Leviat®
A CRH COMPANY

Ancon®

The Use of Stainless Steel

for the Construction Industry

November 2020

Leviat®
A CRH COMPANY

We are one team.
We are Leviat.

Leviat is the new name of CRH's construction accessories companies worldwide.

Under the Leviat brand, we are uniting the expertise, skills and resources of Ancon and its sister companies to create a world leader in fixing, connecting and anchoring technology.

The products you know and trust will remain an integral part of Leviat's comprehensive brand and product portfolio. As Leviat, we can offer you an extended range of specialist products and services, greater technical expertise, a larger and more agile supply chain and better, faster innovation.

By bringing together CRH's construction accessories family as one global organisation, we are better equipped to meet the needs of our customers, and the demands of construction projects, of any scale, anywhere in the world.

This is an exciting change. Join us on our journey.

Read more about Leviat at Leviat.com

Our product brands include:

Ancon®

Connolly

HALFEN

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ISEDIO

PLAKA

60
locations

sales in
30+
countries

3000
people worldwide

Imagine. Model. Make.

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The Use of Stainless Steel

Many of Leviat's products are manufactured from stainless steel. This material offers many advantages to the specifier and its use in the Construction Industry continues to increase. Stainless steel building products ensure a high degree of corrosion resistance without requiring additional protection and are 100% recyclable at the end of a long service life.

NATSPEC ProductPartner

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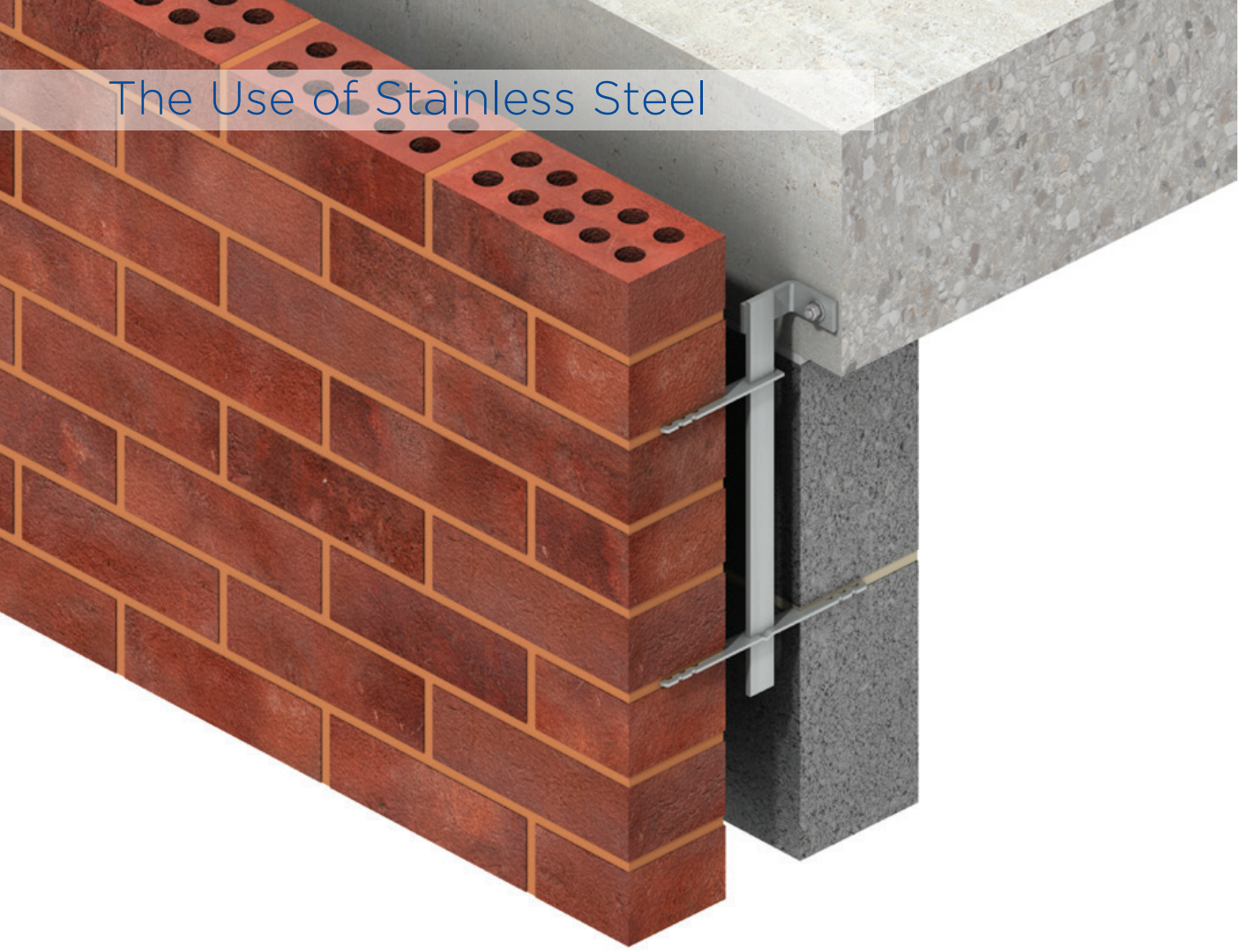


What is Stainless Steel?

Stainless steel is not a single specific material; it is the name given to a group of corrosion resistant steel alloys which contain a minimum of 10.5% chromium.

The chromium in stainless steel reacts with oxygen in the air to produce a very thin, inert, chromium rich oxide film on the surface of the steel. It is the presence of this film which provides the corrosion resistance of stainless steel.

This passive film is unlike coatings such as paint or galvanising in one very important way. If it is damaged by abrasion or mechanical means such as cutting, it re-forms and continues to protect the steel.

Why Use Stainless Steel?

Stainless steel has been used with success by the construction industry for over seventy years. Its use has increased rapidly in recent times as the benefits of stainless steel over other materials have become more widely recognised.

Stainless steel offers many advantages to the specifier:

- Excellent corrosion resistance
- Life-cycle costing benefits
- 60% Recycled content
- 100% Recyclable
- High ductility and strength
- Non-magnetic (Austenitic only)
- Excellent high and low temperature properties
- Resistance to unsightly staining
- Aesthetic surface finish

Life-cycle costing is increasingly recognised as the true way to establish the cost of building components. The maintenance-free life and confirmed integrity of stainless steel mean that no costly remedial or refurbishment measures are required during the life of the structure.

As the trend to higher specification and longer life continues, stainless steel will provide cost-effective long term solutions to specifiers' problems.

Recyclability

Stainless steel is 100% recyclable. When a product finally reaches the end of its long service life, it remains a valuable source of its main alloying elements - chromium, nickel and molybdenum. These can be easily recovered and returned to the production process.

Stainless steel recycling is an economically viable, self-sustaining process. There are considerable savings in energy, and reduced CO_2 emissions, in production methods which use recycled materials. The amount of recycled material in any stainless steel product is typically 60%, and as scrap availability is the limiting factor, this percentage will increase as the use of stainless steel continues to grow. The raw material produced today will not be recycled for many years.

In addition to a product's end-of-life recycling, any scrap material generated during its manufacture is recycled in the same way. Leviat recycles 100% of its stainless steel scrap.

RECYCLABLE
STAINLESS STEEL

Types of Stainless Steel

Austenitic Stainless Steels

Austenitic stainless steels offer excellent resistance to corrosion. These high chromium steels are ductile and strong. They are non-magnetic and can be readily formed and welded. Higher strengths can be obtained by cold working, although this makes the metal slightly magnetic and may reduce its corrosion resistance. Austenitic stainless steels are widely used in the construction, pharmaceutical and chemical industries.

Martensitic Stainless Steels

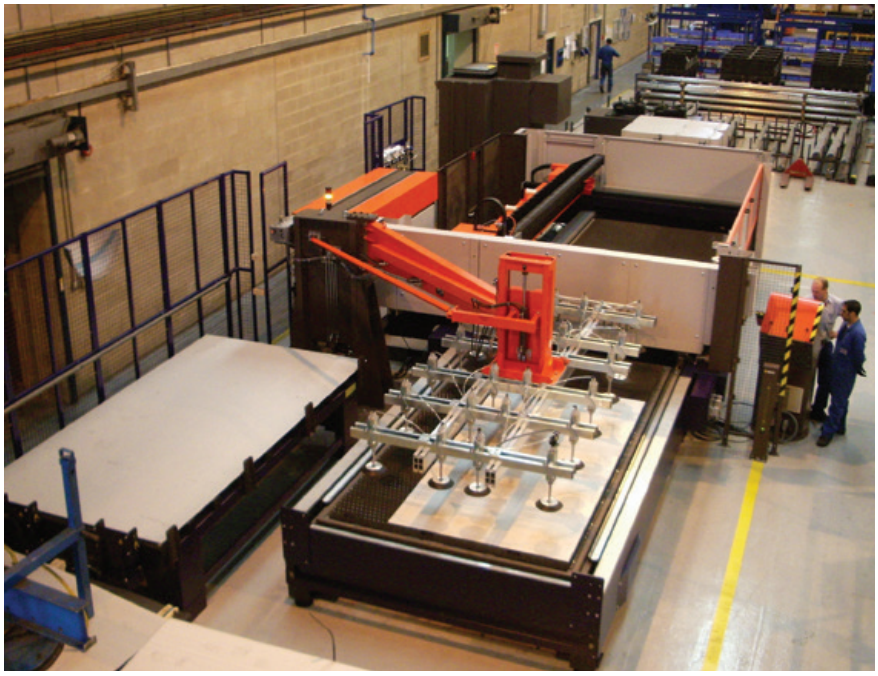
The high carbon content of martensitic steels means they can be hardened by heat treatment; ultimate tensile strengths in excess of 2000MPa can be obtained. They are magnetic and cannot be easily welded. Although they are cheaper than austenitic steels, their low corrosion resistance limits the range of suitable applications to components such as valves, dies and knife blades.

Ferritic Stainless Steels

Ferritic steels are weaker and less ductile than austenitic steels. They are magnetic and their strength can be increased to a certain extent by cold working. Common ferritic steels are comparatively cheap, but they cannot be welded in thick sections. Generally, they have poorer resistance to pitting, but superior resistance to stress corrosion cracking than austenitics. If appearance is important, their use should be restricted to indoor applications. They are used for internal shop-fitting.

Duplex and Super Duplex Stainless Steels

These steels have a mixed austenitic/ferritic microstructure. They are stronger than austenitic steels but are not as easily formed. They are magnetic and can be welded; their corrosion resistance is better than that of austenitic steels, particularly their resistance to stress corrosion cracking. Duplex steels are used in the paper, chemical, oil and construction industries.



Laser Cutting

Welding

Shearing

Section Forming

Leviat has the capability to fabricate all Austenitic, Duplex and Super Duplex stainless steels. Building products are normally manufactured from Austenitic stainless steels. This material is suitable for the vast majority of applications.

The Use of Stainless Steel

Material Specification

There are many grades of stainless steel resulting in a proliferation of international specifications. The two main grades of austenitic stainless steel used in the manufacture of our products are 1.4301 (304) and 1.4401 (316).

These grades of stainless steel are adequate for almost all construction applications, however grades which have even greater pitting or corrosion resistance can also be supplied. Some products are manufactured in grade 1.4462 duplex stainless steel.

In recent years, lean duplex grades have been developed to give similar pitting corrosion resistance to standard austenitic grades but with higher strength and better resistance to stress corrosion cracking e.g. grade 1.4362.

Please contact the Technical Services Team for further advice on selecting the most appropriate grade of stainless steel for your application.

All plate material meets the chemical composition and mechanical property requirements of the material standard for stainless steel, BS EN 10088.

Grade 1.4301 (304)

This austenitic grade is the most commonly used and is suitable for a broad range of construction applications. It typically contains alloying elements of at least 18% chromium and 8-10% nickel. Marginal differences in composition have no significant effect on the material's excellent all-round corrosion resistance.

Grade 1.4401 (316)

This austenitic grade is recommended for highly corrosive areas such as marine locations or heavily polluted industrial environments. The addition of a small proportion of molybdenum (around 2%) and an increase in the nickel content to 10-13% provide a more robust passive film and hence higher resistance to corrosion.

Grade 1.4462

This is a high strength duplex stainless steel with a minimum chromium content of 22%, a nickel content of 4.5-6.5% and a molybdenum content of 2.5-3.5%. It offers superior corrosion resistance especially against pitting and crevice corrosion.

Specifications for Equivalent Grades of Stainless Steel

EN 10088 Number	EN 10088 Name	BS 1449
1.4301	X5CrNi 18-10	304S15 304S16 304S31
1.4306	X2CrNi 19-11	304S11
1.4401	X5CrNiMo 17-12-2	316S31 316S33
1.4404 1.4432	X2CrNiMo 17-12-2 X2CrNiMo 17-12-3	316S11 316S13
1.4462	X2CrNiMoN 22-5-3	-

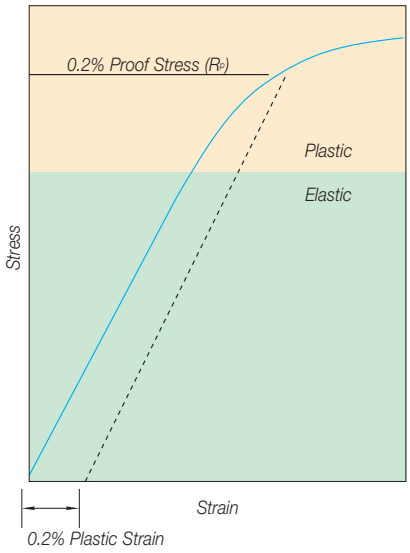
Properties and Working Stresses

The behaviour of constructional stainless steels differs from mild steels in that these stainless steels do not exhibit a well defined yield point when representative test pieces are submitted to tensile load.

A true yield point is obtained in mild steel when plastic deformation starts to occur without any increase in loading. The stress in the test piece at the yield point is known as the yield strength of the material.

Constructional grades of stainless steel show early plastic deformation in test, but continue to sustain increasing load with increasing strain. In order to characterise the useful design strength of such materials, proof strengths are used and are determined as the stress (Rp) at which plastic extension equals a specified strain. For stainless steels this is commonly at 0.2% strain and the proof strength for a particular grade of steel is based on the (Rp) 0.2% proof stress.

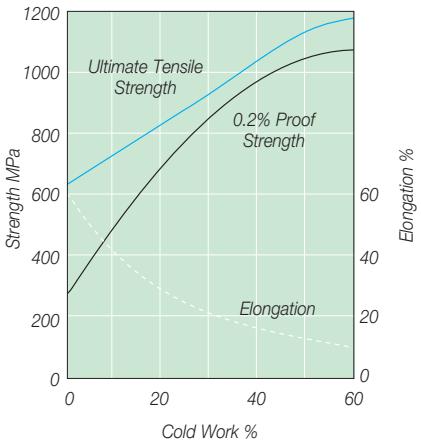
The maximum design stresses are derived from the 0.2% proof stress which is factored to ensure that the material stresses remain within the elastic region of the stress/strain curve.



Typical Stress/Strain Curve for Stainless Steel

Effect of Cold Working

The working of austenitic stainless steel significantly increases the proof strength. Localised cold working arises during the forming of angle and channel sections. The benefits of this cold working are not taken into account in our designs, but provide additional reserves of strength.



Effect of Cold Working in Grade 304 Stainless Steel

Commonly used Grades for Flat Products and their Applications, Properties and Design Stresses

Grade	Alloying Elements	Applications	Minimum 0.2% Proof Stress R_p (MPa)	Ultimate Tensile Strength R_m (MPa)	Elongation After Fracture (%)	Working Stresses Tension Compression (MPa)	Shear (MPa)
1.4301 (304)	Chromium-nickel steel (Basic stainless steel)	Suitable for rural, urban and light industrial sites. Regular washing down is recommended for exposed architectural features to maintain a good appearance.	210	520 - 720	45	140	93
1.4306 (304L)	Low carbon chromium-nickel steel (Lower carbon content improves resistance to intergranular corrosion of thick sections following welding)	Not suitable for exposure in heavily polluted industrial or coastal sites. Low carbon grade need only be considered for welded fabrications involving plates thicker than 16-20mm depending on the welding procedure.	200	500 - 650	45	133	89
1.4401 (316)	Chromium-nickel-molybdenum steel (Molybdenum greatly improves overall corrosion resistance and especially pitting resistance)	Suitable for industrial and coastal sites. Tarnishing or staining may occur; regular washing down is recommended for exposed architectural features to maintain a good appearance.	220	520 - 670	45	146	97
1.4404 1.4432 (316L)	Low carbon chromium-nickel-molybdenum steel (Lower carbon content improves resistance to intergranular corrosion of thick sections following welding)	Low carbon grade need only be considered for welded fabrications involving plates thicker than 16-20mm depending on the welding procedures.	220	520 - 670	45	146	97
1.4462	Low carbon, high chromium-nickel-molybdenum steel, with an austenitic-ferritic microstructure	Suitable for applications where high strength is required or where pitting and crevice corrosion are likely to occur.	460	640 - 840	25	306	204

Notes: *The properties and design stresses are for hot rolled plate to EN 10088. Leviat is able to use higher stresses in accordance with S.C.I. recommendations in the "Structural Design of Stainless Steel", available from the Steel Construction Institute, Silwood Park, Ascot, Berkshire SL5 7QN, United Kingdom (www.steel-sci.org).*

The Use of Stainless Steel

Bi-Metallic Contact

When two dissimilar metals are in contact in the presence of an electrolyte, bi-metallic corrosion may occur. This may result in the corrosion of the base metal while the noble metal is protected. Where contact is unavoidable and moisture is likely to be present, the two metals should be separated.

The table of recommendations indicates which metals may, in certain circumstances, be used together.

The degree of corrosion resulting from bi-metallic contact depends collectively upon:

- The metals in contact
- The environmental conditions
- The time that the contact remains wet or moist
- The relative surface areas of the anodic (carbon steel) and cathodic (stainless steel) metals

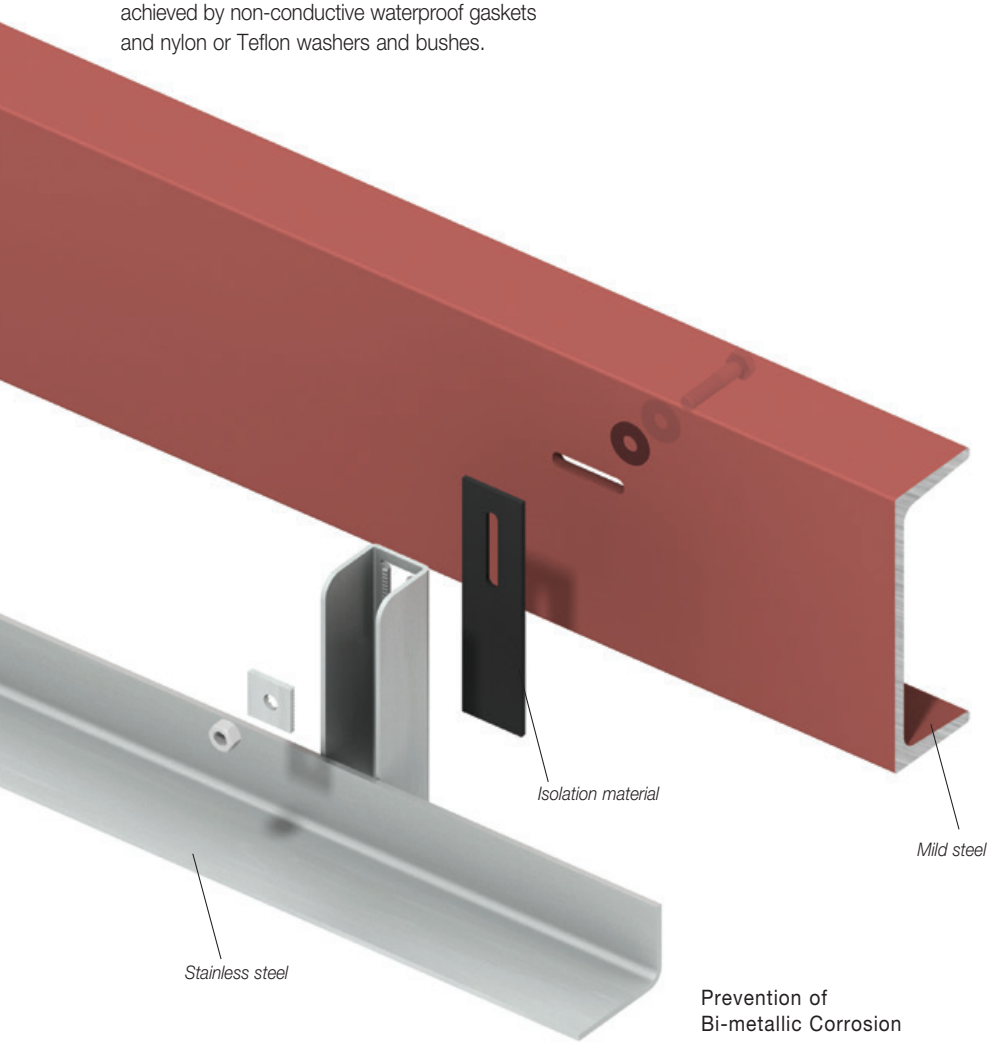
Prevention is possible by excluding water from the detail (painting or taping over the assembled joint) or by isolating the metals from each other (painting the contact surfaces of the dissimilar metals or using isolation patches). Isolation around bolted connections can be achieved by non-conductive waterproof gaskets and nylon or Teflon washers and bushes.

The general behaviour of metals in bi-metallic contact in rural, urban, industrial and coastal environments is fully documented in PD 6484 : Commentary on corrosion at bi-metallic contacts and its alleviation.

Metals	Stainless Steel	Mild Steel	Aluminium Bronze	Phosphor Bronze	Copper	Cast Iron	Aluminium	Zinc
Stainless Steel	✔	✖	●	●	●	✖	✖	●
Mild Steel	✖	✔	✖	✖	✖	●	✖	✖
Aluminium Bronze	●	✖	✔	✔	✔	✖	✖	✖
Phosphor Bronze	●	✖	✔	✔	✔	✖	✖	✖
Copper	●	✖	✔	✔	✔	✖	✖	✖
Cast Iron	✖	●	✖	✖	✖	✔	✖	✖
Aluminium	✖	✖	✖	✖	✖	✖	✔	●
Zinc	●	✖	✖	✖	✖	✖	●	✔

Key

- ✔ Can be used in contact under all conditions.
- ● Can be used in contact under dry conditions (i.e. cast-in, or within a cavity above d.p.c. level except where the cavity is used for free drainage).
- ✖ Should not be used in contact.



Prevention of
Bi-metallic Corrosion

Surface Finish

The surface finish of stainless steel can vary from a matt descaled finish used for construction fixings to a bright highly polished finish.

Mill Finishes

- Hot rolled, softened and descaled (normally used on thicknesses of 4mm, 5mm, 6mm, 8mm and 10mm)
- Cold rolled
- Cold rolled and lightly rolled on polishing rolls
- Bright annealed

Polished Finishes

- Electropolished
- Satin Finish
- Bead Blast

Products supplied by Leviat will usually be in the hot rolled, softened and pickled mill finish 1D to EN 10088 - 2. If a different finish is required, please contact our Technical Services Team.

Where a surface finish is of primary importance, pre-production samples should be produced and agreed. In some aesthetic or highly corrosive applications a cleaning or maintenance programme may be applicable.

Relevant Standards

The Standards in the adjacent table are relevant to the design of stainless steel construction products.

Standards for Stainless Steel Fixings and Ancillary Building Components

Standard	
AS 2699.1: 2020	Built-in components for masonry construction. Pt 1 Wall Ties
AS 2699.2: 2020	Built-in components for masonry construction. Pt 2 Connectors and accessories
AS 2699.3: 2020	Built-in components for masonry construction. Pt 3 Lintels and shelf angles
AS 3700 - 2018	Masonry structures
AS/NZS 4673: 2001	Cold-formed stainless steel structures
BS EN 845-1: 2003	Specification for ancillary components for masonry. Ties, tension straps, hangers and brackets
BS EN 845-3: 2003	Specification for ancillary components for masonry. Bed joint reinforcement of steel meshwork
BS 5628-1: 2005	Code of practice for the use of masonry. Structural use of unreinforced masonry
BS 5628-2: 2005	Code of practice for the use of masonry. Structural use of reinforced and prestressed masonry
BS 5628-3: 2005	Code of practice for masonry: Materials and components, design and workmanship
BS 8298: 1994	Code of practice for design and installation of natural stone cladding and lining
BS 6744: 2001	Stainless steel bars for the reinforcement of and use in concrete
BS 5977: Part 2: 1983	Specification for ancillary components for masonry. Lintels
BS EN ISO 3506-1: 1998	Mechanical properties of corrosion-resistant stainless steel fasteners. Bolts, screws and studs
BS EN ISO 3506-2: 1998	Mechanical properties of corrosion-resistant stainless steel fasteners. Nuts

The Use of Stainless Steel

Leviat

Leviat has a wealth of experience in working with a range of types and grades of stainless steel. Products are manufactured from wire, coil, plate and bar. Considerable material stocks are maintained in order to meet urgent delivery deadlines.

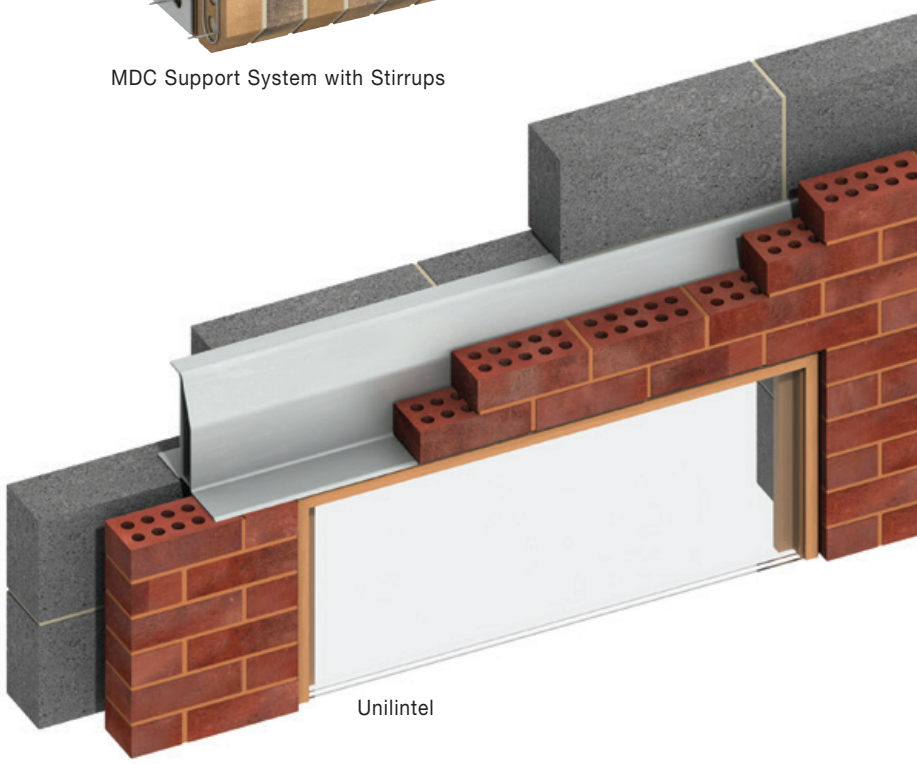
Technical Advice

The use of stainless steel offers many advantages to the specifier. Leviat will advise on the most appropriate and cost-effective solution to suit individual applications.

Masonry Support and Restraint Fixings

Ancon fixings for masonry cladding are usually manufactured from grade 1.4301 (304) stainless steel which is suitable for most building applications. In particularly corrosive environments, or where part of the fixing is exposed, grade 1.4401 (316) should be considered.

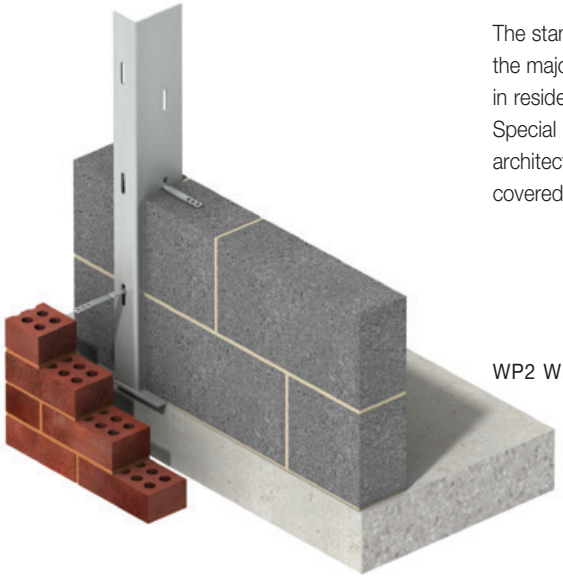
MDC Support System with Stirrups



Unilintel

Structures with brick or stone cladding will usually necessitate the use of stainless steel support for the masonry. Ancon Support Systems are fixed to the structural frame, span the cavity and form a horizontal shelf in the outer leaf. Ancon Windposts span vertically between floors to provide lateral support for large panels of brickwork or panels with openings.

The standard range of Ancon Lintels suits the majority of loading conditions found in residential and commercial buildings. Special lintels can be manufactured to suit architectural features and wall construction not covered by the standard range.



WP2 Windpost

Wall ties and other restraint fixings are an essential element in the stability of masonry panels. Traditionally, wall ties were manufactured from galvanised mild steel. They were expected to last the lifetime of the building, but some corroded after only 15 years. The confirmed integrity of stainless steel means no costly remedial action will be required.

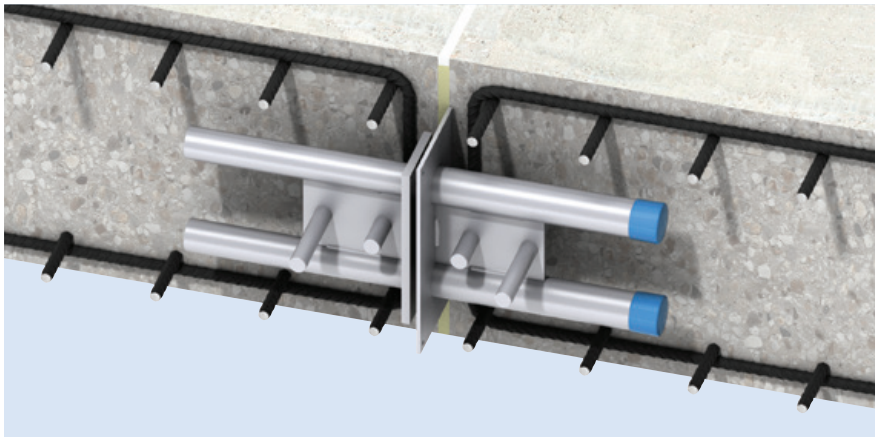
AMD Wall Tie

Ancon Tension Systems
Tension Bar Systems are increasingly being used in structures and buildings as an architectural as well as a structural element. A variety of assemblies can be created from simple tie bars to complex bracing systems involving several bars joined at one point. The Ancon Tension System is available in carbon and stainless steel. The latter is recommended for applications demanding corrosion resistance, a maintenance-free life and where a highly polished finish is required.

Ancon Shear Load Connectors
Ancon Shear Connectors are used to transfer load across movement joints in concrete. Each connector is a two-part assembly comprising a sleeve and a dowel component. The sleeve is nailed to the formwork ensuring subsequent alignment with the dowel. This alignment is essential for effective movement. Dowels are manufactured from duplex stainless steel to ensure a high degree of corrosion resistance with no requirement for additional protection.

Reinforcing Bar
Leviat supplies stainless steel plain and ribbed reinforcing bar direct from stock. Grade 1.4301 (304), grade 1.4436 (316) and, increasingly, duplex grades are readily available.

Tension System



DSD Shear Load Connector

Reinforcing Bar and Tying Wire

Floorplate and Open Grid Flooring
Our stainless steel floorplate and open grid flooring are ideal for environments where corrosion resistance, hygiene, durability and slip resistance are essential. This flooring is suitable for a wide variety of industries including chemical, marine engineering, catering and pharmaceutical. When required, floorplates can be supplied with a polished surface finish.

Special Fabrications
Leviat has the capability to fabricate all Austenitic, Duplex and Super Duplex stainless steels in a plate thickness of up to 30mm. Special fabrications are supplied to industries such as civil and marine engineering, water treatment, petrochemical and food handling.

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