

CORTEN® STEEL

TECHNICAL DATA SHEET

The following information is intended as a brief technical reference guide to CorTen steel.

How CorTen Works

In the presence of water and air, all low alloy steels rust at various rates according to the amount of oxygen present in the atmosphere. With conventional steels, the rust layer becomes non-adherent and detaches from the metal surface – reducing the thickness of the material and consequently the effectiveness of the steel.

With CorTen steel, the process of rusting is initiated in the same way but the alloying elements used, e.g. chrome and copper etc., react to produce a 'patina' or (oxide film) which is much more dense and therefore adheres tightly to the base metal. As the oxidation process develops over time, the 'patina' impedes the access of oxygen and moisture to the metal surface, thus reducing the 'rusting process' considerably, giving increased performance to the steel.

The rapidity with which the steel develops its protective oxide film depends mainly upon the nature of the environment and exposure to the elements. In an industrial atmosphere, the weathering process will be quicker (particularly in the presence of sulphur), and the colour of the 'patina' darker than in a rural atmosphere.

Owing to the warming and drying action of the sun, metal surfaces exposed to the south and west (in the Northern Hemisphere) develop a smoother, more uniform 'patina' than those facing east and north. Higher temperatures permit more rapid conversion/dehydration of the corrosion products, whereas surfaces exposed away from the sun react more slowly; where the 'patina' may exhibit a somewhat granular texture.

Using CorTen Unpainted

CorTen is not a completely maintenance-free material. It should be inspected periodically according to its design and conditions of use to see that all joints and surfaces are performing satisfactorily. If necessary, maintenance is usually by cleaning with compressed air or water hosing to free dust and debris from the structure.

- CorTen has been designed and manufactured to give excellent performance in particular and demanding applications. To obtain optimum performance from CorTen in the unpainted condition, the following points should be noted:
- To provide a sound, uniform surface for the formation of the protective 'patina', all exposed, unpainted CorTen surfaces (including welded areas) must be suitably prepared. Cold reduced and pickled sheets need only be cleaned to remove grease, oil or foreign products.
- Design features that could or will collect or retain water must be avoided such as pockets, crevices etc.
- Since any interruption in the surface can cause the oxide coating to develop unevenly, designers should consider the effect of the system construction, e.g. welding (see section on welding).
- Moisture dripping from the steel, especially during the early years of exposure, will contain soluble iron salts which can stain or streak adjacent materials. This run off is particularly concentrated during the early years of 'patina' formation. This natural process in no way affects the performance of the steel. Designers have used gutters, pipes and dripping rims for the systematic drainage of this natural solution. Materials subject to minimal staining include glass, ceramic tile, glazed brick, porcelain coatings, washable air-drying and thermosetting organic coatings, extruded neoprene, and stainless steels. Materials subject to severe staining are concrete and stucco, galvanized steel, unglazed brick, matte porcelain enamels, stone, and wood.
- Damp debris on CorTen or contact with any materials which may retain moisture will accelerate corrosion.
- Sealants that perform satisfactorily with CorTen are readily available.
- Materials used to mark CorTen for identification purposes should contain non-indelible compounds, or CorTen should be marked in areas that will be hidden after completion. Otherwise, marks will remain visible for many years unless blast cleaned after construction.

Painting and Protection

To prevent 'patina' forming CorTen will require the same paint procedure as for carbon steel. It has been shown that CorTen prevents under-creep at areas of damage or degradation of the paint film. This will be beneficial as the areas of touch-up and repaint will not grow to any great extent, even after a prolonged period of time. Any damaged areas of bare metal will be protected by the subsequent forming of the protective oxide 'patina'.

Find out more or request a sample

Email sales@raaftsystems.com or visit raaftsystems.com



Note: This material has undergone at least 6 months of weathering.

Environmental Considerations

Cor-ten has been extensively used throughout the world where environmental considerations have been of prime importance such as the necessity to blend high strength steel structures with the natural.

- In atmospheres where high concentrations of strong chemical or industrial fumes are present.
- Submerging in water or underground. In both cases, the performance will be the same as with carbon manganese steels.
- Conventional methods of protection such as concrete encasements, cathodic protection or a high quality paint system extended well above the water line and ground level can be used.
- Where the steel would be exposed to high concentrations or chloride ions which would occur from salt-water spray, salt fogs or airborne salts from a coastal environment.
- Salt adversely affects the 'patina' and because of its hygroscopic nature maintains a continuously damp environment on the metal surface.

Weathering

CorTen steel planters naturally weather over time, developing a protective rust-like patina when exposed to the elements. This process typically takes 6–12 months, during which the surface changes from raw steel to a rich, earthy tone. The patina not only enhances the aesthetic with a warm, rustic look but also forms a protective barrier that prevents deeper corrosion, ensuring long-term durability.

Disclaimer: We recommend allowing natural weathering. To accelerate the process, Corten steel can be shot-blasted prior to delivery; however, this option will incur additional costs.

Note: Unless specified then all corten products are supplied unweathered.

Find out more or request a sample

Email sales@raftsystems.com or visit raftsystems.com

Fabrication

Cutting

Flame cutting e.g. oxy-acetylene, oxy-propane or plasma arc cutting can be carried out using the same procedures as with high yield carbon manganese steels of similar CEV and thickness.

To avoid excessive hardening of the flame cut edges, and hence the danger of cracking; processing as a general rule, preheat temperatures similar to those of welding should be used.

Welding

CorTen has been used extensively in welded structures throughout the world. CorTen may be welded with the same facility as ordinary mild steel. However, its greater strength should be considered when selecting a welding procedure. For all welding procedures, appropriate minimum preheat temperatures should be used.

Although welding is straight forward, special procedures may be necessary to give matching weathering properties of the weld when the sheets/plates are to be used in exposed conditions.

In general, single pass welds can be carried out with carbon steel electrodes since there is usually sufficient pick-up of alloying from the parent material to give matching weathering characteristics. If multi-pass weld procedures are to be applied, special electrodes are required.



High Temperature Applications

Although Cor-ten steel was not developed for high temperature applications, subsequent test data has shown that the elevated temperature properties of Cor-ten steel are superior to those of plain carbon structural steels.

Cor-ten A and, to a lesser extent, Cor-ten B have been used successfully in a number of non-critical applications that have not required specific pressure vessel alloy steels such as Cr-Mo.

CorTen A is of a greater interest than Cor-ten B for high temperature applications such as ductwork, chimneys and incinerators. Even in the absence of moisture at temperatures above 400°C, the 'patina' will still form.

At temperatures of about 425°C and higher, Cor-ten A exhibits much better elevated temperature ductility than Cor-ten B. Tension, creep, and creep rupture tests conducted on Cor-ten A steel containing 1% chromium showed that the steel exhibits attractive high temperature properties up to 540°C (1000°F).

Examination of oxidation behaviour shows that there is an improvement by some 50 degrees Celsius in oxidation resistance of Cor -Ten in the 500-700°C range for the same conditions. For example, under conditions which give 1mm/year oxidation loss on carbon or carbo/manganese steels, the temperature to give this loss on Cor-ten would be 50°C higher.

The precise improvement obtained with weather resistant steels is greatly dependent on the heating cycle experienced by the material and upon the environmental conditions prevailing.

Note: Cor-ten is not suitable for use in significant load bearing members above 450°C (approx.).

Find out more or request a sample

Email sales@raftsystems.com or visit raftsystems.com

Steel Corrosion Data

SOIL TYPE	SINGLE SIDED EROSION (mm)				
	INTENDED LIFESPAN				
	5 YEARS	25 YEARS	50 YEARS	75 YEARS	100 YEARS
Dense clean soils	0.00	0.30	0.60	0.90	1.20
Contaminated loose soil	0.15	0.75	1.50	2.25	3.00
Acidic soil	0.20	1.00	1.75	2.50	3.25
Very dense soil (e.g. clay)	0.18	0.70	1.20	1.70	2.20
Aggressive soil	0.50	2.00	3.25	4.50	5.75

Description

The above table displays corrosion data applicable to the Raaft range of steel edgings and planters. The values show the amount of mm that “disappear” over a set number of years (5, 25, 50, 75, 100). These numbers are based on flat standard construction

steel sheet S235, in contact with damp soil on one side. The results for CorTen A steel will be equal or better.

Soil type is a key factor. The more aggressive the soil, the greater the levels of erosion.

Storage and Handling

Upon delivery, unwrap goods immediately to ensure an even finish. Any initial marks or variations that appear will naturally fade over time as the weathering process continues. Standard weathering times apply as noted under Environmental Considerations.

June 2017

Information source: Clusta vzw,
Technologiepark 935,
9052 Zwijnaarde,
+32 9 280 93 41

Find out more or request a sample

Email sales@raaftsyste.ms.com or visit raaftsyste.ms.com