Use of
Structural Stainless Steel

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Executive summary

Stainless steel has excellent corrosion resistance and is widely used in building construction works in terms of its attractive appearance.

In the context, the commonly used stainless steel grades are identified after consultation with stakeholders in the local industry, and this document has summarized their respective mechanical properties and chemical composition. If other uncommon stainless steel grade is proposed, the RSE should provide detailed information on job basis.

While the welding of stainless steel and other steels are not uncommon, recommendations and relevant updated BS EN reference standards are given in the document.

As there is no British Standard for designing structural stainless steel, reference is made to the recommendations given in the Structural Design of Stainless Steel, SCI publication P291.

This document aims to provide a better understanding on the use of stainless steel.

1 Introduction

As the name implies, stainless steel possesses excellent resistance to corrosion at both normal and elevated temperatures. Chromium is the element that makes stainless steel stainless, or corrosion-resistant. This superior corrosion resistance is accomplished by the addition of chromium to iron (most have low carbon content). Stainless steels are alloy steels with nominal chromium content of at least 11.5%, with or without other alloy additions. The corrosion resistance of the stainless steel generally increases with increasing chromium content. The stainlessness and corrosion resistance of these alloy steels are attributed to the presence of a passive oxide film on the surface, and this oxide film prevents any further oxidation (ordinary rusting, which is the most common kind of corrosion). Addition of elements other than chromium to improve various properties has provided a large range of available mechanical and physical properties. Nickel increases corrosion resistance slightly and greatly improves mechanical and fabricating properties. Small amounts of molybdenum increase resistance to pitting type corrosion and general resistance to certain corrosive media. Carbon increases strength but causes chromium carbide precipitation when exposed to temperatures between 800 - 1600ºF. This depletes the matrix in chromium and reduces the corrosion resistance in local areas leading to intergranular corrosion. Some stainless steels have practically an indefinite life even without cleaning. Stainless steels are also resistant to corrosion at elevated temperatures, which are the result of oxidation,

carburization and sulfidation (deterioration of the surface caused by the action of oxygen, carbon, and sulfur respectively).

2. Classification of stainless steels

Stainless steels are generally identified as Austenitic, Ferritic, Martensitic, and Duplex (an amalgamation of Austenitic and Ferritic). In addition, a number of Precipitation-Hardenable (PH) stainless steels exist, which have martensitic or austenitic microstructure.

The unique properties of the stainless steels are derived from the addition of alloying elements, principally chromium and nickel, to steel. According to their material properties and their microstructures, the first 3 consist of a single phase; the fourth one contains both ferrite and austenite, and the last one embraces martensite and austenite in their microstructures.