



CONDITIONS OF APPROVAL OF STAINLESS STEEL [FOR PRODUCTS IN CONTACT WITH DRINKING WATER IN PUBLIC SUPPLY]

1. Background to the Approval of Stainless Steel

The impact of changes to the regulations affecting products in contact with drinking water is illustrated by the case of stainless steel.

Stainless steel products had already been in use by water companies in regulated applications prior to July 1989. They were therefore exempt from the need to apply for approval on the grounds of traditional use under the concession contained in Regulation 25(1)c. However, notice was given in 1997 that concessions under 25(1)c would be withdrawn, and consequently from October 2000 no new work could be contracted using stainless steel products without prior approval under Regulation 25(1)a.

Unfortunately, the stainless steel industry was caught unawares. This was largely due to misunderstanding over terminology. The letter from the Secretary of State advising of the withdrawal of the concession under Regulation 25(1)c referred to “linings” and to “products”. One of the major benefits of stainless steel is that it does not require lining. The addition of >10.5% chromium to basic steel creates a passive layer of chromium oxide, which constitutes its “stainless” character. It is integral to the material and is therefore not a lining. The natural inference for those within the stainless industry was that the regulations did not apply. The requirement to approve individual stainless steel products, rather than stainless steel as a material, was also a new concept to the industry.

As a result, it was only when projects specifying stainless steel began to be questioned by engineers and contractors from October 2000 that the industry began to wake up to the fact that action was necessary. Urgent discussions were held with DWI and the British Stainless Steel Association [BSSA], in conjunction with the Nickel Development Institute [NiDI], the Steel Construction Institute [SCI] and AvestaPolarit - the major domestic producer of stainless steel, undertook the task of applying for approval of stainless steel under Regulation 25(1)a.

The process included two main tasks: *firstly*, the creation of a set of Operational Guidelines and a Code of Practice [OGCP], and *secondly*, material tests to satisfy leaching limits for specified stainless steel grades under a range of water conditions. The process took approximately 12 months to complete and approval was granted by DWI’s Committee on Products and

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Processes in December 2001. This approval may be found in *Regulation 25 Letter 7/2001*, dated 18 December 2001, which may be downloaded from the DWI web site at www.dwi.gov.uk/cpp/index.htm

Despite the hiatus caused by the withdrawal of approval for stainless steel products for a period of time, the outcome has been beneficial in both these aspects.

1. Operational Guidelines, Code of Practice and Table of Approved Grades

The working group, which was set up under the auspices of BSSA, had the benefit of previous work carried out by SCI, in conjunction with the Water Research Council and other parties, which was contained in two publications:

- *Applications for stainless steel in the water industry*
Water Industry Information and Guidance Note No. 4-25-02
The Steel Construction Institute, 1999
(available from the Water Research Council)
- *Steel Package Water and Waste Water Treatment Units*
SCI Publication P254
The Steel Construction Institute, 2000

Building on these foundations, SCI acted as consultants for the development of a specific set of Operational Guidelines and a Code of Practice for stainless steel products in contact with drinking water. The *Code of Practice* identifies all the key requirements with regard to the use of stainless steel materials and products and provides the framework for contract document specifications. The *Operational Guidelines* describe stainless steel materials and products in more detail and provide information on essential application, quality assurance and remedial action. Legal requirements under Regulation 25/31 are defined by use of the imperative term *shall*; recommendations and suggestions are identified by the informative “should” or “may” etc.

The purpose of the OGCP is summed up in the Introduction:

To enable plant designers, installers and operators to identify the key requirements in selecting the appropriate grade of stainless steel for equipment used for drinking water treatment and supply and also in their design, fabrication and installation

It goes on to say that:

The method of working specified ... will minimise any risk of contamination of the water supply by the application and return to service of products using stainless steel materials

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For those perhaps not familiar with stainless steel, it is worth highlighting one or two key points under each of these objectives:

- Material Selection

There are several families of stainless steel and it is important for designers and specifiers to select the most appropriate family and grade for the application. The grades most commonly used in the water industry belong to the nickel containing austenitic family and are 1.4301 (304) and 1.4401/4436 (316), the latter containing molybdenum for added corrosion resistance. Duplex or super austenitic grades can be used in more demanding environments

Selection depends both on the environment – 316 is recommended for a coastal environment – and the operating conditions, in particular the chloride level in ppm. At temperatures normally encountered in drinking water treatment and supply, 1.4301 (304) is recommended for chloride levels up to 200 ppm and 1.4401/4436 (316) for levels up to 1000 ppm

In addition to recommending appropriate grade selection, the OGCP identifies the major international specification standards applicable to stainless steel materials and pipework systems.

- Design

Correct material selection is, of course, a key component of design. The OGCP also provides guidance on designing systems, which optimise the properties of stainless steel, while avoiding potential problems. In particular, this means taking advantage of the high strength to weight ratio of the material, combined with excellent corrosion-erosion properties, allowing thinner walled sections to be used. As with all materials, the understanding of a few simple rules - the avoidance of crevices by good design, for example - goes a long way to ensuring that performance matches expectations, both in terms of service and component/system life.

- Fabrication

Good fabrication practice follows naturally from good design. Stainless steel can be cut, formed, joined and welded as easily as carbon steel. However, it is stronger than most carbon steels and the welding parameters differ. Special attention should be given to welding procedures and to ensuring that welds are cleaned of heat tint,

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which identifies a superficial area where corrosion resistance has been weakened by the welding process.

- Installation, Maintenance & Inspection

It is important to avoid contamination of stainless steel by carbon steel, which will rust and damage the surface. It is therefore recommended to carry out as much work as possible before taking the component on site, where controls are more difficult. Stainless steels require little maintenance, but problems can occur if dirt is allowed to build up, especially in crevices and where chlorine is present. Systems should therefore be thoroughly drained immediately after testing.

Following the procedures recommended in the OGCP will ensure that the primary objectives of the legislation are met, to avoid contamination of the water supply and ensure that delivery systems and treatment plant meet their service requirements and design life.

Copies of the OGCP may be downloaded from the Water Industry section under Publications at the BSSA web site www.bssa.org.uk/fpauth/services/pubs.htm

A final comment is necessary on the Table of Approved Grades, which is provided as an Annex to *Regulation 25 Letter 7/2001*. The Table identifies the three main types of stainless steel, which were submitted to the test programme, which formed part of the approval process. The tests were carried out to BS7766:2001, as modified by DWI, for the assessment of the potential for metallic materials to affect adversely the quality of water intended for human consumption. The concentrations of all the relevant components in the final extracts – specifically those of chromium and nickel – were found to be less than the maximum admissible.

The tests covered the main types of stainless steel used in the treatment and supply of drinking water – 1.4301 (304L), 1.4401/4436 (316L) and the duplex grade 1.4462 (2205). The Table identifies grades of similar composition, which have been accepted as falling within the parameters of the tests, together with the most common international specifications. Grades and specifications not included should be checked with DWI before specification or use.

2. The Approval Process for Stainless Steel

We have noted already that the Regulations were defined to approve ‘products’ rather than ‘materials’. The OGCP and the Table of Approved Grades provides the connection between stainless steel as a material and products made from stainless steel.

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Companies are required to seek approval from DWI under their own specific name or identifier for the stainless steel products they wish to supply for use by the water industry. However, products which conform to the approved grades and specifications and are supplied in accordance with the OGCP will pass through what is in effect an accelerated procedure. The procedure is to complete the special application form *Application Form for Metallic Construction Products (to be used for applications for the approval of metallic products with links to the generic testing and OGCP for the metal)*. The Form, together with guidance on the approval process, can be downloaded from the DWI web site or obtained by contacting DWI directly.

It is important to emphasise which products **do not** require approval:

- *Firstly*, the regulations only apply to those products actually in contact with drinking water. There are a number of applications for stainless steel, both in water supply and waste water treatment, which do not require approval
- *Secondly*, the regulations apply only to the public supply system, from extraction to the stop cock in the road. There has been a growing use of stainless steel for domestic pipes and tanks in recent years, as easy-to-use fittings and connectors become more readily available. While DWI approval is an endorsement for such applications, it is not a requirement for use.
- *Thirdly*, products which would otherwise be covered by the regulations, but are deemed to have a sufficiently small surface area in contact with drinking water as to have no adverse effect on the quality, fall within the scope of Regulation 25(1)b and are exempt from the need for approval. These include such items as valves, pipe fittings, including couplings and gaskets, ladders and pumping installations.

So far (April 2002), two companies are registered as having been granted approval for their stainless steel products, namely:

- *AvestaPolarit* for Avesta Polarit stainless steel pipes of 12mm bore or greater
- *Lancashire Fittings* for Lancashire Fittings pipes and tubes

An updated (December 2002) list of companies listed in the approvals register is provided in the appendix.

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4 Opportunities and Applications for Stainless Steel

In the presentation so far, I have covered the background to, framework for, and approval procedures for stainless steel products in contact with drinking water. I would like to conclude by offering some of the reasons why stainless steel is of growing importance to the water industry, and provide one or two examples of applications, in which it is found.

Greater importance is being given to material selection in the water industry, in order to provide:

- Ease of installation
- Reduced maintenance
- Durability
- Recyclability
- Personal and environmental health

Against these criteria stainless steel performs to advantage and can provide significant life cycle cost savings compared with more traditional materials.

Stainless steel provides a material with extremely low corrosion rates in the handling of a very wide range of waters and water flows. Stainless steel systems, correctly specified, fabricated and installed, require no corrosion allowance or coatings, and can be designed using thinner walls than for more traditional materials due to their excellent corrosion-erosion characteristics, allowing for easier installation.

While initial costs may be higher for stainless steels than for coated or galvanised steels, the difference can be minimised by designing to take advantage of the material properties. Life cycle costs can then be calculated, taking into account the reduced cost of maintenance and superior durability, which stainless steel offers.

Stainless steel is also fully recyclable. Approximately 80% of every new tonne of stainless steel consists of re-melted scrap steel and the limits are defined by availability rather than technology.

Stainless steels of the type normally used in the water industry can be easily formed into a wide variety of shapes and sizes by bending, pressing, cutting or drawing. The variety of application therefore extends well beyond piping systems. They can broadly be classified as:

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- Products in direct contact with water, such as well linings and filters, slide gates, weirs and overflows; screens, scrapers and fasteners; tanks and reservoir linings
- Supporting infrastructure such as platforms, bridges, ladders, railings and manhole covers
- Mechanical equipments, such as pumps, valves and generators
- Chemical treatment lines

Last but not least, stainless steel is excellent in terms of personal and environmental health. The passive chromium-oxide layer, to which we have referred earlier, is both highly stable and self-healing. The safety of stainless steel to human health is well documented in the context of catering, food and drink. The tests for water contamination, which formed part of the Regulation 25(1)a approval process, endorse the conclusion of the DWI Committee on Products and Processes that "... the use of products made from stainless steel grades in contact with drinking water for public supply would be unobjectionable on health grounds".

5. Summary

In summary, the process of approval for stainless steel, which was completed in December 2001, included three main aspects:

- The development of Operational Guidelines and a Code of Practice, to cover procedures for material selection, design, fabrication, installation, inspection and maintenance of stainless steels in water industry applications
- Testing of stainless steel pipes in different water conditions to ensure that leaching of primary metals is within safe limits
- Provision of a Table of Grades and Specifications, which are deemed to meet the approval process

Approval for stainless steel products covered by Regulation 25 may be obtained by completing the special application form *Application Form for Metallic Construction Products (to be used for applications for the approval of metallic products with links to the generic testing and OGCP for the metal)*.

The opportunities for stainless steel in the water industry are growing as the benefits of the material are increasingly recognised in terms of superior performance, life cycle costs and safety in regard to personal and environmental health.

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APPENDIX

The following companies with readily identifiable stainless steel products were listed in the December 2002 Approvals Register (*denotes a BSSA member company):

1.H Stainless Steel Pipes

ABC Stainless Ltd*
Q Pipe System

AJ Engineering & Construction Services Ltd
AJE Stainless Steel Pipe

AvestaPolarit Ltd*
AvestaPolarit Stainless Steel Pipes of 12mm or greater

JK Fabrications Ltd
JFK 306 and 316 Stainless Steel Pipelines

Lancashire Fittings Ltd*
Lancashire Fittings Stainless Steel Tube
Lancashire Fittings Stainless Steel Pipe

Stainless Metric Stock Ltd*
Stainless Metric Stock – SMS 100

Staptina Engineering Services Ltd
Staptina 316L Pipework

2.A Tanks

ABC Stainless Ltd*
ABC Storage, process tanks and vessels

AJ Engineering & Construction Services Ltd
AJE Stainless Steel Tank

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2.C Pressure Vessels

Compressor & Power Engineers Ltd
CPE Pressure Vessels – 304 Stainless Steel
CPE Pressure Vessels – 316 Stainless Steel

Quantum Engineering Developments Ltd
Quantum Pressure Vessels – 304
Quantum Pressure Vessels - 316

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