

BS 9593:2024



BSI Standards Publication

Assessment for the performance of chemical inhibitors for use in domestic central heating and cooling water systems – Test method

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Contents

	Page
Foreword	III
Introduction	1
1 Scope	2
2 Normative references	2
3 Terms and definitions	2
4 General requirements of an inhibitor	3
5 Metal corrosion rate determination	3
5.1 General	3
5.2 Materials and reagents	3
<i>Table 1 — Composition of test water</i>	3
5.3 Apparatus	3
<i>Figure 1 — Diagram of corrosion test glassware assembly</i>	4
5.4 Sampling and preparation of test specimens	5
<i>Table 2 — Test coupons for corrosion testing</i>	5
5.5 Procedure	6
<i>Table 3 — Test parameters for corrosion tests</i>	6
5.6 Cleaning and evaluation of coupons	7
5.7 Expression of results	8
<i>Table 4 — Factor K values for each type of metal test coupon</i>	8
5.8 Pass criterion	9
<i>Table 5 — Maximum corrosion rates for metal coupons</i>	9
6 Scaling tendency test	9
6.1 General	9
6.2 Materials and reagents	9
6.3 Apparatus	10
<i>Figure 2 — Scaling test glassware assembly</i>	11
<i>Figure 3 — Diagram of stainless steel heater sheath</i>	12
<i>Figure 4 — Diagram of heater sheath assembly</i>	13
6.4 Procedure	14
6.5 Expression of results	15
<i>Table 6 — Scaling tendency test</i>	16
<i>Table 7 — Scaling tendency test: example pass</i>	16
<i>Table 8 — Scaling tendency test: example fail</i>	16
6.6 Pass criteria	17
6.7 Calcium balance	17
7 Compatibility with non-metallic materials	17
7.1 Principle	17
7.2 Materials and reagents	17
<i>Table 9 — Non-metallics to be tested by immersion</i>	17
7.3 Procedure	17
7.4 Expression of results	18

7.5	Pass criteria	18
	Table 10 — Percentage change in volume from original (Example 1)	18
	Table 11 — Percentage change in volume from original (Example 2)	19
7.6	Visual inspection	19
Annex A	(informative) Inhibitor evaluation test report template	20
	Bibliography	24

Summary of pages

This document comprises a front cover, an inside front cover, pages I to IV, pages 1 to 24, and a back cover.

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 November 2024. It was prepared by Technical Committee CII/62, *Treatment of water for boilers*. A list of organizations represented on this committee can be obtained on request to the committee manager.

Relationship with other publications

This British Standard is intended to be read in conjunction with [BS 7593](#). The test methodology contained within this British Standard was developed primarily to confirm the suitability of corrosion and scale inhibitors for heating and cooling water systems.

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Presentational conventions

The provisions of this document are presented in roman (i.e. upright) type. Its methods are expressed as a set of instructions, a description, or in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the *Shorter Oxford English Dictionary* is used (e.g. “organization” rather than “organisation”).

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Introduction

The UK Government has recognized that heating homes is a major contributor to CO₂ emissions in the UK. Following on from the review of Approved Document L [1] of the Building Regulations, an ambitious target of 78% reduction in emissions by 2035 was set.

Low carbon, low temperature water heating systems are a major part of that strategy. It is more important than ever to make sure these finer-tuned systems are kept operating at peak efficiency, which led to the development of BS 7593 as the standard for domestic heating system water maintenance.

BS 9593 has now been developed to provide a method of testing the recommendations for chemical inhibitors that are given in BS 7593. Inhibitors that meet this test method can be considered to provide the system protection recommended by BS 7593.

The performance of the chemical inhibitor is evaluated in three stages:

- a) a short-term laboratory evaluation, performed in conventional glassware, to determine the corrosion rate and pitting of standard metal coupons in inhibitor solutions at the manufacturer's recommended strength;
- b) a short-term laboratory evaluation, performed in conventional glassware, to determine the tendency of the inhibited solution to form scale; and
- c) an evaluation of the effect of the inhibitor on non-metallic materials.

The metals used in the tests are representative of the range of alloys found within domestic central heating and cooling water systems. Consideration has been given to those metals found within modern condensing boilers. The metals are in the form of standard coupons, which are prepared by and obtained from a specialist supplier.

Clause 5 describes the procedure for determining the general corrosion rates and propensity for pitting of mild steel, copper, extruded aluminium, brass and stainless steel under a variety of conditions in a glassware test. General corrosion rates and pitting density are determined at the manufacturer's recommended inhibitor concentration in both a standard hard and a standard soft water. Absolute corrosion rates are determined using mass-loss from coupons in the uncoupled condition.

Clause 6 describes the procedure for determining the extent of scaling on stainless steel heat exchanger surfaces in a glassware test at the manufacturer's recommended inhibitor concentration in the standard hard water.

Clause 7 describes a test for determining the compatibility of inhibitors with commonly used non-metallic materials. Accelerated testing is undertaken in laboratory glassware tests at double the manufacturer's recommended strength in the standard soft water.

Standard hard and soft waters are used throughout this British Standard to enable consistency of results.

This British Standard provides a method of testing to verify that the inhibitor:

- 1) when used in accordance with the manufacturer's recommendations, inhibits the corrosion of metals specific to modern condensing boilers and other system components under controlled laboratory conditions;
- 2) inhibits the formation of scale under controlled laboratory conditions; and
- 3) is compatible with, and does not adversely affect, the properties of commonly used non-metallic component materials of central heating and cooling water systems under controlled laboratory conditions.

Annex A provides a test report template which can be used to record the results of the testing detailed within this British Standard.

1 Scope

This British Standard describes a method of test for the assessment of performance of chemical inhibitors for corrosion and scale inhibition and compatibility with non-metallic components in domestic central heating and cooling water systems.

NOTE 1 [BS 7593](#) gives recommendations for the preparation, commissioning and maintenance of domestic central heating and cooling water systems.

This British Standard does not apply to commercial or municipal premises or to multiple residential premises served by one common circuit, unless that common circuit can be effectively cleaned and flushed with domestic equipment. It does apply to individual heating and cooling circuits within individual dwellings in multiple residential premises.

NOTE 2 The temperatures used within this British Standard relate to the temperatures experienced in traditional UK domestic heating systems which utilize boilers. While many systems operate at lower temperatures, testing at the highest expected temperature verifies the universal suitability, quality and longevity of the inhibitors being tested.

NOTE 3 For specialized closed circuits, such as those containing solar thermal panels and ground source heat pump loops, the manufacturer's instructions can be referred to. See also [BS 5918](#) (for solar thermal) and [MIS 3005-1](#) [2] (for ground source heat pumps).

NOTE 4 For larger closed heating systems such as found in commercial or municipal premises, or the primary systems on residential developments, see [BSRIA BG 29](#) [3] and [BSRIA BG 50](#) [4].

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions, or limits the application, of this document¹⁾. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[BS EN 755-2:2016](#), Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 2: Mechanical properties

[BS EN 1652:1998](#), Copper and copper alloys – Plate, sheet, strip and circles for general purposes

[BS EN 10088-1:2023](#), Stainless steels – Part 1: List of stainless steels

[BS EN 10130:2006](#), Cold rolled low carbon steel flat products for cold forming – Technical delivery conditions

[BS ISO 2230](#), Rubber products – Guidelines for storage

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 domestic central cooling water system

configuration of interconnected components that uses the distribution of water below ambient temperature to provide space cooling to buildings, or parts thereof

3.2 domestic central heating water system

configuration of interconnected components that uses water as a heat transfer medium to distribute centrally generated heat to heat emitters for the space heating of buildings, or parts thereof

NOTE Examples include heat pumps, heat interface units (HIU), hybrid systems.

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

3.3 forced aeration

air, of a composition (21 ±0.5)% oxygen and balance nitrogen, sparged through solution at a rate of (100 ±10) ml per min

3.4 non-forced aeration

solution open to the air via an air condenser, but additional air is not sparged through the system

4 General requirements of an inhibitor

An inhibitor shall:

- a) inhibit the corrosion of metals typically found within domestic central heating and cooling water systems;
- b) not damage any rubber components typically found within domestic central heating and cooling water systems; and
- c) inhibit scale formation.

NOTE Building regulations focus on maximizing energy efficiency in the home. Prevention of scale within a domestic central heating and cooling water system is an important element in enabling the energy efficiency of the system to be maintained, and consequently the ability of an inhibitor to also prevent scale formation is important.

5 Metal corrosion rate determination

5.1 General

The test shall be undertaken at a laboratory ambient temperature of (20 ±5) °C.

5.2 Materials and reagents

- 5.2.1 *Standard hard and soft waters*, based on bottled, still mineral water and conforming to [Table 1](#). Analytical grade sodium chloride and anhydrous sodium sulphate (both previously dried at (105 ±5) °C) can be added to achieve the desired composition.

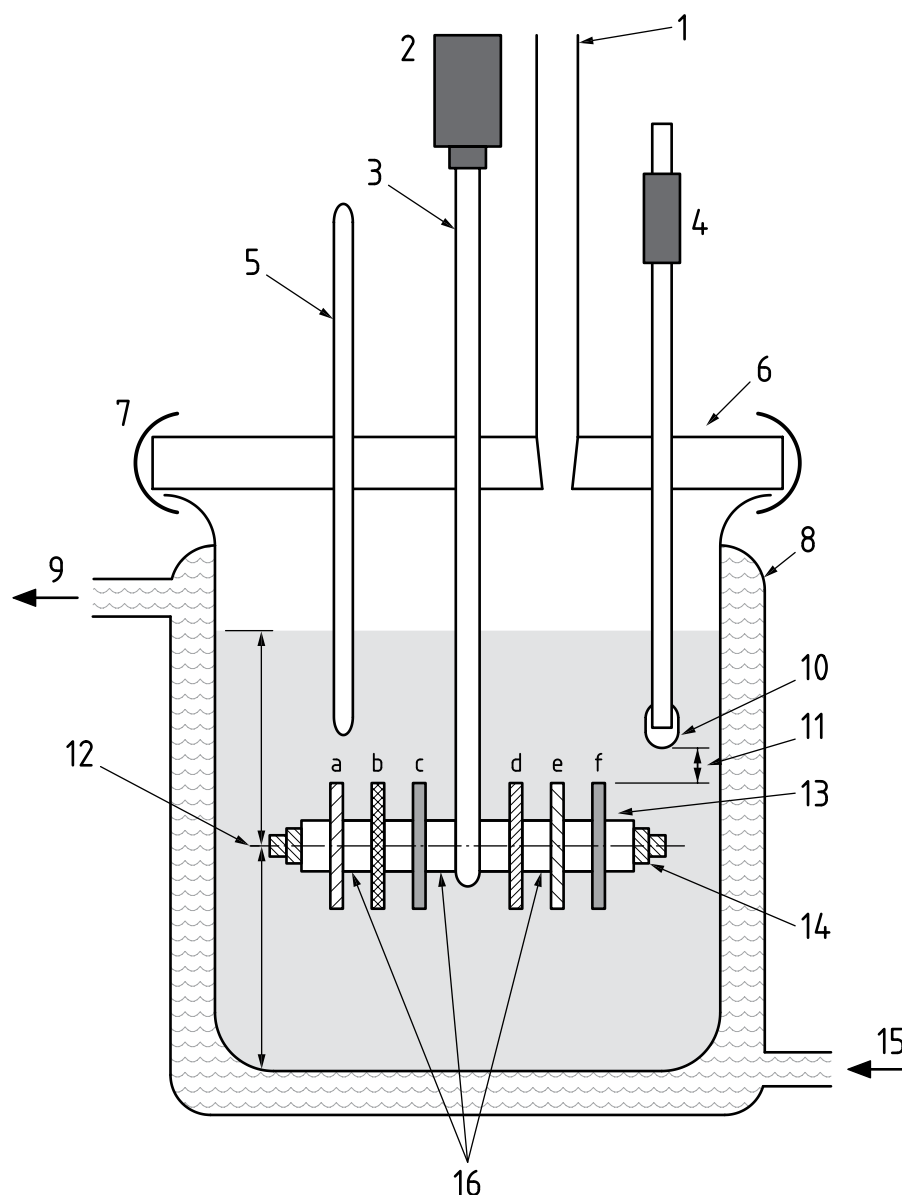
Table 1 — Composition of test water

Parameter	Standard hard water	Standard soft water
Total hardness (mg l ⁻¹ CaCO ₃)	310 ±20	50 ±10
Carbonate hardness (mg l ⁻¹ CaCO ₃)	290 ±20	20 ±10
Chloride (mg l ⁻¹)	60 ±10	60 ±10
Sulphate (mg l ⁻¹)	60 ±10	15 ±5

- 5.2.2 *Test solutions*, prepared by diluting or dissolving the product to achieve the manufacturer’s recommended solution strength in the standard hard water and in the standard soft water. If the product comprises more than one component, these components shall be mixed or dissolved in accordance with the manufacturer’s instructions. Test solutions shall be prepared immediately before use.

5.3 Apparatus

- 5.3.1 *Glassware assembly*, see [Figure 1](#).

Figure 1 — Diagram of corrosion test glassware assembly**Key**

- | | | | |
|----|---|----|--|
| 1 | Air condenser | 12 | Coupon bundle halfway between bottom of flask and surface of solution ± 5 mm |
| 2 | Stirrer motor | 13 | Coupon bundle on rotating spindle |
| 3 | Rotating spindle (200 ± 10) r/min | 14 | Retaining nut |
| 4 | Gas flowmeter | 15 | Water inlet |
| 5 | Thermometer (optional) | 16 | 8 PTFE spacers 6 mm wide with 11 mm OD |
| 6 | Multi-socketed flanged lid | a | Mild steel |
| 7 | Spring cell clamp | b | Brass |
| 8 | Flanged 1 l jacketed corrosion cell | c | Stainless steel |
| 9 | Water outlet | d | Mild steel |
| 10 | Gas sparger | e | Copper |
| 11 | 5 mm to 10 mm | f | Aluminium |