RULES FOR CLASSIFICATION

Inland navigation vessels

Edition December 2015

Part 4 Systems and components

Chapter 2 Pipes, valves, fittings and pumps
FOREWORD

DNV GL rules for classification contain procedural and technical requirements related to obtaining and retaining a class certificate. The rules represent all requirements adopted by the Society as basis for classification.

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CHANGES – CURRENT

This is a new document.
The rules enter into force 1 July 2016.
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SECTION 1 PIPING SYSTEMS

1 General

1.1 Scope

These rules apply to piping systems, including valves, fittings and pumps, which are necessary for the operation of the main propulsion plant together with its auxiliaries and equipment. They also apply to piping systems used in the operation of the vessel whose failure could directly or indirectly impair the safety of vessel or cargo, and to piping systems which are dealt with in other parts of the rules.

Cargo pipelines on vessels for the carriage of chemicals in bulk are additionally subject to the provisions of Pt.6 Ch.1 Sec.2.

Cargo and process pipelines on vessels for the carriage of liquefied gases in bulk are additionally subject to the provisions of Pt.6 Ch.1 Sec.1 and Pt.6 Ch.1 Sec.3.

1.2 Documents for approval

Diagrammatic plans of the following piping systems shall be submitted to the Society, at least in triplicate, and shall contain all the details necessary for assessment:

— steam systems
— boiler feed and condensate systems
— fuel systems (bunkering, transfer and supply systems)
— lubricating oil systems
— cooling water systems
— compressed air systems
— bilge systems
— thermal oil systems
— air, sounding and overflow systems
— drinking water and sewage systems
— systems for remotely controlled valves
— hose assemblies and compensators

Hoses and expansion joints made of non-metallic materials shall be clearly indicated.

1.3 Classes of pipes

Pipes are subdivided into two classes as indicated in Table 1.

Table 1 Classification of pipes into “pipe classes”

<table>
<thead>
<tr>
<th>Medium conveyed by the piping system</th>
<th>Design pressure PR [bar]</th>
<th>Design temperature t [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toxic media</td>
<td>II</td>
<td>III</td>
</tr>
<tr>
<td>Inflammable media with service temperature above the flash point</td>
<td>all</td>
<td>not applicable</td>
</tr>
<tr>
<td>Liquefied gases (LPG, LNG, LG)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrosive media</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2 Materials, quality assurance, pressure tests

2.1 General
Materials shall be suitable for the proposed application and shall comply with Pt.2. In the case of especially corrosive media, the Society may impose special requirements on the materials used. For welds, see Pt.2. For the materials used for pipes and valves for steam boilers, see Ch.3 Sec.1 [1.2].

2.2 Materials

2.2.1 Pipes, valves and fittings of steel
Pipes belonging to class II shall be either seamless drawn or produced by a welding procedure approved by the Society.

2.2.2 Pipes, valves and fittings of copper and copper alloys
Pipes of copper and copper alloys shall be of seamless drawn material or produced by a method approved by the Society. Class II copper pipes shall be seamless.
In general, copper and copper alloys pipe lines shall not be used for media having temperatures above the limits given in Table 2.

Table 2 Medium limit temperature

<table>
<thead>
<tr>
<th>Material</th>
<th>Medium limit temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper and aluminium brass</td>
<td>200°C</td>
</tr>
<tr>
<td>Copper nickel alloys</td>
<td>300°C</td>
</tr>
<tr>
<td>High-temperature bronze</td>
<td>230°C</td>
</tr>
</tbody>
</table>

Medium conveyed by the piping system

<table>
<thead>
<tr>
<th>Medium conveyed by the piping system</th>
<th>Design pressure PR [bar]</th>
<th>Design temperature t [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>steam, thermal oil</td>
<td>PR ≤ 16 and t ≤ 300</td>
<td>PR ≤ 7 and t ≤ 170</td>
</tr>
<tr>
<td>Air, gas</td>
<td>PR ≤ 40 and t ≤ 300</td>
<td>PR ≤ 16 and t ≤ 200</td>
</tr>
<tr>
<td>Lubricating oil, hydraulic oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiler feedwater, condensate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seawater and fresh water for Cooling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid fuels</td>
<td>PR ≤ 16 and t ≤ 150</td>
<td>PR ≤ 7 and t ≤ 60</td>
</tr>
<tr>
<td>Cargo pipelines for tankers</td>
<td>not applicable</td>
<td>all</td>
</tr>
<tr>
<td>Open-ended pipelines (without shut-off), e.g. drains, venting pipes, overflow lines and boiler blowdown lines</td>
<td>not applicable</td>
<td>all</td>
</tr>
</tbody>
</table>
2.2.3 Pipes, valves and fittings of cast iron with spheroidal or nodular graphite (GGG)

Pipes, valves and fittings of nodular ferritic cast iron according to Pt.2 may be accepted for bilge, ballast and cargo pipes within double bottom tanks and cargo tanks and for other purposes approved by the Society at temperatures up to 350°C.

2.2.4 Pipes, valves and fittings of cast iron with lamellar graphite (grey cast iron) (GG)

Pipes, valves and fittings of grey cast iron may be accepted by the Society for class III. Pipes of grey cast iron may be used for cargo and ballast pipelines within cargo tanks of tankers. Grey cast iron is not allowed for clean ballast lines to forward ballast tanks through cargo oil tanks.

Pipes, valves and fittings of grey cast iron may also be accepted for cargo lines on tankers intended to carry flammable liquids with a flash point ≤ 60°C. Tough materials shall be used for cargo hose connections and distributor headers.

This applies also to the hose connections of fuel and lubricating oil filling lines. Grey cast iron may not be used for cargo lines in cargo systems of vessels carrying chemicals (see Pt.6 Ch.1 Sec.1 and Pt.6 Ch.1 Sec.2).

Grey cast iron is not allowed for pipes, valves and fittings for media having temperatures above 220 °C and for pipelines subject to water hammer, excessive strains and vibrations.

Grey cast iron is not allowed for river valves and pipes fitted on the vessel sides and for valves fitted on the collision bulkhead.

Valves on fuel tanks subject to static head may be made of grey cast iron only if they are adequately protected against damage.

The use of grey cast iron for other services will be subject to special consideration by the Society.

2.2.5 Plastic pipes

Plastic pipes may be used after special approval by the Society.

Pipes, connecting pieces, valves and fittings made of plastic materials shall be subjected by the manufacturer to a continuous Society-approved quality control.

Pipe penetrations through watertight bulkheads and decks as well as through fire divisions shall be approved by the Society. Plastic pipes shall be continuously and permanently marked with the following particulars:

— manufacturer’s marking
— standard specification number
— outside diameter and wall thickness of pipe
— year of manufacture

Valves and connecting pieces made of plastic shall, as a minimum requirement, be marked with the manufacturer’s marking and the outside diameter of the pipe.

2.2.6 Aluminium and aluminium alloys

Aluminium and aluminium alloys shall comply with Pt.2 and may in individual cases, with the agreement of the Society, be used for temperatures up to 200 °C. They are not acceptable for use in fire-extinguishing lines.

2.2.7 Application of materials

For the pipe classes materials shall be applied according to Table 3.
Table 3 Approved materials

<table>
<thead>
<tr>
<th>Material or application</th>
<th>Pipe classes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>II</td>
</tr>
<tr>
<td><strong>Pipes</strong></td>
<td>Pipes for general applications, below −10°C pipes made of steels with high low-temperatures toughness, stainless steel pipes for chemicals</td>
</tr>
<tr>
<td><strong>Forgings, plates, flanges</strong></td>
<td>Steels suitable for the corresponding loading and processing conditions, for temperatures below −10°C steels with high low-temperature toughness</td>
</tr>
<tr>
<td><strong>Bolts, nuts</strong></td>
<td>Bolts for general machine construction, below −10 °C steels with high low-temperature toughness</td>
</tr>
<tr>
<td><strong>Cast steel</strong></td>
<td>Cast steel for general applications, below −10°C cast steel with high low-temperature toughness, for aggressive media stainless castings</td>
</tr>
<tr>
<td><strong>Spheroidal/Nodular cast iron (GGG)</strong></td>
<td>Only ferritic grades, elongation A5 at least 12 %</td>
</tr>
<tr>
<td><strong>Cast iron with lamellar graphite (grey cast iron) (GG)</strong></td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Non-ferrous metals (valves, fittings, pipes)</strong></td>
<td><strong>Copper, copper alloys</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Aluminium, aluminium alloy</strong></td>
</tr>
<tr>
<td><strong>Non-metallic</strong></td>
<td>Plastics</td>
</tr>
</tbody>
</table>

2.3 Quality assurance

2.3.1 The proof of the quality of materials for pipe class II shall be in the form of an inspection certificate according to EN 10.204 or equivalent. For this purpose, the manufacturer of the material shall have been accepted by the Society.

2.3.2 For components in pipe class III a works certificate issued by the manufacturer of the material is sufficient.

2.3.3 Welded joints in pipelines of class II shall be tested in accordance with Pt.2.
2.4 Hydraulic tests on pipes

2.4.1 Definitions

a) Maximum allowable working pressure, PB [bar] formula symbol: \( p_{e,perm} \)
   This is the maximum allowable internal or external working pressure for a component or piping system with regard to the materials used, piping design requirements, the working temperature and undisturbed operation.

b) Nominal pressure, PN [bar]
   This is the term applied to a selected pressure temperature relation used for the standardization of structural components. In general, the numerical value of the nominal pressure for a standardized component made of the material specified in the standard will correspond to the maximum allowable working pressure PB at 20°C.

c) Test pressure, PP [bar] formula symbol: \( p_t \)
   This is the pressure to which components or piping systems are subjected for testing purposes.

d) Design pressure, PR [bar] formula symbol: \( p_c \)
   This is the maximum allowable working pressure PB for which a component or piping system is designed with regard to its mechanical characteristics. In general, the design pressure is the maximum allowable working pressure at which the safety equipment will interfere (e.g. activation of safety valves, opening of return lines of pumps, operating of overpressure safety arrangements, opening of relief valves) or at which the pumps will operate against closed valves.

2.4.2 Pressure tests of piping before assembly on board

All class II pipes as well as steam lines, feedwater pressure pipes, compressed air and fuel lines having a design pressure PR greater than 3.5 bar together with their associated fittings, connecting pieces, branches and bends, after completion of manufacture but before insulation and coating, if this is provided, shall be subjected to a hydraulic pressure test in the presence of the surveyor at the following value of pressure:

\[
P = 1.5 \cdot p_c
\]

Where for technical reasons it is not possible to carry out complete hydraulic pressure tests on all sections of piping before assembly on board, proposals shall be submitted for approval to the Society for testing the closing lengths of piping, particularly in respect of closing seams.

When the hydraulic pressure test of piping is carried out on board, these tests may be conducted in conjunction with the tests required under [4.3].

Pressure testing of pipes with a nominal diameter less than 15 mm may be omitted at the Society discretion depending on the application.

2.4.3 Pressure tests of piping after assembly on board

In general, all pipe systems shall be tested for leakage under operational conditions. If necessary, special techniques other than hydraulic pressure tests shall be applied.

In particular the following applies:

— Heating coils in tanks and fuel lines shall be tested to not less than 1.5 PB but in no case less than 4 bar.
— Liquefied gas process piping systems shall be leak tested (by air, halides, etc.) to a pressure depending on the leak detection method applied.
2.5 Hydrostatic tests of valves

The following valves shall be subjected in the manufacturer’s works to a hydraulic pressure test in the presence of a surveyor:

a) Valves of Pipe class II to 1.5 PR
b) Valves mounted on the vessel’s side not less than 5 bar

The valves specified under a) and b) shall also undergo a tightness test at 1.0 times the nominal pressure. For the valves of steam boilers, see Ch. 3 Sec. 5 [2].

3 Pipe wall thicknesses

3.1 Minimum wall thickness

3.1.1 The pipe thicknesses given in Table 4 and Table 5 are the assigned minimum thicknesses

\[ d_a = \text{outside diameter of pipe [mm]} \]
\[ s = \text{minimum wall thickness [mm]} \]

**Table 4 Steel pipes**

<table>
<thead>
<tr>
<th>(d_a)</th>
<th>(s)</th>
<th>(d_a)</th>
<th>(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 10.2</td>
<td>1.6</td>
<td>from 114.3</td>
<td>3.2</td>
</tr>
<tr>
<td>from 13.5</td>
<td>1.8</td>
<td>from 133.0</td>
<td>3.6</td>
</tr>
<tr>
<td>from 20.0</td>
<td>2.0</td>
<td>from 152.4</td>
<td>4.0</td>
</tr>
<tr>
<td>from 48.3</td>
<td>2.3</td>
<td>from 177.8</td>
<td>4.5</td>
</tr>
<tr>
<td>from 70.0</td>
<td>2.6</td>
<td>from 244.5</td>
<td>5.0</td>
</tr>
<tr>
<td>from 88.9</td>
<td>2.9</td>
<td>from 298.5</td>
<td>5.6</td>
</tr>
</tbody>
</table>

**Table 5 Copper and copper alloy pipes**

<table>
<thead>
<tr>
<th>(d_a)</th>
<th>(s)</th>
<th>(d_a)</th>
<th>(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper pipes</td>
<td>Copper alloy pipes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>up to 12.2</td>
<td>1.0</td>
<td>up to 22.0</td>
<td>1.0</td>
</tr>
<tr>
<td>from 14.0</td>
<td>1.5</td>
<td>from 25.0</td>
<td>1.5</td>
</tr>
<tr>
<td>from 44.5</td>
<td>2.0</td>
<td>from 76.0</td>
<td>2.0</td>
</tr>
<tr>
<td>from 60.0</td>
<td>2.5</td>
<td>from 108.0</td>
<td>2.5</td>
</tr>
<tr>
<td>from 108.0</td>
<td>3.0</td>
<td>from 219.0</td>
<td>3.0</td>
</tr>
<tr>
<td>from 159.0</td>
<td>3.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.1.2 Air pipes, sounding pipes, overflow pipes and pipes carrying media which is different to that in the tanks may not be routed through tanks for drinking water, feedwater or lubricating oil. If this cannot be avoided, the arrangement of the pipes in the tanks shall be agreed with the Society.
4 Principles for the construction of pipes, valves, fittings and pumps

4.1 General principles

4.1.1 Piping systems shall be constructed and manufactured on the basis of standards generally used in vessel building.

4.1.2 Welded connections instead of detachable connections should be used for pipelines carrying toxic media and inflammable liquefied gases.

4.1.3 Expansion in piping systems due to heating and shifting of their suspensions caused by deformation of the vessel shall be compensated by bends, compensators and flexible pipe connections. The arrangement of suitable fixed points shall be taken into consideration.

4.2 Pipe connections

4.2.1 Dimensions and calculation
The dimensions of flanges and bolting are to comply with recognized standards.

4.2.2 Pipes connections
The following pipe connections may be used:
— fully penetrating butt welds with/without provision to improve the quality of the root
— socket welds with suitable fillet weld thickness and possibly in accordance with recognized standards
— screw connections of approved type
For the use of these pipe connections, see Table 6.

Table 6 Pipe connections

<table>
<thead>
<tr>
<th>Types of connections</th>
<th>Pipe class</th>
<th>Nominal diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welded butt-joints with spacial provisions for root side</td>
<td>II, III</td>
<td>all</td>
</tr>
<tr>
<td>Welded butt-joints without all spacial provisions for root side</td>
<td>II, III</td>
<td></td>
</tr>
<tr>
<td>Welded sockets</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td>Screwed sockets</td>
<td>for subordinate systems see [4.2.2]</td>
<td>&lt; 50</td>
</tr>
</tbody>
</table>

Screwed socket connections and similar connections are not permitted for pipes of classes II and III. Screwed socket connections are allowed only for subordinate systems (e.g. sanitary and hot-water heating systems) operating at low pressures. Screwed pipe connections and pipe coupling may be used subject to special approval.

Steel flanges may be used under considering the allowed pressures and temperatures as stated in the corresponding standards.

Flanges made of non-ferrous metals may be used in accordance with the relevant standards and within the limits laid down in the approvals. Flanges and brazed or welded collars of copper and copper alloys are subject to the following requirements:

a) Welding neck flanges according to standard up to 200°C or 300°C for all Pipe classes.
b) Loose flanges with welding collar; as for a)
c) Plain brazed flanges: only for Pipe class III up to a nominal pressure of 16 bar and a temperature of 120°C.

Approved pipe couplings are permitted in the following piping systems outside engine rooms:
— bilge and ballast systems
— fuel and oil systems
— fire-extinguishing and deck washing systems
— cargo oil pipes
— air, filling and sounding pipes
— sanitary drain pipes
— drinking water pipes.

These couplings may only be used inside machinery spaces if they have been approved by the Society as flame-resistant.

The use of pipe couplings is not permitted in:
— fuel and seawater lines inside cargo spaces
— bilge lines inside fuel tanks and ballast tanks.

4.3 Layout, marking and installation

4.3.1 Piping systems shall be adequately identified according to their purpose. Valves shall be permanently and clearly marked.

4.3.2 Pipes leading through bulkheads and tank walls shall be water and oil tight. Bolts through bulkheads are not permitted. Holes for set screws may not be drilled in the tank walls.

4.3.3 Piping systems close to electrical switchboards shall be so installed or protected that possible leakage cannot damage the electrical installation.

4.3.4 Piping systems shall be so arranged that they can be completely emptied, drained and vented. Piping systems in which the accumulation of liquids during operation could cause damage shall be equipped with special drain arrangements.

4.4 Shut-off devices

4.4.1 Shut-off devices shall comply with a recognized standard. Valves with screwed-on covers shall be secured to prevent unintentional loosening of the cover.

4.4.2 Hand-operated shut-off devices shall be closed by turning in the clockwise direction.

4.4.3 Indicators shall be provided showing the open/closed position of valves unless their position is shown by other means.

4.4.4 Change-over devices in piping systems in which a possible intermediate position of the device could be dangerous in service shall not be used.

4.5 Outboard connections

4.5.1 Valves may only be mounted on the vessel’s side by means of reinforcing flanges or thick-walled connecting pipes.
4.5.2 Vessel’s side valves shall be easily accessible. Water inlet and outlet valves shall be capable of being operated from above the floor plates. Cocks on the vessel’s side shall be so arranged that the handle can only be removed when the cock is closed.

4.5.3 Where discharge pipes without shutoff devices may be connected to the vessel’s hull below the freeboard deck, the wall thickness of the pipes to the nearest shut-off device shall be equal to that of the shell plating at the ends of the vessel, but need not to exceed 8 mm.

4.5.4 Outboard connections shall be fitted with shutoff valves. Cooling water discharge lines may be provided with loops led at a minimum height of 0.3 m above the maximum draft.

4.6 Remote controlled valves

4.6.1 Scope
These requirements apply to hydraulically, pneumatically or electrically operated valves in piping systems and sanitary discharge pipes.

4.6.2 Construction
Remote controlled bilge valves and valves important to the safety of the vessel shall be equipped with an emergency operating arrangement.

For the emergency operation of remote controlled valves in cargo piping systems, see Pt. 6 Ch. 1 Sec. 1 [3.2].

4.6.3 Arrangement of valves
The accessibility of the valves for maintenance and repairing shall be taken into consideration.

Valves in bilge lines and sanitary pipes shall always be accessible.

Bilge lines valves and control lines shall be located as far as possible from the bottom and sides of the vessel.

The requirements stated here above also apply here to the location of valves and control lines.

Where remote controlled valves are arranged inside the ballast tanks, the valves should always be located in the tank adjoining that to which they relate.

Remote-controlled valves mounted on high and wing fuel tanks shall be capable of being closed from outside the compartment in which they are installed.

Where remote controlled valves are arranged inside cargo tanks, valves should always be fitted in the tank adjoining that to which they relate. A direct arrangement of the remote controlled valves in the tanks concerned is allowed only if each tank is fitted with two suction lines each of which is provided with a remote controlled valve.

4.6.4 Control stands
The control devices of remote controlled valves shall be arranged together in one control stand.

The control devices shall be clearly and permanently identified and marked.

It shall be recognized at the control stand whether the valves are open or closed.

In the case of bilge valves and valves for changeable tanks, the closed position shall be indicated by limit-position indicators approved by the Society as well as by visual indicators at the control stand.

On passenger vessels, the control stand for remote controlled bilge valves shall be located outside the machinery spaces and above the bulkhead deck.

4.6.5 Power units
Power units shall be equipped with at least two independent sets for supplying power for remote controlled valves.

The energy required for the closing of valves which are not closed by spring power shall be supplied by a pressure accumulator.
Pneumatically operated valves can be supplied with air from the general compressed air system. Where the quick-closing valves of fuel tanks are closed pneumatically, a separate pressure accumulator shall be provided. This shall be of adequate capacity and shall be located outside the engine room. Filling of this accumulator by a direct connection to the general compressed air system is allowed. A non-return valve shall be arranged in the filling connection of the pressure accumulator. The accumulator shall be provided either with a pressure control device with a visual and acoustic alarm or with a hand-compressor as a second filling appliance. The hand-compressor shall be located outside the engine room.

4.6.6 After installation on board, the entire system shall be subjected to an operational test.

4.7 Pumps

4.7.1 Displacement pumps shall be equipped with sufficiently dimensioned relief valves without shut-off to prevent any excessive overpressure in the pump housing.

4.7.2 Rotary pumps shall be capable of being operated without damage even when the delivery line is closed.

4.7.3 Pumps mounted in parallel shall be protected against overloading by means of non-return valves fitted at the outlet side.

4.8 Protection of piping systems against overpressure
The following piping systems shall be fitted with safety valves to avoid unallowable overpressure:
— piping systems and valves in which liquids can be enclosed and heated
— piping systems which may be exposed in service to pressures in excess of the design pressure
Safety valves shall be capable of discharging the medium at a maximum pressure increase of 10%. Safety valves shall be fitted on the low-pressure side of reducing valves.

5 Steam systems

5.1 Laying out of steam systems

5.1.1 Steam systems shall be so installed and supported that expected stresses due to thermal expansion, external loads and shifting of the supporting structure under both normal and interrupted service conditions will be safely compensated.

5.1.2 Steam lines shall be so installed that water pockets will be avoided.

5.1.3 Means shall be provided for the reliable drainage of the piping system.

5.1.4 Pipe penetrations through bulkheads and decks shall be insulated to prevent heat conduction.

5.1.5 Steam lines shall be effectively insulated to prevent heat losses. At points where there is a possibility of contact, the surface temperature of the insulated steam systems may not exceed 80°C. Wherever necessary, additional protection arrangements against unintended contact shall be provided. The surface temperature of steam systems in the pump rooms of tankers may nowhere exceed 220°C. It shall be ensured that the steam lines are fitted with sufficient expansion arrangements.
Where a system can be entered from a system with higher pressure, the former shall be provided with reducing valves and relief valves on the low-pressure side. Welded connections in steam systems are subject to the requirements specified in Pt.2.

5.2 Steam strainers
Wherever necessary, machines and apparatus in steam systems shall be protected against foreign matter by steam strainers.

5.3 Steam connections
Steam connections to equipment and pipes carrying oil, e.g. steam atomizers or steam out arrangements, shall be so secured that fuel and oil cannot penetrate into the steam systems.

6 Boiler feedwater and circulating arrangement, condensate recirculation

6.1 Feedwater pumps

6.1.1 At least two feedwater pumps shall be provided for each boiler installation.

6.1.2 Feedwater pumps shall be so arranged or equipped that no backflow of water can occur when the pumps are at a standstill.

6.1.3 Feedwater pumps shall be used only for feeding boilers.

6.2 Capacity of feedwater pumps

6.2.1 Where two feedwater pumps are provided, the capacity of each shall be equivalent to at least 1.25 times the maximum permitted output of all the connected steam producers.

6.2.2 Where more than two feedwater pumps are installed, the capacity of all other feedwater pumps in the event of the failure of the pump with the largest capacity is to comply with the requirements of [6.2.1].

6.2.3 For continuous flow boilers the capacity of the feedwater pumps shall be at least 1.0 times the maximum steam output.

6.3 Delivery pressure of feedwater pumps
Feedwater pumps shall be so laid out that the delivery pressure can satisfy the following requirements:
— the required capacity according to [6.2] shall be achieved against the maximum allowable working pressure of the steam producer
— the safety valves shall have a capacity equal 1.0 times the approved steam output at 1.1 times the allowable working pressure.

The resistances to flow in the piping between the feedwater pump and the boiler shall be taken into consideration. In the case of continuous flow boilers the total resistance of the boiler shall be taken into account.
6.4 Power supply to feedwater pumps
For electric drives, a separate lead from the common bus-bar to each pump motor is sufficient.

6.5 Feedwater systems

6.5.1 General
Feedwater systems may not pass through tanks which do not contain feedwater.

6.5.2 Feedwater systems for boilers
a) Each boiler shall be provided with a main and an auxiliary feedwater systems.
b) Each feedwater system shall be fitted with a shut-off valve and a check valve at the boiler inlet. Where the shut-off valve and the check valve are not directly connected in series, the intermediate pipe shall be fitted with a drain.
c) Each feedwater pump shall be fitted with a shut-off valve on the suction side and a screw-down non-return valve on the delivery side. The pipes shall be so arranged that each pump can supply each feedwater system.
d) Continuous flow boilers need not to be fitted with the valves required in b) provided that the heating of the boiler is automatically switched off should the feedwater supply fail and that the feedwater pump supplies only one boiler.

6.6 Boiler water circulating systems

6.6.1 Each forced-circulation boiler shall be equipped with two circulating pumps powered independently of each other. Failure of the circulating pump in operation shall be signalled by an alarm. The alarm may only be switched off if a circulating pump is started or when the boiler firing is shut down.

6.6.2 The provision of only one circulating pump for each boiler is sufficient if:
— a common stand-by circulating pump is provided which can be connected to any boiler or
— the burners of oil-fired auxiliary boilers are so arranged that they are automatically shut-off should the circulating pump fail and the heat stored in the boiler does not cause any unacceptable evaporation of the water present in the boiler.

6.7 Condensate recirculation
The condensate of all heating systems used to heat oil (fuel, lubricating, cargo oil, etc.) shall be led to condensate observation tanks. These tanks shall be fitted with air vents.

7 Fuel oil systems

7.1 Storage of liquid fuels

7.1.1 General safety precautions for liquid fuel
Tanks and fuel pipes shall be so located and equipped that fuel cannot spread either inside the vessel or on deck and cannot be ignited by hot surfaces or electrical equipment. Tanks shall be fitted with air and overflow pipes to prevent excessive pressure (see [13]).

7.1.2 Distribution and location of fuel tanks
The fuel supply shall be stored in several tanks so that, even in event of damage to one tank, the fuel supply will not be entirely lost. (At least 1 storage tank and 1 service/settling tank).
7.2 Fuel tank fittings and mountings

7.2.1 For fuel filling and suction systems see [7.6]; for air, overflow and sounding pipes, see [13].

7.2.2 Service tanks shall be so arranged that water and residues can settle out despite the movement of the vessel.

7.2.3 Free discharge and drainage lines shall be fitted with self-closing shut-off valves.

7.2.4 Tank gauges
The following tank gauges are permitted:
— sounding pipes
— oil level indicating devices
— oil gauges with flat glasses and self-closing shut-off valves at the connections to the tank and protected against external damage

For fuel storage tanks, the provision of sounding pipes is sufficient. Such sounding pipes need not be fitted to tanks equipped with oil level indicating devices which have been type-tested by the Society.

Fuel service tank supplying the main propulsion unit, important auxiliaries and the driving engines for bow thrusters shall be fitted with low level alarm which has been type-approved by the Society.

The low level alarm shall be fitted at a height which enables the vessel to reach a safe location in accordance with the class notation without refilling the service tank.

Sight glasses and oil gauges fitted directly on the side of the tank and round glass oil gauges are not permitted.

Sounding pipes of fuel tanks may not terminate in accommodation or passenger spaces, nor shall they terminate in spaces where the risk of ignition of spillage from the sounding pipes might arise.

7.3 Attachment of mountings and fittings to fuel tanks

7.3.1 Only appliances, mountings and fittings forming part of the fuel tank equipment may generally be fitted to tank surfaces.

7.3.2 Valves and pipe connections shall be attached to strengthening flanges welded to the tank surfaces. Holes for attachment bolts shall not be drilled in the tank surfaces. Instead of strengthening flanges, short, thick pipe flange connections may be welded into the tank surfaces.

7.4 Hydraulic pressure test
See [2.4]

7.5 Filling and delivery system
The filling of fuels shall be effected from the open deck through permanently installed lines.
7.6 Tank filling and suction systems

7.6.1 Filling and suction lines terminating below the oil level in tanks shall be fitted with remote-controlled shut-off valves. The shut-off valves shall be directly at the tanks.

7.6.2 The remote-controlled shut-off valves shall be capable of being operated from a permanently accessible open deck.

7.6.3 Air and sounding pipes shall not be used to fill fuel tanks.

7.6.4 The inlet openings of suction pipes shall be located above the drain pipes.

7.6.5 Service tanks of up to 50 litres capacity mounted directly on diesel engines need not be fitted with remote controlled shut-off valves.

7.7 Pipe layout

7.7.1 Fuel lines may not pass through tanks containing feedwater, drinking water or lubricating oil.

7.7.2 Fuel lines may not be laid in the vicinity of hot engine components, boilers or electrical equipment. The number of detachable pipe connections shall be limited. Shut-off valves in fuel lines shall be operable from above the floor plates in machinery spaces.

Glass and plastic components are not permitted in fuel systems.

7.7.3 Shut-off valves in fuel spill lines to service tanks are not permitted.

7.8 Filters

Fuel supply lines to continuously operating engines shall be fitted with duplex filters with a changeover cock or with self-cleaning filters. By-pass arrangements are not permitted.

8 Lubricating oil systems

8.1 Storage of lubricating oil

8.1.1 Tank arrangement

For the arrangement of the tanks, requirements of Pt.3 Ch.4 Sec.5 [8] shall be applied.

8.2 Tank fittings and mountings

8.2.1 Oil level glasses shall be connected to the tanks by means of self-closing shut-off valves.

8.2.2 The requirements set out under [2.4] apply likewise to the mounting of appliances and fittings on these tanks.
8.3 Capacity and construction of tanks

8.3.1 Lubricating oil circulating tanks should be sufficiently large to ensure that the dwelling time of the oil is long enough for the expulsion of air bubbles, the settling out of residues, etc. The tanks shall be large enough to hold at least the lubricating oil contained in the entire circulation system.

8.3.2 Measures, such as the provision of baffles or limber holes shall be taken to ensure that the entire contents of the tank remain in circulation. Limber holes should be located as near the bottom of the tank as possible. Lubricating oil drain pipes from engines shall be submerged close to the tank bottom at their outlet ends. Suction pipe connections should be placed as far as is practicable from oil drain pipes so that neither air nor sludge can be sucked up irrespective of the inclination of the vessel.

8.3.3 Lubricating oil drain tanks shall be equipped with sufficient vent pipes.

8.4 Hydraulic pressure test
See [2.4]

8.5 Lubricating oil piping

8.5.1 Lubricating oil systems shall be constructed to ensure reliable lubrication over the whole range of speed and during run-down of the engines and to ensure adequate heat transfer.

8.5.2 Priming pumps
Where necessary, priming pumps shall be provided for supplying lubricating oil to the engines.

8.6 Lubricating oil pumps
The suction connections of lubricating oil pumps shall be located as far as possible from drain pipes.

8.7 Filters
Change-over duplex filters or automatic back-flushing filters shall be mounted in lubricating oil lines on the delivery side of the pumps.

9 Cooling water systems

9.1 Cooling water intakes, river chest

9.1.1 Each river chest shall be provided with an air pipe which can be shut-off and which shall extend above the bulkhead deck. The inside diameter of the air pipe shall be compatible with the size of the river chests and shall not be less than 30 mm.

9.1.2 Where compressed air is used to blow through river chests, the pressure shall not exceed 2 bar.

9.2 Cooling water intake valves
Two valves shall be provided for main propulsion plants. The cooling water pumps of important auxiliaries should be connected to the river chests over separate valves.
9.3 Filters
The suction lines of cooling water pumps for main engines shall be fitted with filters which can be cleaned in service.

9.4 Expansion tanks of fresh water cooling
The fresh water cooling system shall be provided with expansion tanks located at a sufficient height. The tanks shall be fitted with a filling connection, a water level indicator and an air pipe. A venting shall connect the highest point of the cooling water common pipe to the expansion tank.

In closed circuits, the expansion tanks shall be fitted with overpressure/underpressure valves.

9.5 Fresh water coolers
For fresh water coolers forming part of the vessel’s shell plating and for special outboard coolers, provision shall be made for satisfactory deaeration of the cooling water. Drawings of the cooler and the cooler arrangement shall be submitted for approval.

10 Compressed air systems

10.1 General

10.1.1 Pressure lines connected to air compressors shall be fitted with non-return valves at the compressor outlet.

10.1.2 Efficient oil and water traps shall be provided in the filling lines of compressed air receivers. The air discharge from relief valves in the compressed air receivers installed in the engine rooms shall lead to the open air.

10.1.3 Starting air lines may not be used as filling lines for air receivers.

10.1.4 The starting air line to each engine shall be fitted with a non-return valve and a drain.

10.1.5 Typhons shall be connected to at least two compressed-air receivers.

10.1.6 A safety relief valve shall be fitted downstream of each pressure-reducing valve.

10.1.7 Pressure water tanks and other tanks connected to the compressed air system shall be considered as pressure vessels and shall comply with the requirements in Ch.3 Sec.1 [1].

10.2 Compressed air connections for blowing
For compressed air connections for blowing through river chests refer to [9.1.2].

10.3 Compressed air supply to pneumatically
For the compressed air supply to pneumatically operated valves refer to [4.6].
11 Bilge systems

11.1 General
The equipment of vessels with oil-separating facilities is to conform to national and international Regulations.

11.2 Bilge lines

11.2.1 Layout of bilge lines
Bilge lines and bilge suctions shall be so arranged that the bilges can be completely pumped even under disadvantageous trim conditions.
Bilge suctions are normally to be located on both sides of the vessel. For compartments located fore and aft in the vessel, one bilge suction may be considered sufficient provided that it is capable of completely draining the relevant compartment.
Spaces located forward of the collision bulkhead and aft of the stern tube bulkhead and not connected to the general bilge system shall be drained by other suitable means of adequate capacity.
The collision bulkhead may be pierced by a pipe for filling and draining of the fore peak, provided that a screw-down valve capable of being remotely operated from above the open deck is fitted at the collision bulkhead within the fore peak. Where the fore peak is directly adjacent to a permanently accessible room which is separated from the cargo space, this shut-off valve may be fitted directly at the collision bulkhead inside this room without provision for remote control.

11.2.2 Pipes led through tanks
Bilge pipes may not be led through tanks for lubricating oil, thermal oil, drinking water or feedwater.

11.2.3 Bilge suctions and strums
Bilge suctions shall be so arranged as not to impede the cleaning of bilges and bilge wells. They shall be fitted with easily detachable, corrosion-resistant strums.

11.2.4 Bilge valves
Valves in connecting pipes between the bilge and the river water and ballast water system, as well as between the bilge connections of different compartments, shall be so arranged that even in the event of faulty operation or intermediate positions of the valves, penetration of river water through the bilge system will be safely prevented.
Bilge discharge pipes shall be fitted with shut-off valves at the vessel's side.
Bilge valves shall be arranged so as to be always accessible irrespective of the ballast and loading condition of the vessel.

11.2.5 Pipe connections
To prevent water penetration, each of the branch bilge pipes from the individual compartments shall be connected to the main bilge pipe by a screw-down non-return valve. In the case of small vessels with only one cargo hold, the branch bilge pipes serving the various spaces can also be connected to the bilge pumps over changeover or three-way angle cocks.
Where a bilge pump shall also be used for pumping water over the vessel's side and from ballast water tanks, the main bilge pipe shall be connected to the suction line of the pump by a non-return device to prevent raw or ballast water from penetrating the bilge system.
Such non-return devices include three-way cocks with L plugs, three-way angle cocks and changeover gate valves. Instead of these changeover devices, a screw-down non-return valve may also be fitted between the pump and the main bilge pipe, so that two non-return valves will then be connected in series.
A direct suction from the engine room shall be connected to the largest of the specified bilge pumps. Its diameter shall not be less than that of the main bilge pipe.
However, the direct suction in the engine room need be fitted with only one screw-down non-return valve. Where the direct suction is connected to a centrifugal pump which can also be used for cooling water, ballast water or fire-extinguishing, a screw-down non-return valve shall be fitted in the discharge pipe of the pump.

11.3 Calculation of pipe diameters

11.3.1 Tankers
The inside diameter of the main bilge pipe in the main engine rooms of tankers is calculated by applying the formula:

\[ d_H = 3.0 \cdot \sqrt{(B + D) \cdot \ell_1} + 25 \]

\( \ell_1 \) = total length [m] of spaces between cofferdam or cargo bulkhead and stern tube bulkhead.

Other terms as stated under [11.3.2].

Branch bilge pipes shall be dimensioned in accordance with [11.3.2].

11.3.2 Other vessels
a) Main bilge pipes

\[ d_H = 1.5 \cdot \sqrt{(B + D) \cdot L + 25} \]

b) Branch bilge pipes

\[ d_Z = 2.0 \cdot \sqrt{(B + D) \cdot \ell + 25} \]

d_H = inside diameter of main bilge pipe [mm]
d_Z = inside diameter of branch bilge pipe [mm]
L = Rule length [m] defined in Pt.3 Ch.1 Sec.1
B = breadth [m] defined in Pt.3 Ch.1 Sec.1
D = depth [m] defined in Pt.3 Ch.1 Sec.1
\ell = length of the watertight compartment [m]

11.4 Bilge pumps

11.4.1 Capacity of independent pumps
Each bilge pump shall be capable of delivering:

\[ Q = 5.75 \cdot 10^{-3} \cdot d_H^2 \]

\( Q \) = minimum capacity [m³/h]
d_H = calculated inside diameter of main bilge pipe [mm]

11.4.2 Where centrifugal pumps are used for bilge pumping, they shall be self-priming or connected to an air extracting device.
11.4.3 Capacity of attached bilge pumps
Bilge pumps having a smaller capacity than that specified in [11.4.1] are acceptable provided that the independent pumps are designed for a correspondingly larger capacity.

11.4.4 Use of other pumps for bilge pumping
Ballast pumps, general service pumps and similar units may also be used as independent bilge pumps provided they are of the required capacity according to [11.4.1]. Oil pumps may not be connected to the bilge system.

11.4.5 Number of bilge pumps
Vessels with a propulsion power of up to 225 kW shall have one bilge pump, which may be driven from the main engine. Where the propulsion power is greater than 225 kW, a second bilge pump driven independently of the main propulsion plant shall be provided.
On passenger vessels further bilge pumps may be required according to size and propulsion power.

11.5 Bilge pumping for various spaces

11.5.1 Machinery spaces
The bilges of every main machinery space shall be capable of being pumped as follows:

a) through the bilge suctions connected to the main bilge system and
b) through one direct suction connected to the largest independent bilge pump.

11.5.2 Fore and after peaks
Connection of the fore and after peaks to the general bilge system is not permitted. Where the peak tanks are not connected to the ballast system, separate means of pumping shall be provided. Where the after peak terminates at the engine room, it may be drained to the engine room bilge through a pipe fitted with a shut-off valve. Similar emptying of the fore peak into an adjoining space is not permitted.

11.5.3 Spaces above peak tanks
These spaces may either be connected to the bilge system or be pumped by means of hand-operated bilge pumps. Spaces above the after peak may be drained to the machinery space, provided that the drain line is fitted with a self-closing shut-off valve at a clearly visible and easily accessible position. The drain pipes shall have an inside diameter of at least 40 mm.

11.5.4 Cofferdams and void spaces
Bilge pumping arrangements shall be provided for cofferdams and void spaces.

11.5.5 Chain lockers
Chain lockers may be connected to the main bilge system or drained by a hand pump. Draining to the forepeak tank is not permitted.

12 Thermal oil systems

12.1 General
Thermal oil systems shall be installed in accordance with Ch.3 Sec.1 [3].

12.2 Pumps

12.2.1 Circulating pumps
One circulating pump shall be provided; as the second circulating pump, a complete spare pump stored on board can be accepted.
With the owner’s confirmation, the spare pump on board may be omitted.

12.2.2 Transfer pumps
A transfer pump shall be installed for filling the expansion tank.

12.2.3 The pumps shall be so mounted that any oil leakage can be safely disposed of.

12.2.4 For emergency stopping, see Sec.8 [2.3].

12.3 Valves

12.3.1 Only valves made of ductile materials may be used.

12.3.2 Valves shall be designed for a nominal pressure of PN 16.

12.3.3 Valves shall be mounted in accessible positions.

12.3.4 Non-return valves shall be fitted in the pressure lines of the pumps.

12.3.5 Valves in return pipes shall be secured in the open position.

12.4 Piping

12.4.1 The material of the sealing joints shall be suitable for permanent operation at the design temperature and resistant to the thermal oil.

12.4.2 Provision shall be made for thermal expansion by an appropriate pipe layout and the use of suitable compensators.

12.4.3 The pipe lines shall be preferably connected by means of welding. The number of detachable pipe connections shall be minimized.

12.4.4 The laying of pipes through accommodation, public or service spaces is not permitted.

12.4.5 Pipelines passing through cargo holds shall be installed in such a way that no damage can be caused.

12.4.6 Pipe penetrations through bulkheads and decks shall be insulated against conduction of heat.

12.4.7 The venting shall be so arranged that air/oil mixtures can be carried away without danger.

12.5 Tightness and operational testing

12.5.1 Location and equipment of thermal tanks
After installation, the entire arrangement shall be subjected to tightness and operational testing under the supervision of the Society.

12.6 Location and equipment of thermal oil tanks
For the location and equipment of thermal oil tanks, see Ch.3 Sec.1 [3].
12.7 Design pressure and test pressure
For design pressure and test pressure, see Ch.3 Sec.1 [3].

13 Air, sounding and overflow pipes

13.1 Air / overflow pipes

13.1.1 Tank equipment in general
All tanks, void spaces, etc. shall be fitted at their highest point with air pipes which shall normally terminate above the open deck.

The height of air and overflow pipes above deck shall be at least 0.45 m, for fuel oil tanks of tankers 0.5 m (see Pt.6 Ch.1 Sec.1 [3.5.1]).

Air and overflow pipes shall be laid vertically. Air and overflow pipes passing through cargo holds shall be protected against damage.

Where tanks are filled by pumping through permanently installed pipelines, the inside cross-section of the air pipes shall equal at least 125% that of the corresponding filling pipe.

Air pipes of lubricating oil storage tanks may terminate in the engine room. Air pipes of the lubricating oil storage tanks which form part of the vessel’s shell are to terminate in the engine room casing above the freeboard deck.

It is necessary to ensure that no leaking oil can spread on to heated surfaces where it may ignite.

The air pipes of lubricating oil tanks, gear and engine crankshaft casings shall not be led to a common line.

Cofferdams and void spaces with bilge connections shall be provided with air pipes terminating above the open deck.

13.2 Sounding pipes

13.2.1 General arrangement
Sounding pipes shall be provided for tanks, void spaces, cofferdams and bilges (bilge wells) in spaces which are not accessible at all times. As far as possible, sounding pipes shall be laid straight and are to extend as close as possible to the bottom of the tank.

Sounding pipes which terminate below the deepest load waterline shall be fitted with self-closing shutoff devices. Such sounding pipes are only permissible in spaces which are accessible at all times. All other sounding pipes shall be extended to the open deck. The sounding pipe openings shall always be accessible and fitted with watertight closures.

Sounding pipes of tanks shall be provided close to the top of the tank with holes for equalizing the pressure. A striking pad shall be fitted under every sounding pipe. Where sounding pipes are connected to the tanks over a lateral branch pipe, the branch-off under the sounding pipe shall be adequately reinforced.

13.2.2 Sounding pipes for fuel and lubricating oil
Where sounding pipes cannot be extended above the open deck, they shall be provided with self-closing shut-off devices as well as with self-closing test valves.

The openings of sounding pipes shall be located at a sufficient distance from boilers, electrical equipment and hot components.

Sounding pipes shall not terminate in accommodation or service spaces. They shall not be used as filling pipes.
13.3 Overflow pipes

13.3.1 Liquid fuel tanks
Where an overflow pipe is provided for liquid fuel tanks, the discharge shall generally led to an overflow tank of appropriate capacity.
Overflows from service tanks shall generally led back either to the fuel bunkers, or to an overflow tank of appropriate capacity.
Where filling of a tank is performed by a power pump, it is recommended to fit on the overflow pipe an alarm or a sight glass to indicate when the tank is full.

13.3.2 Design of overflow systems
Where overflows from service tanks intended to contain the same liquid or different ones are connected to a common main, provision shall be made to prevent any risk of intercommunication between the various tanks in the course of movements of liquid when emptying or filling.

13.3.3 Construction
Overflow pipes are normally to be made of the same material as the pipes serving the corresponding compartments.
In each compartment which can be pumped up, the total cross-section of overflow pipes shall not be less than required in [13.1.1].

14 Hose assemblies and compensators

14.1 Scope

14.1.1 The following requirements are applicable for hose assemblies and compensators made of non-metallic and metallic materials.

14.1.2 Hose assemblies and compensators made of non-metallic and metallic materials may be used according to their suitability in systems for fuel, lubricating oil, hydraulic oil, bilge, ballast, fresh water cooling, river water cooling, compressed air, auxiliary steam, exhaust gas and thermal oil, as well as in secondary piping systems.

14.1.3 Compensators made of non-metallic materials are not approved for the use in cargo lines of tankers.

14.2 Definitions

14.2.1 Hose assemblies consist of metallic or non-metallic hoses completed with end fittings ready for installation.
Compensators consist of bellows with end fittings as well as anchors for absorption of axial loads where angular or lateral flexibility shall be ensured. End fittings may be flanges, welding ends or approved pipe unions.
Burst pressure is the internal static pressure at which a hose assembly or compensator will be destroyed.

14.2.2 High-pressure hose assemblies made of non-metallic materials
Hose assemblies or compensators which are suitable for use in systems with predominantly static load characteristics.
14.2.3 Low-pressure hose assemblies and compensators
Hose assemblies or compensators which are suitable for use in systems with predominantly static load characteristics.

14.2.4 Maximum allowable working pressure respectively nominal pressure of hose assemblies and compensators made of non-metallic materials
The maximum allowable working pressure of high-pressure hose assemblies is the maximum dynamic internal pressure permitted to be imposed on the components.
The maximum allowable working pressure respectively nominal pressure for low-pressure hose assemblies and compensators is the maximum static internal pressure permitted to be imposed on the components.

14.2.5 Test pressure
For non-metallic high-pressure hose assemblies the test pressure is 2 times the maximum allowable working pressure.
For non-metallic low-pressure hose assemblies and compensators the test pressure is 1.5 times the maximum allowable working pressure or 1.5 times the nominal pressure.
For metallic hose assemblies and compensators the test pressure is 1.5 times the maximum allowable working pressure or 1.5 times the nominal pressure.

14.2.6 Burst pressure
For non-metallic as well as metallic hose assemblies and compensators the burst pressure shall be at least 4 times the maximum allowable working pressure or 4 times the nominal pressure. Excepted hereof are non-metallic hose assemblies and compensators with a maximum allowable working pressure or nominal pressure of not more than 20 bar. For such components the burst pressure has to be at least three times the maximum allowable working pressure or three times the nominal pressure. For hose assemblies and compensators in process and cargo piping for gas and chemical tankers the burst pressure is required to be at least 5 times the maximum allowable working pressure.

14.3 Requirements

14.3.1 Hoses and compensators used in the systems mentioned in [14.1.2] shall be type approved.

14.3.2 Manufacturers of hose assemblies and compensators shall be approved by the Society.

14.3.3 Hose assemblies and compensators including their couplings shall be suitable for media, pressures and temperatures they are designed for.

14.3.4 The selection of hose assemblies and compensators shall be based on the maximum allowable working pressure of the system concerned. A pressure of 5 bar shall be considered as the minimum working pressure.

14.3.5 Hose assemblies and compensators for the use in systems for fuel, lubricating oil, hydraulic oil, bilge and river water shall be flame-resistant

14.4 Installations

14.4.1 Non-metallic hose assemblies shall only be used at locations where they are required for compensation of relative movements. They shall be kept as short as possible under consideration of the installation instructions of the hose manufacturer.

14.4.2 The minimum bending radius of installed hose assemblies shall not be less than specified by the manufacturers.
14.4.3 Non-metallic hose assemblies and compensators shall be located at visible and accessible positions.

14.4.4 In fresh water systems with a working pressure of ≤ 5 bar and in charging and scavenging air lines, hoses may be fastened to the pipe ends with double clips.

14.4.5 Where hose assemblies and compensators are installed in the vicinity of hot components they shall be provided with approved heat-resistant sleeves.

14.5 Tests
Hose assemblies and compensators shall be subjected in the manufacturer’s works to a pressure test in accordance with [2.4] under the supervision of the Society.

14.6 Vessel cargo hoses

14.6.1 Vessel cargo hoses for cargo-handling on chemical tankers and gas tankers shall be type-approved. Mounting of end fittings shall be carried out only by approved manufacturers.

14.6.2 Vessel cargo hoses shall be subjected to final inspection at the manufacturer under supervision of a surveyor as follows:
— visual inspection
— hydrostatic pressure test with 1.5 times the maximum allowable working pressure or 1.5 times the nominal pressure. The nominal pressure shall be at least 10 bar
— measuring of the electrical resistance between the end fittings. The resistance shall not exceed 1 kΩ

14.7 Marking
Hose assemblies and compensators shall be permanently marked with the following particulars:
— manufacturer’s mark or symbol
— date of manufacturing
— type
— nominal diameter
— maximum allowable working pressure respectively nominal pressure
— test certificate number and sign of the Society.
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