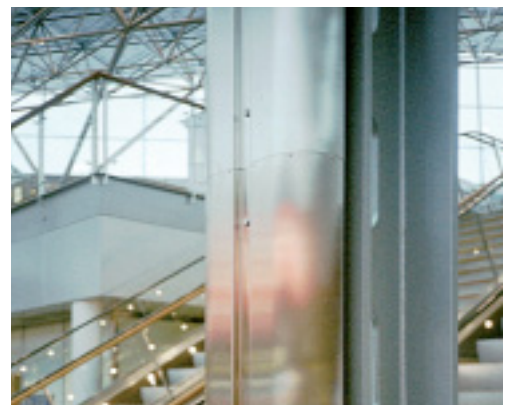


Satin-polished downpipe on the facade of a hotel building at Imperia, Italy



3.3 Brushed and polished

Classic brushed and polished surface finishes are used for eye-catching applications where the components are highly visible. This would include, for example, downpipes that are guided through the inside of a building, where they are in full view.



Photos:
Thomas Pauly, Brussels
(top right, bottom right),
Riccardo Carera,
Malnati s.a.s., Milano (left)

Brushed stainless steel roof drainage leading through the interior of an airport building

3.4 Tin-coated

Grades 1.4510 and 1.4404 have also been produced with a tin coated finish for many years. This finish reacts very differently to uncoated stainless steel, in that it changes over time, in a similar way to the surface of standard mill-finish building metals (e.g. zinc or copper). In general partial changes of colour take place, which then gradually develop into a matt-grey patina.

There is variation in how long it takes for this patina to develop. In the case of components frequently wet by rain, the rate of change is considerably faster than in those components less exposed to rain.



Development of a patina on tinned stainless steel of grade 1.4404. Left: new; right: after about two years weathering



Tinned surfaces are often requested for older houses, and they are widespread on listed buildings. Tinned stainless steel is the material of choice for buildings of historical interest where waterproofing has to be guaranteed for a long period of time and where visual harmony with the older, traditional materials is desired (see chapter 4.3).

Use of tinned ferritic steel, grade 1.4510, in the downpipes of a listed church building

Photos: Gert Bröhl, Cologne

3.5 Bright annealed

Among the many types of surface style there are also high-gloss finishes. Designated 2R, this surface is created by bright annealing to create an almost mirror-like surface. This finish is often found on cladding for façades and interiors, and in window and door systems.

When used for roof drainage systems, however, high-gloss surfaces are extremely demanding in terms of workmanship, as even the slightest depression or unevenness is easily seen. In site work on the roof drainage system, it is advisable, therefore, to reserve this surface for special cases only.



Downpipes made from bright annealed stainless steel at a steel service center at Gavá, Spain

Photos:
Thomas Pauly, Brussels
(top left and right)
Gert Bröhl, Cologne
(bottom)



3.6 Coloured

A simple and often used method is to give colour accent to the steel by painting it. Experience has shown that tinned stainless steel provides a good base for paint. Standard mill finished steel can also be painted, but it is advisable to treat it first. Stainless steel owes its corrosion resistance to a self-renewing “passive” (chemically-stable) film that is just a few atoms thick, and this does not offer sufficient adhesion for paint. Before painting stainless steel components made of standard mill finishes they should be roughened using a suitable abrasive and, if necessary, an appropriate primer.



Coloured stainless steel drainage as a design feature

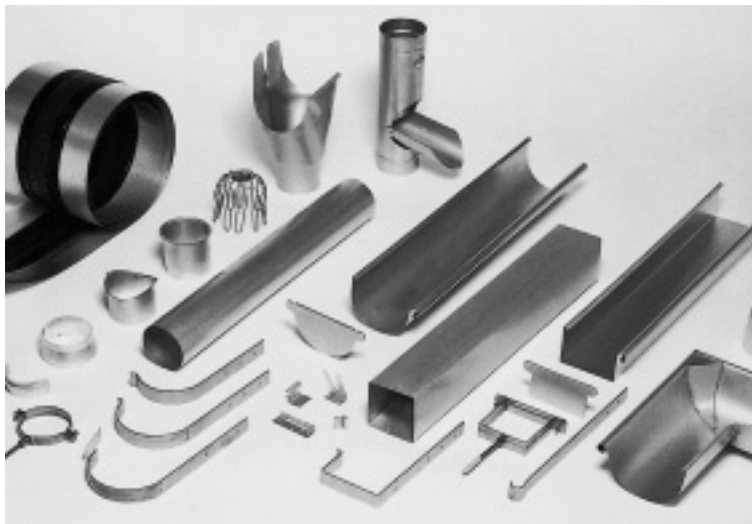
4 Areas of application

Stainless steel can be used in virtually all types of roof drainage systems.

4.1 Roof geometries

Whether the overall design calls for round or box-type cross-sections, there is a wide range of quality guttering and accessories available as standard components. Virtually all the sizes offered in other materials are also provided in stainless steel – including for roofs that call for particularly large or small size systems.

Even in the case of concealed gutters, which often have to be specially made, stainless steel versions are readily obtained. Such styles are used in residential buildings where the gutter is to remain hidden, or where the roof edge is a special design feature. In com-



Roofing accessories in standard and special dimensions

mercial buildings, concealed guttering is often dictated by the roof form. For more rounded building forms too, guttering can be made in corresponding segments.

Concealed gutters are preferred where the roof edge is a special design feature.

Photos: Brandt Edeltahldach GmbH, Cologne (top), UGINE & ALZ, La Défense (bottom left), Binder & Sohn, Ingolstadt (bottom right)



Concealed gutter on a school building at Allonnes, France



Photo:
Gert Bröhl, Cologne

Stainless steel with a standard bright mill finish on the guttering continues the surface effect of the high-quality glazed tiles.

Commercial buildings are often located in areas with some degree of air pollution, making higher-alloyed grades an obvious choice. Here, grades like 1.4401 or similar are often preferred.

Of particular interest are building projects where stainless steel is essential because no other material can fulfil the requirements in terms of visual appearance or corrosion-resistance.

In the case of domestic buildings, both the roof drainage system and the cladding on the chimney can be made of stainless steel with the same surface finish. Hence the attention to quality and design that is shown in the glazed roofing tiles, is then continued in the roof drainage system. The distinctive surface effect on chimney, guttering and downpipes is then just as durable as that on the roofing tiles.

4.2 Roof drainage systems on bitumen-felt roofs

UV radiation and weathering of bituminous roofing felt, coatings, paint or tiles and of ECB⁸⁾ sheeting, can lead to ageing processes that release highly aggressive degradation products. Some metals are severely affected not only by direct contact with bituminous materials but also by water running off surfaces covered with such material. Advice from the Trade Associations of the roofing

industry recommend that the affected roof drainage components should always have a protective coating.

Because of their limited durability, the coatings must be regularly inspected and renewed. However, applying these coatings to the inside of pipework, particularly those with say 90° bends, is no easy task.

In these cases stainless steel is the sensible

⁸⁾ Ethylene copolymer bitumen

solution. Many years of experience have shown stainless steel to be resistant to “bitumen corrosion”. And no time and money needs to be spent on applying and main-

taining protective coatings. In this way, the higher-quality material is the more cost-effective solution in a life-cycle analysis ⁹⁾.

4.3 Stainless steel and historic monuments

Stainless steel is also available in finishes that lend themselves very well for use on historic monuments. In no way does the material always have to have a bright, shiny surface, as is commonly thought. Such a finish would indeed contrast inappropriately with the look of a historic building.

A matt (tinned or matt-rolled) finish gives an optical effect more like that produced by more traditional materials. Because of its universal, inherent corrosion resistance, stainless steel helps protect the building for generations against leaks in the roof drainage system.

Photos: Fausto Capelli, Centro Inox, Milan (bottom)
UGINE & ALZ, La Défense (right)



Matt stainless steel used on listed buildings and other historic monuments echoes the traditional metal roofing materials. (Basilica di Sant' Antonio, Padova, Italy).

The superior durability of Stainless Steel is an important additional benefit (Basilica Saint Martin-de-Tours, France).

⁹⁾ The Euro Inox Life Cycle Costing (LCC) software is a tool for producing life-cycle comparisons of the cost of using stainless steel or other materials. The programme can be downloaded free from the website www.euro-inox.org, or you can order a free copy on CD-ROM.

5 Guidelines for working with stainless steel

Working with stainless steel roof drainage systems is very similar to working with traditional metals. In comparison to other building materials stainless steel has a significantly higher strength. As a result thicknesses of only 0.4 to 0.5 mm are typically used in roof drainage systems. At this thickness stainless steel can easily be worked using standard tools and equipment¹⁰⁾. European standard EN 612 sets out these dimensions explicitly, giving the user additional security, particularly from a performance point of view.

It is important to identify the material type and surface finish before starting work. A test run on a sample piece of the material is advisable to learn how it cuts, bends and solders. When describing materials and surface finishes, use only those terms set out in EN 10088. Familiar descriptions such as “stainless steel”, “Inox” or “18/10” etc. are not adequate for unambiguous identification amidst the wide variety of types available, and can lead to misunderstandings between client and contractor.

Development width w (mm)	Nominal material thickness (mm)						
	Aluminium min. Class A min.	Aluminium min. Class B min.	Copper min.	Steel min.	Stainless Steel Class A min.	Stainless Steel Class B min.	Zinc Class A min. Class B min.
w ≤ 250	0.7	0.6	0.6	0.6	0.5	0.4	0.65 0.65
250 < w ≤ 333	0.7	0.6	0.6	0.6	0.5	0.4	0.7 0.65
333 < w	0.8	0.7	0.7	0.7	0.6	0.5	0.8 0.8

Table 1: Material thickness of gutters according to EN 612

Cross section shape and dimensions (mm)	Nominal material thickness (mm)					
	Aluminium min. Class A min.	Aluminium min. Class B min.	Copper min.	Steel min.	Stainless Steel min. Class A min. Class B min.	Zinc min.
Round						
Diameter ≤ 100	0.7	0.6	0.6	0.6	0.5	0.4 0.65
Diameter > 100	0.7	0.7	0.7	0.7	0.6	0.5 0.7
Side of square or longer side of rectangle						
Side < 100	0.7	0.6	0.6	0.6	0.5	0.4 0.65
100 ≤ side < 120	0.7	0.7	0.7	0.7	0.5	0.4 0.7
120 ≤ side	0.7	0.7	0.7	0.7	0.6	0.5 0.8

Table 2: Material thicknesses for downpipes according to EN 612

¹⁰⁾ Technical Guide to Stainless Steel for Roofing, Luxembourg 2003 (Euro Inox Building Series, Volume 5), p. 14

A comprehensive assortment of roof drainage components is available on the market, and, it is easy to obtain the required parts.

Standard techniques can be employed when working with the material, in particular for folding and soft soldering.

5.1 Tools and machines

Sheet shears are best for cutting stainless steel. As with all tools, the shears must be free of rust particles.

Cutting or grinding wheels and circular saws have limited application. The high level of heat arising during the cutting process causes discoloration and the inherent corrosion resistance of the material can no longer be guaranteed in those areas. When tinned stainless steel is cut in this way, the tin recedes, thus reducing the easy solderability of the material at that point. The areas that are discoloured through the action of heat should be cut out manually and cleanly. If cutting wheels are used, they must be suitable for use with stainless steels and may

not contain or release any extraneous iron particles.

Otherwise, standard tools and machines can be used, e.g. including manual and mechanical bending presses and squaring shears. With all tools and machinery, however, it should be stressed that no iron or rust particles should be pressed into the surface. The reason being that due to the galvanic reaction between the comparatively “reactive” iron and the “non-reactive” stainless steel, these particles would suffer accelerated corrosion. The resulting corrosion products are not only unsightly, they can also penetrate the normally self-repairing “passive” layer and damage the stainless steel itself.

5.2 Forming

Stainless steel has higher mechanical properties than other building metals. However, typical stainless steel sheet for roofing purposes is only 0.4 to 0.5 mm and therefore significantly thinner than other materials. Forming operations can be carried out, manually or automatically, with the normal tools and procedures. Care has to be taken to avoid ferrous contamination. A set of hand tools must either be reserved to stainless steel or, otherwise, be cleaned thoroughly before being used for stainless steel.

On-site forming of concealed gutters in 0.4 mm stainless steel



Photo: UGINE & ALZ, La Défense

5.3 Soft soldering

When soft-soldering with stainless steel it is important to use special fluxing agents with the following characteristics:

- The recipe must be based on orthophosphoric acid, and;
- The flux must be completely free of chlorides.

Fluxing agents designed for other metals, e.g. copper or zinc, are entirely unsuitable for use with stainless steel, and even harmful. They can impair the solderability of stainless steel and, because of their chloride content, can lead to corrosion.

After soldering, the stainless steel surfaces must be cleaned and rinsed with liberal amounts of fresh water to remove all traces of flux.

In particular with bright and matt-finished surfaces it is recommended that the seams are secured before soldering with appropriate rivets or fixings, preferably of stainless

steel. These take up any mechanical stresses that arise during the fitting process. In addition they can help maintain the strength of the joint, even when it is subjected to loading e.g. by snow, misuse by people treading on it or the hanging of objects.

Among the forces acting on a connection, expansion due to heat has to be taken into account. This varies considerably between the different grades of steel. The coefficient of thermal expansion of ferritic steel grade 1.4510 is 10.5, which is comparable to that of carbon steel; in the case of austenitic grades e.g. 1.4301, it is higher, around 16.0¹¹⁾.

Soldering demonstrated on an articulated bend and a gutter corner section.



Photos:
Informationsstelle Edelstahl
Rostfrei, Düsseldorf

¹¹⁾ Given in $10^{-6} \cdot K^{-1}$. Example: With a temperature difference of 50 Kelvin (~ degrees Celsius) the expansion of a 600 cm gutter made of ferritic stainless steel grade 1.4510 (thermal expansion coefficient: 10.5) is $600 \text{ cm} \cdot 50 \text{ K} \cdot 10.5/1,000,000/K = 0.315 \text{ cm}$. The same calculation for the austenitic grade 1.4301 (thermal expansion coefficient: 16.0) gives the result 0.48 cm.

5.4 Adhesive bonding

In recent times bonding as a method of connection has gained acceptance and is now included in the rules of practise of the trade organisations. In roof drainage systems the most common type of bonding agent used is polyurethane adhesive, applied using triangular jets to a thickness specified by the manufacturer.

The surfaces to be bonded must be clean, dry and free of grease. In general bonding requires an ambient temperature of above 5°C. During the hardening period, the join must not be subject to any forces.

Adhesive bonding is by no means any more forgiving than soldering. It requires just as much care in design and fabrication. Because adhesive bonds are less resistant to shear stress than soldered counterparts,



Photo: Willem De Roover, Ghent

Special tools are available to keep adhesive bonds in place while curing.

tension due to poor fit must be avoided and, thermal expansion needs to be taken into account. It may be advisable to fit rivets to reinforce the bond. Special tools are available to steady the joints until curing is complete. Practical long-term experience with adhesive bonding in metallic rainwater goods is, as yet, limited.

5.5 Fixings

To avoid the risk of galvanic corrosion¹²⁾, brackets, screws, nails and rivets etc. used for fixing the roof drainage components should also be made of stainless steel. Choosing the same material here, too, helps ensure that all parts of the roof drainage system – guttering, accessories and fixings – have the same long service-life.

Photo:
Brandt Edeldach GmbH,
Cologne



To avoid the risk of galvanic corrosion, the fasteners should also be made from stainless steel.

¹²⁾ See also: Technical Guide to Stainless Steel Roofing, Luxembourg: Euro Inox 2003 (Building Series, vol. 5), p. 13

6 Special accessories

In response to a fast-growing market, manufacturers have developed a wide range of special accessories in stainless steel to complete their standard programmes. This means that roof drainage systems can be designed and built entirely of stainless steel, right down to the last details. Examples include highly visible components such as articulated pipe bends and bucket gullies.



Bucket gullies, angles, T-joints and other rainwater goods are available as standard components or can be made to measure.



Stainless steel snow guards

A unified appearance can now be achieved, to include the roof, the drainage system and the chimney, as well as any cladding and accessories. Outlet vent hoods and roof vent blocks are available in either rounded or angular shapes. Roof safety hooks and snow guards, as well as their fixings, are also obtainable in stainless steel. Safety components in particular have to fulfil special requirements in terms of long-lasting functionality.

Photos: Marianne Heil, Munich (top right), Wilmes GmbH, Winterberg-Silbach (middle right) Spengler Direkt, Ermatingen (left), Brandt Edeltahldach GmbH, Cologne (middle top, bottom)



Downpipe with access cover

Photos: Wilmes GmbH, Winterberg-Silbach (top left), Lorowerk, Bad Gandersheim (middle), Willem de Roover, Ghent (top right) Binder und Sohn, Ingolstadt (middle right, bottom right) Gert Bröhl, Cologne (bottom left)

Flap access units for square and round section downpipes



Managing rainwater run-off from balconies is possible using a range of small-scale components including drains, pipes and elbows and sleeves. Also available in stainless steel are junctions for bringing together several smaller drains as well as downpipes with inspection and diverting hatches for directing rainwater into containers, land-drains or soakaways in the ground.

Stainless steel gullies before and after fitting into the roofing skin



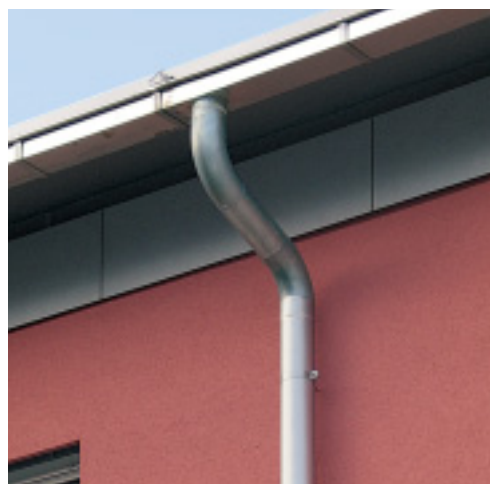
Vacuum drainage system in stainless steel



Stainless steel gully in a loaded flat roof next to a ventilation outlet and a chimney cladding in the same material

7 Closing remarks

The use of stainless steel in roof drainage systems is innovative but by no means new. It has been established now for many years and has proven to be a very practical alternative. Countless roof drainage systems in stainless steel have now been giving trouble-free service for decades, demonstrating the outstanding durability and attractiveness of the material. A long service life, life-cycle cost benefits, aesthetic appeal, practicability and sustainability are key considerations both now and in the future.



Photos:
Kent Lindström/Fotografen
i Avesta AB, Avesta (left),
Thomas Pauly, Brussels
(bottom top),
Spengler Direkt, Ermatingen
(middle right),
Willem De Roover, Ghent,
(bottom right).

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