Pre-commission Cleaning of Pipework Systems

By Reginald Brown and Chris Parsloe

Revised and updated for 2012

BG 29/2012
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Additional input was received from the drafting group for BS 8552[1]. A list of contributors to the previous versions is included in Appendix E.

It is not intended that contracts or specifications refer to the guide in its entirety, rather that direct references are made to specific sections to suit the particular circumstances.

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Every opportunity has been taken to incorporate the views of the contributors, but final editorial control of this document rested with BSRIA.

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System contaminants such as mill scale, jointing compound and building debris will inevitably be found in newly-fabricated heating and cooling pipework systems. If allowed to remain in the system in sufficient quality, these contaminants will make the system prone to blockage at strainers, control valves and small bore heat exchangers. They may also initiate further corrosion and encourage the growth of micro-organisms.

**AG 8/91**
The subject of cleaning pipework systems to remove these contaminants prior to commissioning was first addressed in the 1991 BSRIA Application Guide AG 8/91: Pre-Commissioning Cleaning of Water Systems. Many of the recommendations in this guide were considered unconventional at the time. However, in the intervening years, experience has shown that systems that are designed and cleaned following this guidance are far less likely to suffer operating problems. The importance of pre-commission cleaning has also increased as modern heating and cooling systems move towards energy efficient control strategies that result in low flow rates in terminal units with consequently very small orifices in control valves.

**AG 1/2001**
In 2001, the first revision to AG 8/91 was launched as BSRIA Application Guide AG 1/2001: Pre-Commission Cleaning of Pipework Systems. This guide was intended as a direct replacement for AG 8/91. The preceding recommendations were revised in order to take on board feedback received since 1991, but also to address the growing incidence of bacteria-related problems being reported, particularly *Pseudomonas*-related problems. For reasons not fully understood, such problems had become more common during the 1990s. AG 1/2001 therefore contained more information on precautionary measures to avoid or address bacteria in systems.

**AG 1/2001.1**
The guide was updated in 2004. At this time it was recognised that there was a serious contamination risk when new pipework sections were connected to existing systems (such as in shell and core situations). It was decided that additional guidance was required to address these particular situations. BSRIA AG 1/2001.1 therefore contains all of the recommendations provided in AG 1/2001, but also has a completely new stand-alone section which deals with the issues raised when connecting new pipework to existing pipework.

**BG 29/2011**
This version of the guide incorporated industry feedback from nearly twenty years of flushing and cleaning using the guide. In particular it aimed to clarify the roles and responsibilities of the parties, improve the exchange of information between them and provide consistency between service offerings of the pre-commission cleaning contractors.
PREFACE

BG 29/2012

The purpose of the 2012 update is to reflect new British and European standards, correct some minor errors in the 2011 edition, and to clarify certain points that have been raised in the past year. Changes are as follows:

- Figure 2: Amended to clarify location of fill point
- Table 5: Terminology for parameters made consistent with table 4
- Table 6: Pseudomonad guideline for practical completion changed from 10,000 cfu/ml to 10,000 cfu/100 ml (a corrigenda to this effect was issued in October 2011)
- Section 4.1.5: Reference to HVCA COSHH manuals removed
- Section 5.1.1 and table 9: Amended to include internal pipe diameters and revised flushing flow rates
- Figures 10, 11, 12, 13, 15 and 16: The flushing supply valve has been numbered "valve 0"
- Section 5.2.3: Steps 5 and 10 of the example procedure revised to remove reference to temporary flushing pumps
- Section 5.2.4: Steps 6 and 7 of the example procedure revised to remove reference to temporary flushing pumps
- Figures 13, 15 & 16: Path of water flow corrected
- Figure 18: Changed to two separate schematics showing path of water flow during first and second stage of flush
- Appendix C site analysis record sheets: Terminology for parameters made consistent with table 4

Reginald Brown
2012
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<th>Description</th>
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<tbody>
<tr>
<td>IV</td>
<td>Isolating valve</td>
</tr>
<tr>
<td>DRV</td>
<td>Double regulating valve</td>
</tr>
<tr>
<td>OP</td>
<td>Orifice plate</td>
</tr>
<tr>
<td>TP</td>
<td>Test point</td>
</tr>
<tr>
<td>STR</td>
<td>Strainer</td>
</tr>
<tr>
<td>MV</td>
<td>Motorised four-port valve</td>
</tr>
<tr>
<td>MV</td>
<td>Motorised three-port valve</td>
</tr>
<tr>
<td>MV</td>
<td>Motorised two-port valve</td>
</tr>
<tr>
<td>DRV</td>
<td>Drain off cock with hose connection</td>
</tr>
<tr>
<td>P</td>
<td>Pressure gauge</td>
</tr>
<tr>
<td>T</td>
<td>Temperature gauge</td>
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<tr>
<td>NRV</td>
<td>Non-return valve</td>
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<tr>
<td>SV</td>
<td>Safety valve</td>
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<tr>
<td>PICV</td>
<td>Pressure independent control valve</td>
</tr>
<tr>
<td>F</td>
<td>Fan coil unit</td>
</tr>
<tr>
<td>M</td>
<td>Water meter</td>
</tr>
<tr>
<td>AAV</td>
<td>Automatic air vent</td>
</tr>
<tr>
<td>MAV</td>
<td>Manual air vent</td>
</tr>
<tr>
<td>FC</td>
<td>Flexible coupling</td>
</tr>
<tr>
<td>FC</td>
<td>Flexible hose</td>
</tr>
<tr>
<td>M</td>
<td>Gas-fired boiler</td>
</tr>
<tr>
<td>MAV</td>
<td>Manual air vent</td>
</tr>
<tr>
<td>LSV</td>
<td>Lockshield valve</td>
</tr>
<tr>
<td>FP</td>
<td>Fill point</td>
</tr>
<tr>
<td>CFR</td>
<td>Constant flow valve</td>
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INTRODUCTION

Pre-commission cleaning, as it is applied to heating, cooling and other closed pipework systems, is the process of bringing the system to a satisfactory state for commissioning and on-going maintenance of water quality. This means that:

1. The system water should be free of construction debris, dirt and excessive particulate matter
2. Internal surfaces should be free of millscale and appropriately treated to minimise on-going corrosion
3. Pipework, fittings and terminal units should be free from settled solids that could increase the risk of corrosion
4. Residual levels of suspended solids should be low enough not to cause difficulties with commissioning or significant accumulation in low flow areas
5. Biofilm formation should be minimised by appropriate use of biocides and those bacteria associated with microbiologically induced corrosion should be controlled.

This guide is not concerned with the cleaning of domestic hot and cold water services systems in buildings.

Pre-commission cleaning is achieved through a process of flushing and chemical cleaning (where required) followed by the addition of biocides and inhibitors. Since it is not possible to directly examine all the internal surfaces of the system, the success of pre-commission cleaning is inferred from water samples that are analysed for a range of parameters including, but not limited to, suspended solids, iron and bacteria.

These activities should be carried out by trained and experienced operatives working within a management framework that ensures safe and effective working practices and appropriate record keeping at each stage of the process with clear lines of communication to the designer and other parties involved in the project.

The success of pre-commission cleaning and avoidance of subsequent problems will depend on the design and prior history of the system:

- the designer should aim to ensure that the system is amenable to cleaning, and remaining clean, and that appropriate features (such as flushing bypasses and drain points) are included to make this possible. These issues are discussed in Section 2
- manufacturing, storage and assembly methods should aim to minimise residues and the ingress of contamination
- water supplied to the system for pressure testing should be of sufficient quality and suitable measures should be applied to avoid the build-up of corrosion and bacteriological problems prior to pre-commission cleaning. The sequence of system monitoring from initial filling to practical completion is described in section 3.
The processes of pre-commission cleaning are discussed in Sections 4, 5 and 6. The particular issues associated with connecting new and existing systems are discussed in Section 7.

Even where the pre-commission cleaning activity is completely successful it is still possible for the system to deteriorate between conclusion of the clean and practical completion unless the system is properly treated and closely monitored and managed. Recommendations are given in Section 3.2.

This guide is intended to be used in conjunction with BS 8552[1] which describes the requirements for sampling water from buildings. This includes sampling methodology, the selection of locations and frequency of sampling, transport and analysis of samples and interpretation of results according to the guidelines included in this guide.

It is emphasised that the guidelines on water quality contained in this guide relate to pre-commission cleaning activity for new heating and chilled water systems. They are guidelines and are intended to demonstrate that the system has been adequately cleaned and that water quality is under control. The results of water quality analysis should always be subject to interpretation by the appointed cleaning or water treatment specialists in the context of the project and water treatment regime.

A new guide, currently being prepared by a joint working group of the Water management Society (WMS), British Association of Chemical Specialists (BACS), Commissioning Specialists Association (CSA), Institute of Corrosion (ICorr) and BSRIA will provide guidance on reducing corrosion risk and the long term maintenance of water quality after practical completion. That guide is expected to be published in 2013.

Throughout this publication, various legislation is referred to. Only legislation currently applicable in England is stated. In some cases, different legislation applies in different parts of the UK. The full text of all UK legislation can be found at www.legislation.gov.uk Further information can be found in the BSRIA Legislation and Compliance Resource, which can be accessed through the BSRIA website www.bsria.co.uk.
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