Guidelines for the design, installation and management of small bore tubing assemblies

2nd edition
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May 2013
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# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword</td>
<td>3</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>4</td>
</tr>
<tr>
<td>1 Introduction</td>
<td>5</td>
</tr>
<tr>
<td>1.1 Vulnerability and consequences of releases</td>
<td>5</td>
</tr>
<tr>
<td>1.2 Scope</td>
<td>6</td>
</tr>
<tr>
<td>1.3 Application</td>
<td>7</td>
</tr>
<tr>
<td>1.4 Overview of principal changes</td>
<td>7</td>
</tr>
<tr>
<td>2 Management systems</td>
<td>8</td>
</tr>
<tr>
<td>2.1 Introduction</td>
<td>8</td>
</tr>
<tr>
<td>2.2 Management policy</td>
<td>8</td>
</tr>
<tr>
<td>2.3 Management process</td>
<td>10</td>
</tr>
<tr>
<td>3 Performance standards</td>
<td>11</td>
</tr>
<tr>
<td>4 Design</td>
<td>12</td>
</tr>
<tr>
<td>4.1 Introduction</td>
<td>12</td>
</tr>
<tr>
<td>4.2 Policy, philosophy, engineering standards and specifications</td>
<td>12</td>
</tr>
<tr>
<td>4.3 Design activities</td>
<td>13</td>
</tr>
<tr>
<td>4.3.1 Initial assessment</td>
<td>13</td>
</tr>
<tr>
<td>4.3.2 Material selection</td>
<td>14</td>
</tr>
<tr>
<td>4.3.3 Tubing specification</td>
<td>14</td>
</tr>
<tr>
<td>4.3.4 Fittings specification</td>
<td>14</td>
</tr>
<tr>
<td>4.3.5 Valve selection</td>
<td>16</td>
</tr>
<tr>
<td>4.3.6 Identification of static loads</td>
<td>16</td>
</tr>
<tr>
<td>4.3.7 Identification of dynamic loads and vibration</td>
<td>17</td>
</tr>
<tr>
<td>4.3.8 Supporting SBT assemblies</td>
<td>17</td>
</tr>
<tr>
<td>4.3.9 Selection of clamps/supports for SBT assemblies</td>
<td>19</td>
</tr>
<tr>
<td>4.3.10 Trace heating and/or insulation</td>
<td>20</td>
</tr>
<tr>
<td>4.3.11 Tools</td>
<td>20</td>
</tr>
<tr>
<td>4.4 Design deliverables</td>
<td>21</td>
</tr>
<tr>
<td>4.5 Checking the design</td>
<td>21</td>
</tr>
<tr>
<td>4.6 Close-out and as-building</td>
<td>22</td>
</tr>
<tr>
<td>5 Installation</td>
<td>23</td>
</tr>
<tr>
<td>5.1 Introduction</td>
<td>23</td>
</tr>
<tr>
<td>5.2 Materials handling and stock control</td>
<td>23</td>
</tr>
<tr>
<td>5.3 Installing SBT components</td>
<td>24</td>
</tr>
<tr>
<td>5.3.1 Initial review</td>
<td>24</td>
</tr>
<tr>
<td>5.3.2 Weld fittings</td>
<td>24</td>
</tr>
<tr>
<td>5.3.3 Threaded connectors</td>
<td>25</td>
</tr>
<tr>
<td>5.4 Tubing</td>
<td>25</td>
</tr>
<tr>
<td>5.4.1 Installation practice</td>
<td>26</td>
</tr>
<tr>
<td>5.5 Support</td>
<td>26</td>
</tr>
<tr>
<td>5.6 Thermal expansion and anti-vibration arrangements</td>
<td>27</td>
</tr>
<tr>
<td>5.7 Selection and use of thread sealant</td>
<td>27</td>
</tr>
<tr>
<td>5.7.1 PTFE tape</td>
<td>27</td>
</tr>
<tr>
<td>5.7.2 Anaerobic sealants</td>
<td>27</td>
</tr>
</tbody>
</table>
GUIDELINES FOR THE DESIGN, INSTALLATION AND MANAGEMENT OF SMALL BORE TUBING ASSEMBLIES

5.8 Installation checklist ........................................... 28  
5.9 Confirmation and close-out ..................................... 28  

6. Inspection and repair ............................................. 29  
6.1 Introduction .................................................. 29  
6.2 Inspection ...................................................... 29  
6.2.1 Overview .................................................. 29  
6.2.2 Inspection strategy ......................................... 30  
6.2.3 Inspection planning ......................................... 33  
6.2.4 Inspection procedures ....................................... 33  
6.2.5 Hidden faults ............................................... 34  
6.2.6 Execution of inspection work ............................. 34  
6.3 Intervention management ....................................... 34  
6.3.1 Containment failures and/or severe mechanical damage .. 35  
6.3.2 Remedial/corrective operations following inspection .. 35  
6.3.3 Isolation of associated plant and equipment where SBT assemblies need to be disturbed .......... 37  
6.3.4 Pressure testing after SBT assembly intervention .... 38 

Annexes  
Annex A Terms and abbreviations ................................... 39  
Annex B References and bibliography ................................ 41  
Annex C Competency requirements .................................. 43  
Annex D Policies relating to design of SBT assemblies ........ 52  
Annex E Materials selection for SBT assemblies ............... 56  
Annex F Component selection ....................................... 61  
Annex G Identification and mitigation of static loads .......... 68  
Annex H Identification and mitigation of dynamic loads and vibration ....................................... 95  
Annex I Tubing support ............................................. 110  
Annex J Close-coupled instrument arrangements ............... 114  
Annex K Design deliverables ......................................... 117  
Annex L Designer self-checks ....................................... 121  
Annex M Pressure testing (following SBT assembly intervention) ........................................... 122  
Annex N Assembly practice .......................................... 124
FOREWORD

This publication provides good practice for the management of integrity of Small Bore Tubing (SBT) assemblies throughout their entire life cycle with the aim of maintaining their safety and integrity as well as the systems in which they are deployed. It aims to assist all personnel involved with the design, installation, inspection and maintenance of SBT assemblies, including those involved in operations, site management, and those having specific safety and integrity roles with the organisation.

This document is a substantially revised version of the 1st edition (June, 2000). The revision was under the technical direction of a Steering Group (SG) convened from a cross section of UK offshore operators, consultants and specialist companies who play a key role in the design, inspection and repair of SBT assemblies for the offshore oil and gas industry.

Adoption of these guidelines should assist in managing the operator's responsibilities, instilled by the UK Health and Safety at Work etc. Act and its supporting statutory instruments, or by equivalent legislative requirements elsewhere in the world. Although prepared primarily for use by the petroleum, process and petrochemical industries in the United Kingdom, the principles and practices are likely to be applicable to similar industries worldwide.

Note:
In several places throughout this document, examples provided by members of the SG have been utilised. Where these have been cited, it is implicit that there are alternative ways and methods that other users may use to meet the same objectives. Therefore, these examples are provided for guidance only and should not be regarded as a recommendation or an industry standard.

The Energy Institute and those involved with compiling this document cannot accept any responsibility of whatsoever kind for loss or damage or alleged loss or damage arising or otherwise occurring in or about premises, areas or facilities to which these guidelines have been applied.

It is intended that these guidelines will be reviewed and revised when there are changes in related standards, industry practices or in the light of practical experience. Comments on the document are welcome with a view to incorporating improvement at the next issue. Comments should be addressed to:

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The work was managed by Keith Hart (consultant to the Energy Institute) who was also the principal editor and SG chairman.
1 INTRODUCTION

Small bore tubing (SBT) assemblies are used extensively in industry including onshore and offshore oil and gas processing plants, petroleum refineries, power generation stations and petrochemical plants. As well as crude oil, gas and natural gas liquids (NGL) systems, SBT also features in utility plant such as high pressure water, chemical injection, sampling and hydraulic fluid. One of their principal uses is for the connection of instruments to the process plant for monitoring, control and safeguarding purposes.

An SBT assembly comprises tubing and all associated fittings and can range in size from 1/8" to 2" outside diameter or metric equivalents; 90% of assemblies usually being ½" and below. The routing geometry of a given tubing ‘run’ is often complex; involving the use of many in-line tube connectors, tees, bends, valves and supporting arrangements.

The mechanical features of SBT assemblies make them economically attractive because of their ease of installation and by design, they should provide the required integrity over the entire installation life cycle. Consequently, they are widely deployed particularly as modern processing plants feature large numbers of control and monitoring instruments which require a considerable inventory of SBT assemblies that involve a large number of fittings and joints.

This presents a challenge for managing associated integrity assurance programmes as these need to take into account, the large number of assemblies usually present. Most will be integral parts of main systems, standalone plant or other items, any of which could be classed as safety critical. (See EI Guidelines for the management of safety critical elements).

1.1 VULNERABILITY AND CONSEQUENCES OF RELEASES

Due to their complexity and extensive use, SBT assemblies are vulnerable to failure due to poor installation practice, vibration fatigue or the lack of effective inspection and maintenance programmes. This means that if good practice is not being applied throughout the whole SBT assembly life-cycle, there is a relatively high probability that an integrity failure event will occur at some time during service.

The need to recognise SBT assemblies as potentially being high risk is also evident from incident statistics for the offshore UKCS collated by the Health and Safety Executive (HSE) in 1997. These indicated that SBT assemblies were the largest single contributor to the incidence of loss of process containment in potentially hazardous plants and that there was considerable room for improvement in terms of installation, inspection and maintenance practices.

Separate statistics collated for the period 2009 to 2010 indicate that:

- 20.4% of all reported hydrocarbon leaks recorded on the Hydrocarbon Release (HCR) database were related to ‘instruments’, i.e. they are regarded as SBT related.
- Of these events, just over half were classified as major or significant HCRs, i.e. 11% of all reported HCRs were classed as major or significant severity HCR events linked to SBT assemblies.
- 68% of all ‘instrument’ leaks were gas releases, for which the ‘significant’ severity threshold was breached (notionally an amount greater than 1 kg).

It should be noted that complete fracture of a section of SBT, or parting of an SBT coupling, can potentially rapidly escalate to a major release, particularly if operating in gas service.