CLASS PROGRAMME

Type approval

DNVGL-CP-0184 Edition December 2015

Flexible hoses with permanently fitted couplings - Metallic materials
FOREWORD

DNV GL class programmes contain procedural and technical requirements including acceptance criteria for obtaining and retaining certificates for objects and organisations related to classification.

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CHANGES – CURRENT

This is a new document.
SECTION 1 GENERAL

1 Introduction

1.1 Objective

The objective of this class programme (CP) is to give a description of the Society's type approval scheme for which the Society bases its type approval (TA) of flexible hoses of metallic material with permanently fitted couplings.

For a description of the Society's type approval scheme in general and further information on general conditions and procedures for obtaining the Society's TA certificate, see the Society's document DNVGL CP 0338 - Type approval scheme.

The procedures and requirements described in this CP are applicable for obtaining the Society’s TA certificate based on requirements in:

— DNV GL rules for classification of ships RU SHIP Pt.4 Ch.6
— DNV GL offshore standard DNVGL OS D101 as governed by applicable rules for offshore standards.

1.2 Scope

This CP gives a description of the procedures and requirements related to documentation, design and type testing applicable for TA of flexible hoses of metallic material with permanently fitted couplings.

This CP does not set the design requirements for these products. TA is based on compliance with design requirements given in the rules and/or other regulations and standards. The CP describes the applicable design requirements and how to document compliance with the requirements in order to obtain a TA certificate for the equipment. This includes, where relevant, technical requirements for how the type tests shall be performed.

1.3 Application

DNV GL rules for classification of ships RU SHIP Pt.4 Ch.6 require that flexible hoses of metallic material with permanently fitted couplings are type approved by the Society, and TA in accordance with this CP is thus mandatory for equipment to be installed on vessels classed by the Society.

A TA certificate in accordance with this CP will confirm compliance with the requirements in the rules as specified in [1.1]. The TA certificate will not confirm compliance with requirements in other parts of the rules. In case additional requirements in other parts of the rules shall be covered by the TA certificate, this shall be specified in the application for TA and will be stated in the TA certificate.

1.4 Definitions

Table 1 Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
</table>
| hose assembly           | final product, complete and ready for service” i.e. “a flexible metal hose with end fittings attached”, with or without 1 or 2 wire braids and/or other strengthening or cover(s) as required, and hereinafter called the “hose assembly”.
| hose assembly manufacturer | — hose manufacturers who weld their own couplings to their own hoses.  |
|                         | — hose manufacturers who weld standard couplings manufactured by others to their own hoses. |
|                         | — coupling manufacturers who weld their own couplings to standard hoses manufactured by others. |
|                         | — hose dealers or coupling dealers who weld purchased couplings to purchased hoses. |
2 Documentation

For TA of flexible hoses of metallic material with permanently fitted couplings the following documentation shall be submitted:

— type approval application form
— hose design detail: Description of design and cross sectional drawings, or manufacturer's catalogue of all the hose types with reference to a recognized national/international standard. Reference to the manufacturer's standard for the hose, if relevant.
— end couplings drawings: Typical cross sectional drawings of all coupling categories, or manufacturers’ catalogue covering the couplings used, with reference to a recognised national/international standard, as relevant.
— specification of the material used in the hoses and the couplings. Reference to National/ International material standard shall be given.
— documentation of type testing as required by this document.
— welding procedure specifications (WPS) with relevant welding procedure qualification records (WPQR).
— maximum working pressure of all types and sizes.
— temperature range to be applied.
— media to be carried by the hose assemblies.
— special operational limitations.
— marking of the hose assembly.
SECTION 2 TECHNICAL REQUIREMENTS

1 General
Each hose design including end fitting (welding to the hose end) as well as applicable welding procedures shall be considered for selection of the test specimen for type testing. The connection side of standard connections (flanges, threaded connections, etc.) are not evaluated in connection with the prototype tests. Hoses shall not be used where fixed piping is possible/required. Brazing connections between hose and couplings may in special cases be accepted for type approval of flexible metallic hoses.

2 Material requirements
Corrugated metal hoses shall be manufactured of metallic materials suitable for the fabrication, e.g. cold forming, welding etc. as appropriate. The suitability of the material will be evaluated with regard to possible corrosion, both from the fluid or gas transported and from the surroundings. Information, regarding the material in the hose, braiding and end fittings shall be included in the type approval documentation. The specification of the material qualities shall refer to a recognised National/International material standard.

2.1 Low temperature service
Flexible metal hose assemblies (hose, braid and fittings) for low temperature applications (< –20ºC) shall be made from austenitic steels. Austenitic steels may be evaluated for temperatures down to –200ºC. For hoses with end couplings of carbon steel, the minimum temperature is –20ºC. Other materials used in hoses and couplings may be accepted after special consideration.

2.2 High temperature service
The rating of the hoses shall be reduced dependent upon the reduction in the mechanical properties of the material. When no documentation of the mechanical properties of the material at high temperatures is available, then the maximum working pressure shall be reduced according to Table 1. Temperature range of hose assemblies shall be in accordance with relevant material standard.

Table 1 Maximum working pressure

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Carbon steels, unalloyed</th>
<th>Low alloyed steels</th>
<th>Stainless steels</th>
</tr>
</thead>
<tbody>
<tr>
<td>20ºC</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>50ºC</td>
<td>1.00</td>
<td>1.00</td>
<td>0.95</td>
</tr>
<tr>
<td>100ºC</td>
<td>1.00</td>
<td>1.00</td>
<td>0.85</td>
</tr>
<tr>
<td>150ºC</td>
<td>0.89</td>
<td>0.93</td>
<td>0.77</td>
</tr>
<tr>
<td>200ºC</td>
<td>0.81</td>
<td>0.87</td>
<td>0.71</td>
</tr>
<tr>
<td>250ºC</td>
<td>0.72</td>
<td>0.81</td>
<td>0.67</td>
</tr>
<tr>
<td>300ºC</td>
<td>0.65</td>
<td>0.75</td>
<td>0.63</td>
</tr>
<tr>
<td>350ºC</td>
<td>0.59</td>
<td>0.69</td>
<td>0.60</td>
</tr>
<tr>
<td>400ºC</td>
<td>0.54</td>
<td>0.63</td>
<td>0.58</td>
</tr>
<tr>
<td>450ºC</td>
<td>0.50</td>
<td>0.57</td>
<td>0.57</td>
</tr>
</tbody>
</table>
2.3 Oxygen Service
Hose assemblies that shall be type approved for systems with an oxygen content >25% shall be made of copper alloys or austenitic stainless steels.

3 Welding
Welding requirements shall be in accordance with the Society's rules for classification of ships RU SHIP Pt.2 Ch.4 and/or offshore standards RU OS Ch.2 Sec.6, where applicable.

4 Type testing
Type tests shall be performed on complete hose assemblies with the same type of end fittings that will be covered by the type approval. The outermost end of the coupling performing the connection to the fixed piping will not be specified in the type approval, and may be standard flanges, screwed connections, bite/compression type couplings etc., subject to manufacturers choice for the actual installation.
Except for the burst test, the test reports shall be signed by the QA manager of the manufacturer.
Prior to any type testing hoses or hose assemblies shall be visually inspected.

4.1 Type testing of metal hoses for ordinary machinery systems
4.1.1 The following type tests shall be performed according to EN ISO 10380 or equivalent:
a) Burst test
   1. To be performed on all hoses
   2. When hose assemblies of the same design are manufactured in a number of sizes, one size tested will qualify for the next upper and the next lower size.
   3. Three identical samples of each test size shall be selected for testing.
   4. If one of the hose assemblies fails to meet the requirements, two additional hose assemblies of the same size as the one that failed shall be tested. If one of these hose assemblies fail to meet the requirements, all the untested, remaining sizes shall be burst tested.
   5. The test shall be witnessed by a surveyor who also shall sign and stamp the test reports.
b) Pliability (bending) test
   1. To be performed on all hoses.
c) Fatigue test
   1. To be performed on hoses subject to cyclic loading

4.1.2 Pressure pulsation test
— Generally, flexible metal hoses shall not be used in systems where they may be subjected to high pressure pulsation or vibration. In the special case when flexible metal hoses shall be type approved for use in systems where pressure impulses may occur, the flexible metal hoses shall pass a pressure pulsation test.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Carbon steels, unalloyed</th>
<th>Low alloyed steels</th>
<th>Stainless steels</th>
</tr>
</thead>
<tbody>
<tr>
<td>500ºC</td>
<td>N/A</td>
<td>0.52</td>
<td>0.56</td>
</tr>
<tr>
<td>550ºC</td>
<td>N/A</td>
<td>N/A</td>
<td>0.55</td>
</tr>
<tr>
<td>600ºC</td>
<td>N/A</td>
<td>N/A</td>
<td>0.50</td>
</tr>
</tbody>
</table>
— A straight sample of hose of a length of at least 600 mm between the ferrules shall be subject to pressure impulses of 1.5 x design pressure at a rate between 0.5 Hz and 1.7 Hz. The hoses shall be subject to 150,000 cycles of pressure impulses without leakage or permanent deformations.
— One tested hose assembly will normally qualify for the nearest size smaller and the nearest size bigger. One sample of each of the selected sizes shall be tested.

4.2 Additional requirements for LNG, LPG and chemical service
The hose assemblies shall be in compliance with rules for liquefied gas carriers. In addition to type testing according to DNV GL rules SHIP Pt. 5 Ch. 7 following consideration shall be taken:
The hose assemblies shall be subject to a burst pressure type test at 5 times the maximum design pressure at a temperature corresponding to the minimum design temperature. No signs of cracks or leakage are permitted when the hose assembly is pressure tested to 1.5 times the maximum design pressure, at ambient temperature, after the type test.
One complete assembly of each size shall be burst pressure tested.
The burst test shall be witnessed by a surveyor who also shall sign and stamp the test reports. Fatigue test according to EN ISO 10380 shall be performed.

5 Production tests
For hose assemblies to be delivered on vessels classed with the Society a production test according to DNV GL rules for classification of ships RU SHIP Pt.4 Ch.6 Sec.8 is applicable. In this case a copy of the pressure test report shall follow the hose assemblies.

6 Certification renewal
For general terms, refer to the Society's document DNVGL CP 0338. In addition a surveyor shall witness the following tests on every 3rd size:
— burst test
— production test.

7 Marking
For identification purposes, in relation to the type approval, the hose(s) shall, at least, be marked with: manufacturer’s name or trade mark and type designation.
SECTION 3 CERTIFICATION OF HOSE ASSEMBLING COMPANIES

1 General
Hose assembling companies need to be certified by the Society.
Welding requirements shall be in accordance with the Society's rules for classification of ships RU SHIP Pt.2 Ch.4 and/or offshore standards RU OS Ch.2 Sec.6, where applicable.
If a hose assembling company is holder of a type approval certificate an additional certification for the range of type approved hose assemblies is not necessary.

2 Application for certification
Application for the certification of manufacturers of hose assemblies shall be submitted to the local DNV GL office.
To receive certification from the Society, the hose assembling company shall submit the following documents prior to the initial audit:
— certification of the QM system (e.g. ISO 9001), if available
— description of the manufacturing processes as well as of production and test facilities
— procedure specifications, work instructions, and testing instructions for the product's manufacture
— list of designated persons being responsible for the hose assembling, including qualification records.

3 Initial assessment
The Society will carry out an initial assessment covering the quality system, the production and testing processes as well as the training plan and training requirements for assemblers of the hose assembling company.
During the assessment, tests (e.g. burst test) will be witnessed on a range of types and sizes.

4 Certification

4.1
If the assessment is successful a certification will be granted.

4.2
The certification remains valid for a period of 5 years. During this period the effectiveness of the quality system and the manufacturing processes shall be verified by a periodical assessment every second year.

4.3
Application for a renewal of the certificate shall be made at least three months prior to expiry of the certification. The Society will carry out a renewal assessment to verify that the conditions for the certificate are not altered.

4.4
The Society reserves the right to suspend the certification in case of deficiencies in the quality system or the processes which affect the required product quality.
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