

SCOSS – Standing Committee on Structural Safety

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STAINLESS STEEL: A REMINDER OF THE RISK OF FAILURE DUE TO STRESS CORROSION CRACKING IN SWIMMING POOL BUILDINGS

Purpose

This note is intended as a reminder to designers, specifiers, and those who maintain facilities containing stainless steel, that in certain circumstances problems can arise. This is not new; these issues are well established. However there is some concern that not all those involved are fully aware of the need for care to avoid stress corrosion cracking.

Background

Stainless steel provides a wide ranging and vital service to industry, the leisure market and other sectors, stemming from its very specific properties. The characteristics most commonly relied upon are its resistance to corrosion and its appearance. However it also exhibits other benefits such as low susceptibility to bacteriological retention and improved fire resistance and ductility compared to carbon steels.¹

Notwithstanding these attributes, care is required when selecting the specific grade of stainless steel as, in swimming pool environments, stress corrosion can result. This is clearly of vital importance if the use is for structural purposes or if failure might cause harm or damage. This latter category might encompass items not ordinarily thought of as 'structural' eg advertising sign support brackets.

Swimming pool building environments can create very aggressive situations stemming from high temperatures, the number of users and the chemical disinfectants used. The literature makes it clear that stress corrosion cracking may occur under a specific combination of the three following conditions:

- High applied stress levels in the component (arising from applied load or from residual stresses from welding or forming the component)
- Susceptible grades of steel
- Specific aggressive environment

Stress Corrosion Cracking relates only to components in the pool atmosphere and not those fully immersed in the pool water.

¹ Item 2 in the table of references

The Standing Committee on Structural Safety is an independent body supported by the Institutions of Civil and Structural Engineers and the Health & Safety Executive to maintain a continuing review of building and civil engineering matters affecting the safety of structures.

Design Guides and other information

There is no British Standard for the use and design of stainless steel items. The subject is due to be covered as part of the new structural Eurocode suite (BS EN 1993-1-4) but this is not due for publication by BSI until 2006 and there will be a further period before the National Annex appears.

Relevant background advice and design assistance is included in the following:

1	Stress corrosion cracking of stainless steel in swimming pools C L Page & R D Anchor The Structural Engineer Vol 66 No 24 20 December 1988 p416	
2	The structural use of stainless steel A P Mann The Structural Engineer Vol 71 No 4 16 February 1993 p60-69	Also discussion Vol 71 No 7 6 April 1993 p128.
3	Structural design of stainless steel N R Baddoo, B A Burgan P291 Steel Construction Institute 2001	
4	Technical Note: Stainless steel in indoor swimming pool buildings N R Baddoo, C P Cutler The Structural Engineer Vol 82 No 9 4 May 2004 p26	This also provides a bibliography on the subject.
5	Stress Corrosion Cracking of Stainless Steels in Swimming Pools Operational Circular SIM 5/2002/18. Health and Safety Executive	
6	Stainless steel in swimming pool buildings Nickel Institute (previously NiDI) Nickel Development Institute 1995	

Item 4 is particularly relevant in respect of the choice of stainless steel grade and composition in order to avoid the risk of stress corrosion, and supersedes or supplements Item 3 in this respect.

Management

It is important that steps are taken to manage existing swimming pool buildings where stainless steel has been used. This may require on-site surveys and a review of the original design specification to establish whether the three 'trigger' points outlined above are relevant. Buildings erected since 1995 should have information within the health and safety file.

New Facilities

It is also important to ensure that new facilities are designed to take into account current state of knowledge, and that adequate information is provided in the health and safety file for those who maintain the facility.

Current Initiatives

A seminar was held in September 2005, sponsored by the British Stainless Steel Association to review the current state of knowledge and appropriate actions.

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