



## Intumescent coatings & Celsius® concrete filled columns

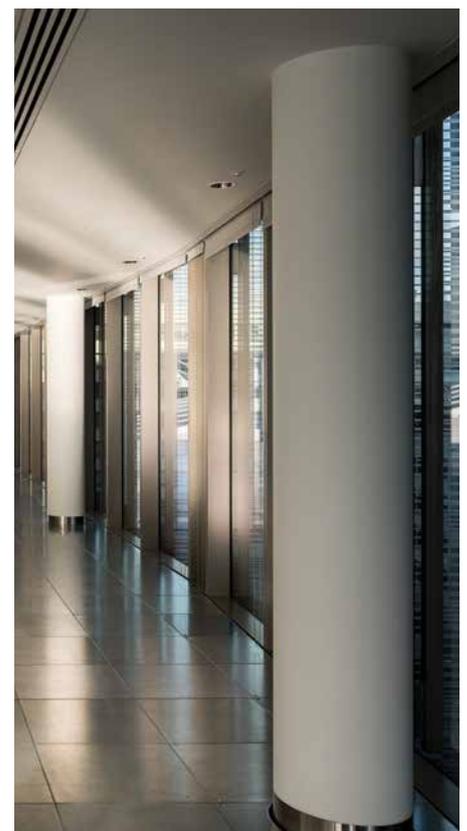
Minimise column size with external fire protection

The intumescent thickness recommendations in this document are derived from a research project undertaken by AkzoNobel.

### Overview

Structural hollow sections are the most efficient of all structural steel sections in resisting compression. Tata Steel Celsius®355NH Celsius®420NH hot finished structural hollow sections have a high strength to weight ratio and produce slender attractive lines that make them a natural choice for building structures. These hollow sections can achieve a constant external dimension for all weights of a given size, which enables them to achieve standardisation of architectural and structural details throughout the full height of the building if required.

By filling hollow sections with concrete and, sometimes, reinforcement a composite section (concrete filled tube or CFT) is produced, which will increase the section's room temperature load carrying capacity, whilst retaining all the advantageous features of the basic unfilled section. ▶



The type of CFT column chosen will depend on the design specification, but the construction process anticipated and the equipment available will also have an important influence. With larger columns (e.g 406mm to 508mm outside diameter), steel reinforcing bars may be easily fitted within the column and this has the added advantage that no external fire protection is then usually necessary for up to 90 minutes fire rating.

If external coatings are acceptable then it is possible, in many cases, to reduce the plan dimension of the column. By using external fire protection on a CFT column, the steel tube maintains strength and stiffness at elevated temperatures. This means that the column dimension is not governed by the internal reinforced concrete core alone carrying load in the fire condition.

For CFT columns, the external fire protection thickness may be significantly reduced compared to that required for the same section tube when unfilled. This is possible because of the heat sink effect of the concrete, which effectively reduces the section factor of the composite column. These reductions have been shown to be particularly substantial where intumescent coatings are the preferred form of external fire protection.

### Types of intumescent

There are three main types of intumescent coatings; solvent-borne, water-borne and epoxy intumescent. Solvent and water-borne coatings are generally considered where aesthetic requirements dictate their use. Typical examples include interior steelwork for airports, stadiums and commercial office buildings. Epoxy intumescent are typically used in more aggressive environments where a high degree of durability is required. Application methodology can often influence product choice. Epoxy coatings are suitable for off-site application as they resist mechanical, abrasion and handling damage better than thin film coatings. Solvent-borne coatings can be applied on or off-site, whereas water-borne coatings are typically applied on-site.

### Testing

AkzoNobel has undertaken an extensive test programme to consider the structural fire design of concrete filled tubes incorporating extensive fire testing of protected and unprotected sections to evaluate optimised design guidance for these types of structural member.



**Table of Interchar intumescent coating thickness and corresponding notes**

Fire Resistance Period	30 minutes	60 minutes	90 minutes	120 minutes
<b>Solvent-borne</b>	0.215 mm Interchar 2060	0.566 mm Interchar 2060	1.346 mm Interchar 2090	2.819 mm Interchar 2090
<b>Water-borne</b>	0.224 mm Interchar 1260	0.311 mm Interchar 1260	1.211 mm Interchar 1190	2.839 mm Interchar 1190
<b>Epoxy</b>	1.220 mm Interchar 212	1.220 mm Interchar 212	2.200 mm Interchar 212	2.950 mm Interchar 212

All dry film thickness are certified by independent testing in accordance with BS 476 Parts 20 and 21. Limiting steel temperature taken as 520°C. For thicknesses at other limiting temperatures, fire resistance periods not shown including those in excess of 120 minutes and details of compatible primers and topcoats, please contact AkzoNobel: Email: [pc.communication@akzonobel.com](mailto:pc.communication@akzonobel.com) Website: [www.international-pc.com](http://www.international-pc.com)

### Comparison of coating an empty tube compared to a protected tube

- Fire resistance period: 90 minutes
- Section: 323.9 x 10 CHS
- Structural stability not demonstrated at 90 minutes, therefore applied protection required
- Product: Interchar 1190 (water-borne for on-site application)
- Unfilled steel tube dry film thickness: 3.195 mm
- Protected concrete filled tube dry film thickness: 1.211 mm
- Approximate saving of 62% in intumescent material and a reduced number of application coats.

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