

# Amended Rules for the Classification of Steel Ships

## (Part 5 Machinery Installations)

Dec. 2019



KR

## - Main Amendments -

### (1) Effective date : 1 Jan. 2020 (Date of which contracts for construction are signed)

- Clarify the meaning of alternative and novel features.
- The word "up to an angle of inclination of 45 degree" has been deleted regarding switching operation or operational changes in the inclined condition reflecting the amendment of IACS UR M46(Rev.2 Dec 2018).
- Lignum vitae in sea water lubricated bearings has been deleted reflecting the amendment of IACS UR M52(Rev.1 Jan 2019).
- Newly added content of IACS UR P2.13(New Oct 2018) has been reflected.
- MSC.1/Circ.1567(June 2017) has been reflected.(Criteria for pipes passing through collision bulkheads are classified as cargo ships and passenger ships, and the use of butterfly valves is permitted only for cargo ships.)

### (2) Effective date : 1 Jan. 2020(Date of application for approval)

- The amendments in IACS UR M72(Rev.2 Jan 2019) regarding engine components have been reflected.
- Amendments of IACS UR P2.7.4(Rev.9 Oct 2018) has been reflected.(examples and adaptations of mechanical joints in common compression formats are added).

(1) Effective date : 1 Jan 2020

(Date of which contracts for construction are signed)

Present	Amendment
<p style="text-align: center;"><b>CHAPTER 1 GENERAL</b></p> <p style="text-align: center;"><b>Section 1 General</b></p> <p><b>101. Application</b></p> <ol style="list-style-type: none"> <li>1. The requirements of this Part apply to the machinery installations intended for the ships which have no special limitations for their service area and purpose. For machinery installations intended for the ships having any limitations for their service area or intended for the small ships, the requirements in this Part may be modified. Special consideration is to be given to the ships with any limitations for their purpose. <b>【See Guidance】</b></li> <li>2. <u>The machinery installations which do not comply with the requirements of this Part may be accepted, provided that they are considered acceptable by the Society. <b>【See Guidance】</b></u></li> <li>3. ~ 8. &lt;omitted&gt;</li> </ol>	<p style="text-align: center;"><b>CHAPTER 1 GENERAL</b></p> <p style="text-align: center;"><b>Section 1 General</b></p> <p><b>101. Application</b></p> <ol style="list-style-type: none"> <li>1. The requirements of this Part apply to the machinery installations intended for the ships which have no special limitations for their service area and purpose. For machinery installations intended for the ships having any limitations for their service area or intended for the small ships, the requirements in this Part may be modified. Special consideration is to be given to the ships with any limitations for their purpose. <b>【See Guidance】</b></li> <li>2. <u>The equivalence of alternative and novel features which deviate from or are not directly applicable to the Rules is to be in accordance with <b>Pt 1, Ch 1 of Rules.</b></u></li> <li>3. ~ 8. &lt;same as the present&gt;</li> </ol>

Present	Amendment																																														
<p><b>103. Construction, materials and installation</b></p> <p><b>1. &lt;omitted&gt;</b></p> <p><b>Table 5.1.2 Angle of inclination</b></p> <table border="1"> <thead> <tr> <th rowspan="3">Type of machinery installations</th> <th colspan="4">Angle of inclination (deg)<sup>(2)</sup></th> </tr> <tr> <th colspan="2">Athwart-ships</th> <th colspan="2">Fore-and-aft</th> </tr> <tr> <th>Static</th> <th>Dyna mic</th> <th>Static</th> <th>Dyna mic</th> </tr> </thead> <tbody> <tr> <td>Main and auxiliary machinery</td> <td>15</td> <td>22.5</td> <td>5<sup>(4)</sup></td> <td>7.5</td> </tr> <tr> <td>Safety equipment (emergency power installations, emergency fire pumps and their devices) Switch gear<sup>(1)</sup> (electrical and electronic appliances and remote control systems)</td> <td>22.5<sup>(3)</sup></td> <td>22.5<sup>(3)</sup></td> <td>10</td> <td>10</td> </tr> </tbody> </table> <p>NOTES:</p> <p>(1) <u>Up to an angle of inclination of 45° no</u> undesired switching operation or operational changes <u>may</u> occur.</p> <p>(2) Athwartships and fore-and-aft inclinations may occur simultaneously.</p> <p>(3) In ships for the carriage of liquefied gases and of chemicals the emergency power supply must also remain operable with the ship flooded to a final athwartships inclination up to a maximum of 30 degrees.</p> <p>(4) Where the length of the ship exceeds 100 m, the fore-and-aft static angle of inclination may be taken as <math>500/L</math> degrees. (<math>L</math> : Length of the ship as defined in <b>Part 3, Ch 1, 102.</b> of the Rules, m)</p> <p>(hereafter, omitted)</p>	Type of machinery installations	Angle of inclination (deg) <sup>(2)</sup>				Athwart-ships		Fore-and-aft		Static	Dyna mic	Static	Dyna mic	Main and auxiliary machinery	15	22.5	5 <sup>(4)</sup>	7.5	Safety equipment (emergency power installations, emergency fire pumps and their devices) Switch gear <sup>(1)</sup> (electrical and electronic appliances and remote control systems)	22.5 <sup>(3)</sup>	22.5 <sup>(3)</sup>	10	10	<p><b>103. Construction, materials and installation</b></p> <p><b>1. &lt;same as the present&gt;</b></p> <p><b>Table 5.1.2 Angle of inclination</b></p> <table border="1"> <thead> <tr> <th rowspan="3">Type of machinery installations</th> <th colspan="4">Angle of inclination (deg)<sup>(2)</sup></th> </tr> <tr> <th colspan="2">Athwart-ships</th> <th colspan="2">Fore-and-aft</th> </tr> <tr> <th>Static</th> <th>Dyna mic</th> <th>Static</th> <th>Dyna mic</th> </tr> </thead> <tbody> <tr> <td>Main and auxiliary machinery</td> <td>15</td> <td>22.5</td> <td>5<sup>(4)</sup></td> <td>7.5</td> </tr> <tr> <td>Safety equipment (emergency power installations, emergency fire pumps and their devices) Switch gear<sup>(1)</sup> (electrical and electronic appliances and remote control systems)</td> <td>22.5<sup>(3)</sup></td> <td>22.5<sup>(3)</sup></td> <td>10</td> <td>10</td> </tr> </tbody> </table> <p>NOTES:</p> <p>(1) <del>Up to an angle of inclination of 45°</del> <u>No</u> undesired switching operation or operational changes <u>are to</u> occur.</p> <p>(2) Athwartships and fore-and-aft inclinations may occur simultaneously.</p> <p>(3) In ships for the carriage of liquefied gases and of chemicals the emergency power supply must also remain operable with the ship flooded to a final athwartships inclination up to a maximum of 30 degrees.</p> <p>(4) Where the length of the ship exceeds 100 m, the fore-and-aft static angle of inclination may be taken as <math>500/L</math> degrees. (<math>L</math> : Length of the ship as defined in <b>Part 3, Ch 1, 102.</b> of the Rules, m)</p> <p>(hereafter, same as the present Rules)</p>	Type of machinery installations	Angle of inclination (deg) <sup>(2)</sup>				Athwart-ships		Fore-and-aft		Static	Dyna mic	Static	Dyna mic	Main and auxiliary machinery	15	22.5	5 <sup>(4)</sup>	7.5	Safety equipment (emergency power installations, emergency fire pumps and their devices) Switch gear <sup>(1)</sup> (electrical and electronic appliances and remote control systems)	22.5 <sup>(3)</sup>	22.5 <sup>(3)</sup>	10	10
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Present	Amendment
<p style="text-align: center;"><b>CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS</b></p> <p style="text-align: center;"><b>Section 2 Shaftings</b></p> <p>201. ~ 205. &lt;omitted&gt;</p> <p><b>206. Stern tube bearing and sealing device</b></p> <p>1. The length of stern bearing in the stern tube or of strut bearing supporting the weight of propeller is to comply with the following requirements.</p> <p>(1) The bearings are to be type approved by the Society in their materials, construction and lubricating arrangements when rubber or synthetic materials are used.</p> <p>(2) For sea water lubricated bearings <u>of lignum vitae, rubber or synthetic materials</u>, the length of the bearing is to be not less than 4 times the required diameter of the shaft in way of the bearing. However when rubber or synthetic materials are used, where the material has been proven satisfaction of society through testing and operating experience, consideration may be given to an increased bearing pressure or a lessened bearing length. In this case, the length of the bearing is to be not less than 2 times the required diameter of the shaft in way of the bearing.</p> <p>(hereafter, omitted)</p>	<p style="text-align: center;"><b>CHAPTER 3 PROPULSION SHAFTING AND POWER TRANSMISSION SYSTEMS</b></p> <p style="text-align: center;"><b>Section 2 Shaftings</b></p> <p>201. ~ 205. &lt;same as the present&gt;</p> <p><b>206. Stern tube bearing and sealing device</b></p> <p>1. The length of stern bearing in the stern tube or of strut bearing supporting the weight of propeller is to comply with the following requirements.</p> <p>(1) The bearings are to be type approved by the Society in their materials, construction and lubricating arrangements when rubber or synthetic materials are used.</p> <p>(2) For sea water lubricated bearings <del>of lignum vitae, rubber or synthetic materials</del>, the length of the bearing is to be not less than 4 times the required diameter of the shaft in way of the bearing. However when rubber or synthetic materials are used, where the material has been proven satisfaction of society through testing and operating experience, consideration may be given to an increased bearing pressure or a lessened bearing length. In this case, the length of the bearing is to be not less than 2 times the required diameter of the shaft in way of the bearing.</p> <p>(hereafter, same as the present Rules)</p>

Present	Amendment
<p style="text-align: center;"><b>CHAPTER 6 AUXILIARIES AND PIPING ARRANGEMENT</b></p> <p style="text-align: center;"><b>Section 1 General</b></p> <p style="text-align: center;">&lt;omitted&gt;</p> <p><b>107. General requirements for piping arrangement</b></p> <p style="text-align: center;">&lt;omitted&gt;</p> <p><b>2. Protection of pipes and fittings</b></p> <p style="text-align: center;">&lt;omitted&gt;</p> <p>(4) <u>&lt;Added&gt;</u></p>	<p style="text-align: center;"><b>CHAPTER 6 AUXILIARIES AND PIPING ARRANGEMENT</b></p> <p style="text-align: center;"><b>Section 1 General</b></p> <p style="text-align: center;">&lt;same as present&gt;</p> <p><b>107. General requirements for piping arrangement</b></p> <p style="text-align: center;">&lt;same as present&gt;</p> <p><b>2. Protection of pipes and fittings</b></p> <p style="text-align: center;">&lt;same as present&gt;</p> <p>(4) <u>Seawater pipes located in cargo holds and in other spaces where pipes may be subject to impacts (e.g. fish holds, chain lockers), are to be protected from mechanical damage. (2020)</u></p>

Present	Amendment
<p data-bbox="667 276 786 300" style="text-align: center;">&lt;omitted&gt;</p> <p data-bbox="322 371 842 395"><b>8. Watertight bulkheads [See Guidance]</b></p> <p data-bbox="356 416 1133 501">(1) Valves or cocks such as drain valves, which do not constitute a part of any pipe line are not to be fitted on the collision bulkhead.</p> <p data-bbox="356 507 1133 810">(2) <u>Except as provided in para. (3), the collision bulkhead may be pierced below the bulkhead deck by not more than one(1) pipe for dealing with fluid in the forepeak tank in principle and the pipe is to be fitted with a screw-down valve capable of being operated from above the bulkhead deck, the valve chest being secured inside the forepeak to the collision bulkhead. The valve, however, may be fitted on the after side of the collision bulkhead provide that the valves are readily accessible under all service conditions and the space in which they are located is not a cargo space.</u></p> <p data-bbox="667 1074 786 1098" style="text-align: center;">&lt;omitted&gt;</p>	<p data-bbox="1464 276 1682 300" style="text-align: center;">&lt;same as present&gt;</p> <p data-bbox="1167 371 1686 395"><b>8. Watertight bulkheads [See Guidance]</b></p> <p data-bbox="1200 416 1977 501">(1) Valves or cocks such as drain valves, which do not constitute a part of any pipe line are not to be fitted on the collision bulkhead.</p> <p data-bbox="1200 507 1977 1026">(2) <u>Except as provided in para. (3), the collision bulkhead may be pierced below the bulkhead deck of passenger ships and the freeboard deck of cargo ships by not more than one pipe for dealing with fluid in the forepeak tank, provided that the pipe is fitted with a screw-down valve capable of being operated from above the bulkhead deck of passenger ships and the freeboard deck of cargo ships, the valve being located inside the forepeak at the collision bulkhead. The valve, however, may be the fitted on the after side of the collision bulkhead provided that the valve is readily accessible under all service conditions and the space in which it is located is not a cargo space. Alternatively, for cargo ships, the pipe may be fitted with a butterfly valve suitably supported by a seat or flanges and capable of being operated from above the freeboard deck. All valves shall be of steel, bronze or other approved ductile material. Valves of ordinary cast iron or similar material are not acceptable. (2020)</u></p> <p data-bbox="1464 1074 1682 1098" style="text-align: center;">&lt;same as present&gt;</p>



(2) Effective date : 1 Jan 2020

(Date of application for approval)

Present	Amendment
<p style="text-align: center;"><b>CHAPTER 1 GENERAL</b></p> <p style="text-align: center;"><b>Section 1 General</b></p> <p><b>102. Definitions</b></p> <p>1. ~ 25. &lt;omitted&gt;</p> <p><b>26. KR Certificate (KRC)</b> is a document issued by the Society stating below.</p> <ol style="list-style-type: none"> <li>(1) Conformity with the requirements of the Rules</li> <li>(2) The tests and inspections have been carried out on the <u>certified product itself, or on samples taken from the certified product itself.</u></li> <li>(3) The inspection and tests were performed in the presence of the Surveyor or in accordance with quality assurance system.</li> </ol> <p><b>27. Work's Certificate (W)</b> is a document signed by the manufacturer stating below.</p> <ol style="list-style-type: none"> <li>(1) Conformity with the requirements</li> <li>(2) The tests and inspections have been carried out on the <u>certified product itself, or on samples taken from the raw material, used for the product to be certified.</u></li> <li>(3) The tests were witnessed and signed by a qualified representative of the applicable department of the manufacturer.</li> </ol> <p><b>28. Test Report (TR)</b> is a document signed by the manufacturer stating below.</p> <ol style="list-style-type: none"> <li>(1) Conformity with the requirements</li> <li>(2) The tests and inspections have been carried out on samples from the current production.</li> </ol> <p>(hereafter, omitted)</p>	<p style="text-align: center;"><b>CHAPTER 1 GENERAL</b></p> <p style="text-align: center;"><b>Section 1 General</b></p> <p><b>102. Definitions</b></p> <p>1. ~ 25. &lt;same as the present&gt;</p> <p><b>26. KR Certificate (KRC)</b> is a document issued by the Society stating below.</p> <ol style="list-style-type: none"> <li>(1) Conformity with the requirements of the Rules</li> <li>(2) The tests and inspections have been carried out on the <u>finished certified component itself; or on samples taken from earlier stages in the production of the component, when applicable. (2020)</u></li> <li>(3) The inspection and tests were performed in the presence of the Surveyor or in accordance with quality assurance system.</li> </ol> <p><b>27. Work's Certificate (W)</b> is a document signed by the manufacturer stating below.</p> <ol style="list-style-type: none"> <li>(1) Conformity with the requirements</li> <li>(2) The tests and inspections have been carried out on the <u>finished certified component itself; or on samples taken from earlier stages in the production of the component, when applicable. (2020)</u></li> <li>(3) The tests were witnessed and signed by a qualified representative of the applicable department of the manufacturer.</li> </ol> <p><b>28. Test Report (TR)</b> is a document signed by the manufacturer stating below.</p> <ol style="list-style-type: none"> <li>(1) Conformity with the requirements</li> <li>(2) The tests and inspections have been carried out on samples from the current production <u>batch.</u></li> </ol> <p>(hereafter, same as the present Rules)</p>

Present	Amendment
<p style="text-align: center;"><b>CHAPTER 2 MAIN AND AUXILIARY ENGINES</b></p> <p style="text-align: center;"><b>Section 2 Internal Combustion Engines</b></p> <p>201. ~ 210. &lt;omitted&gt;</p> <p><b>211. Tests and Inspections</b></p> <p><b>1. Test of engine components</b></p> <p>(1) &lt;omitted&gt;</p> <p>(2) The manufacturer is not exempted from responsibility for any relevant tests and inspections of those parts for which documentation is not explicitly requested by the Society. <u>Manufacturing works</u> is to be <u>equipped</u> in such a way that all materials and components can be consistently produced to the required standard. This includes production and assembly lines, machining units, special tools and devices, assembly and testing rigs as well as all lifting and transportation devices. <i>(2017)</i></p> <p>(hereafter, omitted)</p>	<p style="text-align: center;"><b>CHAPTER 2 MAIN AND AUXILIARY ENGINES</b></p> <p style="text-align: center;"><b>Section 2 Internal Combustion Engines</b></p> <p>201. ~ 210. &lt;same as the present&gt;</p> <p><b>211. Tests and Inspections</b></p> <p><b>1. Test of engine components</b></p> <p>(1) &lt;same as the present&gt;</p> <p>(2) The manufacturer is not exempted from responsibility for any relevant tests and inspections of those parts for which documentation is not explicitly requested by the Society. <u>The manufacturing process and equipment</u> is to be <u>set up and maintained</u> in such a way that all materials and components can be consistently produced to the required standard. This includes production and assembly lines, machining units, special tools and devices, assembly and testing rigs as well as all lifting and transportation devices. <i>(2020)</i></p> <p>(hereafter, same as the present Rules)</p>

<Present>

Table 5.2.4 Test and inspection of engine components (2017)

Component	Material properties <sup>(1)</sup>	Non-destructive examination <sup>(2)</sup>	Hydraulic testing <sup>(3)</sup>	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines <sup>(6)</sup>	Component certificate	
Welded bedplate	W(C+M)	W(UT+CD)			fit-up + post-welding	All	KRC	
Bearing transverse girders GS	W(C+M)	W(UT+CD)			X	All	KRC	
Welded frame box	W(C+M)	W(UT+CD)			fit-up + post-welding	All	KRC	
Cylinder block GJL			W <sup>(5)</sup>			<u>CH</u>		
Cylinder block GJS			W <sup>(5)</sup>			<u>CH</u>		
Welded cylinder frames	W(C+M)	W(UT+CD)			fit-up + post-welding	CH	KRC	
Engine block GJL			W <sup>(5)</sup>			>400 kW/cyl.		
Engine block GJS	W(M)		W <sup>(5)</sup>			>400 kW/cyl.		
Cylinder liner	W(C+M)		W <sup>(5)</sup>			D>300 mm		
Cylinder head GJL			W			D>300 mm		
Cylinder head GJS			W			D>300 mm		
Cylinder head GS	W(C+M)	W(UT+CD)	W		X	D>300 mm	KRC	
Forged cylinder head	W(C+M)	W(UT+CD)	W		X	D>300 mm	KRC	
Piston crown GS	W(C+M)	W(UT+CD)			X	D>400 mm	KRC	
Forged piston crown	W(C+M)	W(UT+CD)			X	D>400 mm	KRC	
Crankshaft: made in one piece	KRC(C+M)	W(UT+CD)		W	Random, of fillets and oil bores	All	KRC	
Semi-built crankshaft	<u>Crank throw</u>	<u>KRC(C+M)</u>	<u>W(UT+CD)</u>		<u>W</u>	<u>Random, of fillets and shrink fittings</u>	<u>All</u>	KRC
	<u>Forged main journal and journals with flange</u>	<u>KRC(C+M)</u>	<u>W(UT+CD)</u>		<u>W</u>	<u>Random, of shrink fittings</u>	<u>All</u>	
Exhaust gas valve cage			W			CH		
Piston rod, if applicable	KRC(C+M)	W(UT+CD) <u>CD again after final machining (grinding)</u>			Random	<u>D&gt;400 mm</u>	KRC	

<Present>

**Table 5.2.4 Test and inspection of engine components (continued)**

Component	Material properties <sup>(1)</sup>	Non-destructive examination <sup>(2)</sup>	Hydraulic testing <sup>(3)</sup>	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines	Component certificate
Cross head	KRC(C+M)	W(UT+CD) <u>CD again after final machining (grinding and polishing)</u>			Random	CH	KRC
Connecting rod with cap	KRC(C+M)	W(UT+CD)		W	Random, of all surfaces, in particular those shot peened	All	KRC
Coupling bolts for crankshaft	KRC(C+M)	W(UT+CD)		W	Random, of interference fit	All	KRC
Bolts and studs for main bearings	W(C+M)	W(UT+CD)				D>300 mm	
Bolts and studs for cylinder heads	W(C+M)	W(UT+CD)				D>300 mm	
Bolts and studs for connecting rods	W(C+M)	W(UT+CD)		TR of thread making		D>300 mm	
Tie rod	W(C+M)	W(UT+CD)		TR of thread making	Random	CH	KRC
High pressure fuel injection pump body			W			D>300 mm	
			TR			D≤300 mm	
High pressure fuel injection valves (only for those not autofretted <sup>(7)</sup> )			W			D>300 mm	
			TR			D≤300 mm	
High pressure fuel injection pipes including common fuel rail	W(C+M)		W for those that are not autofretted <sup>(7)</sup>			D>300 mm	
			TR for those that are not autofretted <sup>(7)</sup>			D≤300 mm	
High pressure common servo oil system	W(C+M)		W			D>300 mm	
			TR			D≤300 mm	
Cooler, both sides <sup>(4)</sup>	W(C+M)		W			D>300 mm	

<Present>

**Table 5.2.4 Test and inspection of engine components (continued)**

Component	Material properties <sup>(1)</sup>	Non-destructive examination <sup>(2)</sup>	Hydraulic testing <sup>(3)</sup>	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines <sup>(6)</sup>	Component certificate
Accumulator of common rail fuel or servo oil system	W(C+M)		W			All engines with accumulators with a capacity of >0.5 l	
Piping, pumps, actuators, etc. for hydraulic drive of valves, if applicable	W(C+M)		W			>800 kW/cyl.	
Engine driven pumps (oil, water, fuel, bilge)			W			>800 kW/cyl.	
Bearings for main, crosshead, and crankpin	TR(C)	TR (UT for full contact between basic material and bearing metal)		W		>800 kW/cyl.	

NOTES:

- C : Chemical composition
- M : Mechanical properties
- CD : Crack detection by Magnetic particle test or liquid penetrant test
- UT : Ultrasonic testing
- CH : Crosshead engines
- GJL : Grey iron casting
- GJS : Spheroidal graphite iron casting
- GS : Steel casting
- D : Cylinder bore diameter
- KRC : KR Certificate
- W : Work's certificate (refer to **Ch 1, 301. 2**)
- TR : Test report
- X : Visual examination of accessible surfaces by the Surveyor

- (1) Material properties include chemical composition and mechanical properties, and also surface treatment such as surface hardening (hardness, depth and extent), peening and rolling (extent and applied force).
- (2) Non-destructive examination means e.g. ultrasonic testing, crack detection by magnetic particle tests or liquid penetrant tests.
- (3) Hydraulic testing is applied on the water/oil side of the component. Items are to be tested by hydraulic pressure at the pressure equal to 1.5 times the maximum working pressure. High pressure parts of the fuel injection system are to be tested by hydraulic pressure at the pressure equal to 1.5 maximum working pressure or maximum working pressure plus 300 bar, whichever is the less. Where design or testing features may require modification of these test requirements, special consideration may be given.
- (4) Charge air coolers need only be tested on the water side.
- (5) Hydraulic testing is also required for those parts filled with cooling water and having the function of containing the water which is in contact with the cylinder or cylinder liner.
- (6) For the small auxiliary engines at discretion of the Society, **Ch 2, 101. 1** is to be applied.
- (7) Manufacturers using autofretted method are to obtain the manufacturer approval by the Society. (2018)

<New>

Table 5.2.4 Test and inspection of engine components (2017)

Component	Material properties <sup>(1)</sup>	Non-destructive examination <sup>(2)</sup>	Hydraulic testing <sup>(3)</sup>	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines <sup>(6)</sup>	Component certificate
Welded bedplate	W(C+M)	W(UT+CD)			fit-up + post-welding	All	KRC
Bearing transverse girders GS	W(C+M)	W(UT+CD)			X	All	KRC
Welded frame box	W(C+M)	W(UT+CD)			fit-up + post-welding	All	KRC
Cylinder block GJL			W <sup>(5)</sup>			>400 kW/cyl.	
Cylinder block GJS			W <sup>(5)</sup>			>400 kW/cyl.	
Welded cylinder frames	W(C+M)	W(UT+CD)			fit-up + post-welding	CH	KRC
Engine block GJL			W <sup>(5)</sup>			>400 kW/cyl.	
Engine block GJS	W(M)		W <sup>(5)</sup>			>400 kW/cyl.	
Cylinder liner	W(C+M)		W <sup>(5)</sup>			D>300 mm	
Cylinder head GJL			W			D>300 mm	
Cylinder head GJS			W			D>300 mm	
Cylinder head GS	W(C+M)	W(UT+CD)	W		X	D>300 mm	KRC
Forged cylinder head	W(C+M)	W(UT+CD)	W		X	D>300 mm	KRC
Piston crown GS	W(C+M)	W(UT+CD)			X	D>400 mm	KRC
Forged piston crown	W(C+M)	W(UT+CD)			X	D>400 mm	KRC
Crankshaft: made in one piece	KRC(C+M)	W(UT+CD)		W	Random, of fillets and oil bores	All	KRC
Semi-built crankshaft (Crank throw, forged main journal and journals with flange)	KRC(C+M)	W(UT+CD)		W	Random, of fillets and shrink fittings	All	KRC
Exhaust gas valve cage			W			CH	
Piston rod, if applicable	KRC(C+M)	W(UT+CD) <del>ED</del> again after final machining (grinding)			Random	D>400 mm CH	KRC

<New>

Table 5.2.4 Test and inspection of engine components (continued)

Component	Material properties <sup>(1)</sup>	Non-destructive examination <sup>(2)</sup>	Hydraulic testing <sup>(3)</sup>	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines	Component certificate
Cross head	KRC(C+M)	W(UT+CD) <del>ED</del> again after final machining (grinding and polishing)			Random	CH	KRC
Connecting rod with cap	KRC(C+M)	W(UT+CD)		W	Random, of all surfaces, in particular those shot peened	All	KRC
Coupling bolts for crankshaft	KRC(C+M)	W(UT+CD)		W	Random, of interference fit	All	KRC
Bolts and studs for main bearings	W(C+M)	W(UT+CD)				D>300 mm	
Bolts and studs for cylinder heads	W(C+M)	W(UT+CD)				D>300 mm	
Bolts and studs for connecting rods	W(C+M)	W(UT+CD)		TR of thread making		D>300 mm	
Tie rod	W(C+M)	W(UT+CD)		TR of thread making	Random	CH	KRC
High pressure fuel injection pump body	<u>W(C+M)<sup>(8)</sup></u>		W			D>300 mm	
	<u>W(C+M)<sup>(8)</sup></u>		TR			D≤300 mm	
High pressure fuel injection valves (only for those not autofretted <sup>(7)</sup> )			W			D>300 mm	
			TR			D≤300 mm	
High pressure fuel injection pipes including common fuel rail	<u>W(C+M)<sup>(8)</sup></u>		W for those that are not autofretted <sup>(7)</sup>			D>300 mm	
	<u>W(C+M)<sup>(8)</sup></u>		TR for those that are not autofretted <sup>(7)</sup>			D≤300 mm	
High pressure common servo oil system	<u>W(C+M)<sup>(8)</sup></u>		W			D>300 mm	
	<u>W(C+M)<sup>(8)</sup></u>		TR			D≤300 mm	
Cooler, both sides <sup>(4)</sup>	<u>W(C+M)<sup>(9)</sup></u>		W			D>300 mm	



<New>

**Table 5.2.4 Test and inspection of engine components (continued)**

Component	Material properties <sup>(1)</sup>	Non-destructive examination <sup>(2)</sup>	Hydraulic testing <sup>(3)</sup>	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines <sup>(6)</sup>	Component certificate
Accumulator of common rail fuel or servo oil system	W(C+M) <sup>(8)</sup>		W			All engines with accumulators with a capacity of >0.5 l	
Piping, pumps, actuators, etc. for hydraulic drive of valves, if applicable	W(C+M) <sup>(8)</sup>		W			>800 kW/cyl.	
Engine driven pumps (oil, water, fuel, bilge) other than high pressure fuel injection pump body and pump for hydraulic drive of valve above			W			>800 kW/cyl.	
Bearings for main, crosshead, and crankpin	TR(C)	TR (UT for full contact between base material and bearing metal)		W <sup>(8)</sup>		>800 kW/cyl.	

NOTES:

- C : Chemical composition
- M : Mechanical properties
- CD : Crack detection by Magnetic particle test or liquid penetrant test
- UT : Ultrasonic testing
- CH : Crosshead engines
- GJL : Grey iron casting
- GJS : Spheroidal graphite iron casting
- GS : Steel casting
- D : Cylinder bore diameter
- KRC : KR Certificate
- W : Work's certificate (refer to **Ch 1, 301. 2**)
- TR : Test report
- X : Visual examination of accessible surfaces by the Surveyor

- (1) Material properties include chemical composition and mechanical properties, and also surface treatment such as surface hardening (hardness, depth and extent), peening and rolling (extent and applied force).
- (2) Non-destructive examination means e.g. ultrasonic testing, crack detection by magnetic particle tests or liquid penetrant tests.
- (3) Hydraulic testing is applied on the water/oil side of the component. Items are to be tested by hydraulic pressure at the pressure equal to 1.5 times the maximum working pressure. High pressure parts of the fuel injection system are to be tested by hydraulic pressure at the pressure equal to 1.5 maximum working pressure or maximum working pressure plus 300 bar, whichever is the less. Where design or testing features may require modification of these test requirements, special consideration may be given.
- (4) Charge air coolers need only be tested on the water side.
- (5) Hydraulic testing is also required for those parts filled with cooling water and having the function of containing the water which is in contact with the cylinder or cylinder liner.
- (6) For the small auxiliary engines at discretion of the Society, **Ch 2, 101. 1** is to be applied.
- (7) Manufacturers using autofretted method are to obtain the manufacturer approval by the Society. (2018)
- (8) The manufacturer approval in accordance with **Ch 1, 301. 2** may be omitted. (2020)
- (9) The application of classification for pressure vessels given in **Ch 5, 303. 1** is to be complied with. (2020)

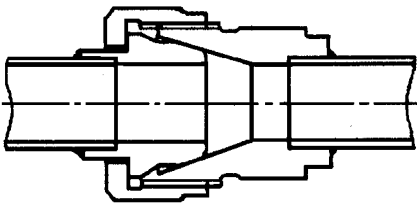
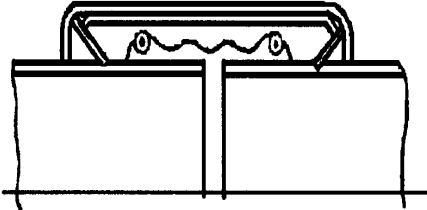
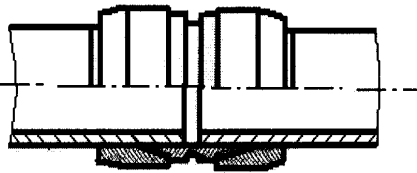
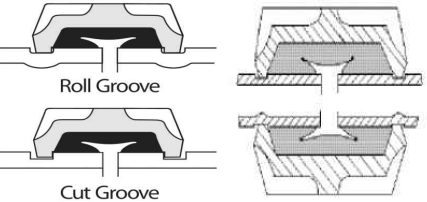
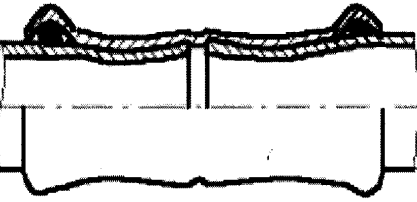
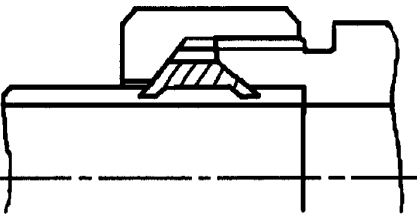
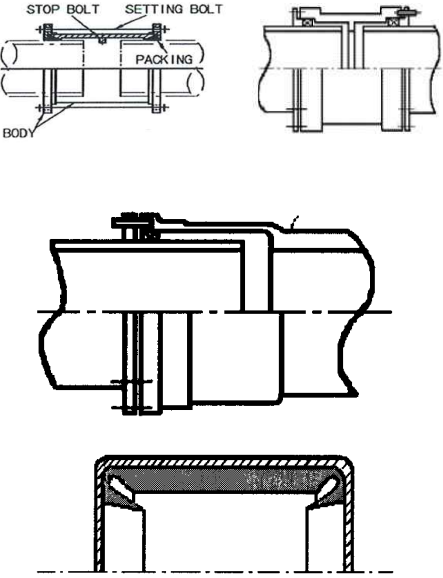
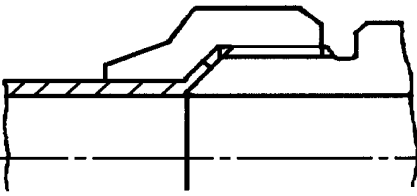
**CHAPTER 6 AUXILIARIES AND PIPING ARRANGEMENT**

**Section 1 General**

<omitted>

**104. Type of connections**

<omitted>

Type of mechanical joints	Examples of mechanical joints	Type of mechanical joints	Examples of mechanical joints
	Pipe union		Slip-on joints
Welded and brazed types		Grip type	
	Compression couplings		
Swage type		Machine grooved type	 <p>Roll Groove</p> <p>Cut Groove</p>
Press type			
Bite type		Slip type	 <p>STOP BOLT    SETTING BOLT</p> <p>PACKING</p> <p>BODY</p>
Flared type			

**Fig 5.6.2 Examples of Mechanical Joints**

## Present

<omitted>

**Table 5.6.10 Application of Mechanical Joints**

Systems		Kind of connections		
		Pipe Unions	Compression Couplings	Slip-on joints
Flammable fluids (Flash point $\leq$ 60 °C)				
1	Cargo oil lines <sup>(4)</sup>	○	○	○
2	Crude oil washing lines <sup>(4)</sup>	○	○	○
3	Vent lines <sup>(3)</sup>	○	○	○
4	Water seal effluent lines	○	○	○
5	Scrubber effluent lines	○	○	○
6	Main lines <sup>(2)(4)</sup>	○	○	○
7	Distributions lines <sup>(4)</sup>	○	○	○
Flammable fluids (Flash point $>$ 60 °C)				
8	Cargo oil lines <sup>(4)</sup>	○	○	○
9	Fuel oil lines <sup>(3)(2)</sup>	○	○	○
10	Lubricating oil lines <sup>(2)(3)</sup>	○	○	○
11	Hydraulic oil <sup>(2)(3)</sup>	○	○	○
12	Thermal oil <sup>(2)(3)</sup>	○	○	○
Sea water				
13	Bilge lines <sup>(1)</sup>	○	○	○
14	Water filled fire extinguishing systems, e.g. sprinkler systems <sup>(3)</sup>	○	○	○
15	Non water filled fire extinguishing systems, e.g. foam, drencher systems <sup>(3)</sup>	○	○	○
16	Fire main (not permanently filled) <sup>(3)</sup>	○	○	○
17	Ballast system <sup>(1)</sup>	○	○	○
18	Cooling water system <sup>(1)</sup>	○	○	○
19	Tank cleaning services	○	○	○
20	Non-essential systems	○	○	○

## Present

**Table 5.6.10 Application of Mechanical Joints (continued)**

Systems		Kind of connections		
		Pipe Unions	Compression Couplings <sup>6)</sup>	Slip-on joints
Fresh water				
21	Cooling water system <sup>1)</sup>	○	○	○
22	Condensate return <sup>1)</sup>	○	○	○
23	Non-essential system	○	○	○
Sanitary/Drains/Scuppers				
24	Deck drains (internal) <sup>6)</sup>	○	○	○ <sup>4)</sup>
25	Sanitary drains	○	○	○
26	Scuppers and discharge (overboard)	○	○	-
Sounding/Vent				
27	Water tanks/Dry spaces	○	○	○
28	Oil tanks (f.p. > 60 °C) <sup>2)(3)</sup>	○	○	○
Miscellaneous				
29	Starting/Control air <sup>1)</sup>	○	○	-
30	Service air (non-essential)	○	○	○
31	Brine	○	○	○
32	CO <sub>2</sub> system <sup>1)</sup>	○	○	-
33	Steam	○	○	○ <sup>5)</sup>

Abbreviations      ○ : Application is allowed,   - : Application is not allowed

**NOTES - Fire resistance capability**

If mechanical joints include any components which readily deteriorate in case of fire, they are to be of an approved fire resistant type under consideration of the following footnotes:

- 1) Inside machinery spaces of category A - only approved fire resistant types.
- 2) Not inside machinery spaces of category A or accommodation spaces. May be accepted in other machinery spaces provided the joints are located in easily visible and accessible positions.
- 3) Approved fire resistant types except in cases where such mechanical joints are installed on exposed open decks, as defined in SOLAS II-2/Reg. 9.2.3.3.2.2(10) and not used for fuel oil lines.
- 4) Only in pump rooms and open decks - only approved fire resistant types.

**NOTES - General**

- 5) Slip type slip-on joints as shown in Fig 5.6.2. May be used for pipes on deck with a design pressure of 10 bar or less.
- 6) Only above bulkhead deck of passenger ships and freeboard deck of cargo ships.

## Present

**Table 5.6.11 Application of mechanical joints depending upon the class of piping**

Type of joints	Classes of piping systems		
	Class I	Class II	Class III
Pipe Unions			
Welded and brazed type	○(OD≤60.3 mm)	○(OD≤60.3 mm)	○
Compression Couplings			
Swage type	○	○	○
Bite type	○(OD≤60.3 mm)	○(OD≤60.3 mm )	○
Flared type	○(OD≤60.3 mm )	○(OD≤60.3 mm )	○
Press type	-	-	○
Slip-on joints			
Machine grooved type	○	○	○
Grip type	-	○	○
Slip type	-	○	○
Abbreviations      ○ : Application is allowed - : Application is not allowed			

<omitted>

## Amendment

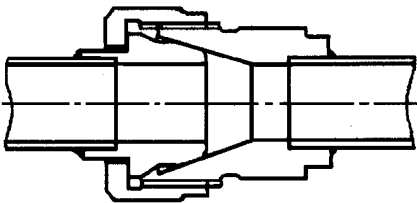
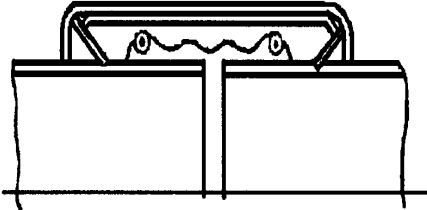
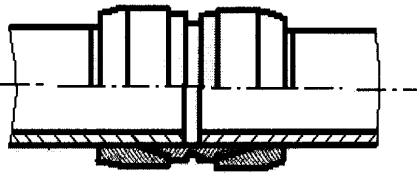
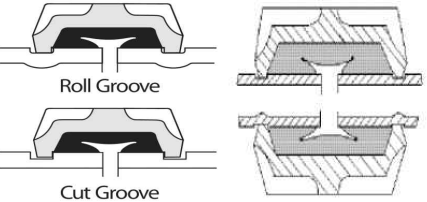
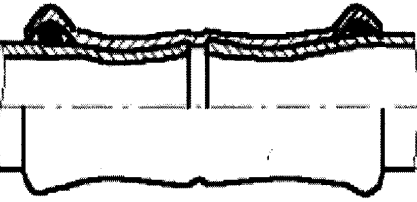
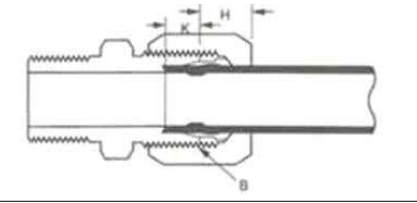
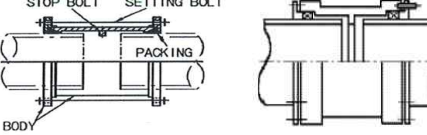
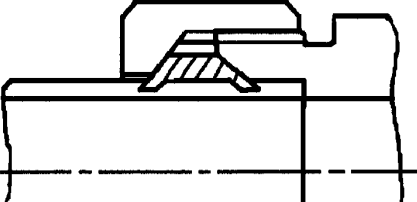
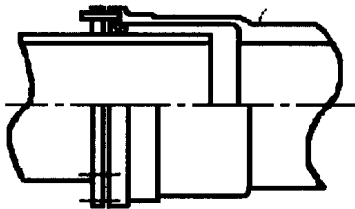
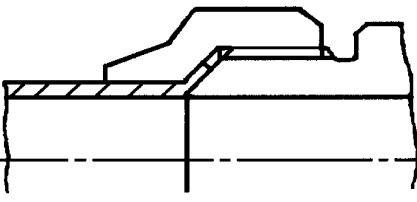

# CHAPTER 6 AUXILIARIES AND PIPING ARRANGEMENT

## Section 1 General

<same as present>

### 104. Type of connections

<same as present>

Type of mechanical joints	Examples of mechanical joints	Type of mechanical joints	Examples of mechanical joints
	Pipe union		Slip-on joints
Welded and brazed types		Grip type	
	Compression couplings		
Swage type		Machine grooved type	 <p style="text-align: center;">Roll Groove</p> <p style="text-align: center;">Cut Groove</p>
Press type			
<u>Typical compression type</u>			
Bite type		Slip type	
Flared type			

**Fig 5.6.2 Examples of Mechanical Joints**

## Amendment

<same as present>

**Table 5.6.10 Application of Mechanical Joints**

Systems		Kind of connections		
		Pipe Unions	Compression Couplings	Slip-on joints
Flammable fluids (Flash point $\leq 60$ °C)				
1	Cargo oil lines <sup>(4)</sup>	○	○	○
2	Crude oil washing lines <sup>(4)</sup>	○	○	○
3	Vent lines <sup>(3)</sup>	○	○	○
<u>Inert Gas</u>				
4	Water seal effluent lines	○	○	○
5	Scrubber effluent lines	○	○	○
6	Main lines <sup>(2)(4)</sup>	○	○	○
7	Distributions lines <sup>(4)</sup>	○	○	○
Flammable fluids (Flash point $> 60$ °C)				
8	Cargo oil lines <sup>(4)</sup>	○	○	○
9	Fuel oil lines <sup>(3)(2)</sup>	○	○	○
10	Lubricating oil lines <sup>(2)(3)</sup>	○	○	○
11	Hydraulic oil <sup>(2)(3)</sup>	○	○	○
12	Thermal oil <sup>(2)(3)</sup>	○	○	○
Sea water				
13	Bilge lines <sup>(1)</sup>	○	○	○
14	Water filled fire extinguishing systems, e.g. sprinkler systems <sup>(3)</sup>	○	○	○
15	Non water filled fire extinguishing systems, e.g. foam, drencher systems <sup>(3)</sup>	○	○	○
16	Fire main (not permanently filled) <sup>(3)</sup>	○	○	○
17	Ballast system <sup>(1)</sup>	○	○	○
18	Cooling water system <sup>(1)</sup>	○	○	○
19	Tank cleaning services	○	○	○
20	Non-essential systems	○	○	○

## Amendment

**Table 5.6.10 Application of Mechanical Joints (continued)**

Systems		Kind of connections		
		Pipe Unions	Compression Couplings <sup>6)</sup>	Slip-on joints
Fresh water				
21	Cooling water system <sup>(1)</sup>	○	○	○
22	Condensate return <sup>(1)</sup>	○	○	○
23	Non-essential system	○	○	○
Sanitary/Drains/Scuppers				
24	Deck drains (internal) <sup>(6)</sup>	○	○	○ <sup>(4)</sup>
25	Sanitary drains	○	○	○
26	Scuppers and discharge (overboard)	○	○	-
Sounding/Vent				
27	Water tanks/Dry spaces	○	○	○
28	Oil tanks (f.p. > 60 °C) <sup>(2)(3)</sup>	○	○	○
Miscellaneous				
29	Starting/Control air <sup>(1)</sup>	○	○	-
30	Service air (non-essential)	○	○	○
31	Brine	○	○	○
32	CO <sub>2</sub> system <sup>(1)</sup>	○	○	-
33	Steam	○	○	○ <sup>(5)</sup>

Abbreviations      ○ : Application is allowed,   - : Application is not allowed

**NOTES - Fire resistance capability**

If mechanical joints include any components which readily deteriorate in case of fire, the following footnotes are to be observed:

- 1) Inside machinery spaces of category A - approved fire resistant types.
- 2) Slip on joints are not accepted Not inside machinery spaces of category A or accommodation spaces. May be accepted in other machinery spaces provided the joints are located in easily visible and accessible positions.
- 3) Approved fire resistant types except in cases where such mechanical joints are installed on open decks, as defined in SOLAS II-2/Reg. 9.2.3.3.2.2(10) and not used for fuel oil lines.
- 4) In pump rooms and open decks - approved fire resistant types.

**NOTES - General**

- 5) Slip type slip-on joints as shown in Fig 5.6.2. May be used for pipes on deck with a design pressure of 10 bar or less.
- 6) Only above bulkhead deck of passenger ships and freeboard deck of cargo ships.



## Amendment

**Table 5.6.11 Application of mechanical joints depending upon the class of piping**

Type of joints	Classes of piping systems		
	Class I	Class II	Class III
Pipe Unions			
Welded and brazed type	○(OD≤60.3 mm)	○(OD≤60.3 mm)	○
Compression Couplings			
Swage type	○	○	○
Bite type	○(OD≤60.3 mm)	○(OD≤60.3 mm)	○
<u>Typical compression type</u>	<u>○(OD≤60.3 mm)</u>	<u>○(OD≤60.3 mm)</u>	<u>○</u>
Flared type	○(OD≤60.3 mm)	○(OD≤60.3 mm)	○
Press type	-	-	○
Slip-on joints			
Machine grooved type	○	○	○
Grip type	-	○	○
Slip type	-	○	○
Abbreviations      ○ : Application is allowed   - : Application is not allowed			

<same as presents>

# Amended Guidances for the Classification of Steel Ships

## (Part 5 Machinery Installation)

Dec. 2019



KR

## - Main Amendments -

- (1) Effective date : 1 Jan. 2020(Date of application for type approval) & 1 July 2021(Date of which the contract for construction is signed)
  - To reflect IACS UR P4(Rev. 5 Dec 2018)
    - It has been amended for requirements relating to the design and testing requirements of plastic piping.

(1) Effective date :

1 Jan 2020<sub>(Date of application for type approval)</sub> and

1 July 2021<sub>(Date of which the contract for construction is signed)</sub>

Present	Amendment
<p style="text-align: center;"><b>Annex 5-6 Plastic Piping System</b> &lt;omitted&gt;</p> <p><b>2. Definitions</b></p> <p>(1) Plastic(s) is both thermoplastic and thermosetting plastic materials with or without reinforcement, such as PVC and fibre reinforced plastics – FRP.</p> <p style="text-align: center;">&lt;omitted&gt;</p> <p><b>4. General requirements</b></p> <p>The specification of piping is to be in accordance with a recognised national or international standard approved by the Society. In addition, the following requirements apply:</p> <p>(1) Strength</p> <p style="text-align: center;">&lt;omitted&gt;</p> <p><u>(E) External pressure</u> External pressure is to be determined by the following.</p> $P_{ext} \leq \frac{P_{col}}{3}$ <p><math>P_{ext}</math> : External pressure <math>P_{col}</math> : Pipe collapse pressure. In no case is the collapse pressure to be less than 0.3 MPa.</p> <p><u>The design external pressure is a sum of the vacuum inside the pipe and a head of liquid acting on the outside of the pipe.</u></p> <p style="text-align: center;">&lt;omitted&gt;</p>	<p style="text-align: center;"><b>Annex 5-6 Plastic Piping System</b> &lt;same as present&gt;</p> <p><b>2. Definitions</b></p> <p>(1) Plastic(s) is both thermoplastic and thermosetting plastic materials with or without reinforcement, such as PVC and fibre reinforced plastics – FRP. Plastic includes synthetic rubber and materials of similar thermo/mechanical properties.</p> <p style="text-align: center;">&lt;same as present&gt;</p> <p><b>4. General requirements</b></p> <p>The specification of piping is to be in accordance with a recognised national or international standard approved by the Society. In addition, the following requirements apply:</p> <p>(1) Strength</p> <p style="text-align: center;">&lt;same as present&gt;</p> <p><u>(E) External pressure(for any installation which may be subject to vacuum conditions inside the pipe or a head of liquid acting on the outside of the pipe; and for any pipe installation required to remain operational in case of flooding damage, as per Regulation II-1/8-1 of SOLAS 1974 Convention, as amended, or for any pipes that would allow progressive flooding to other compartments through damaged piping or through open ended pipes in the compartments).</u> External pressure is to be determined by the following.</p> $P_{n_{ext}} \leq \frac{P_{col}}{3}$ <p><math>P_{ext}</math> : External pressure <math>P_{col}</math> : Pipe collapse pressure. In no case pipe is the collapse pressure to be less than 0.3 MPa.</p> <p><u>The maximum working external pressure is a sum of the vacuum inside the pipe and a head of liquid acting on the outside of the pipe.</u> <u>Notwithstanding the requirements of (D) or (E) above as applicable, the pipe or pipe layer minimum wall thickness is to follow recognized standards. In the absence of standards for pipes not subject to external pressure, the requirements of (E) above are to be met.</u> <u>The maximum permissible working pressure is to be specified with due regard for maximum possible working temperatures in accordance with Manufacturer's recommendations.</u></p> <p style="text-align: center;">&lt;same as present&gt;</p>
29/38	<same as present>

Present	Amendment
<p style="text-align: center;">&lt;omitted&gt;</p> <p>(4) Temperature</p> <p>(A) The design temperature depending on the working pressure is to be in accordance with Manufacturer's recommendations, but in each case it is to be at least 20 °C lower than the minimum heat <u>distortion</u> temperature of the pipe material, determined according to <i>ISO 75</i> method A, or equivalent.</p> <p>(B) The minimum heat <u>distortion</u> temperature is to be not less than 80 °C.</p> <p><b>5. Requirements for pipes/piping systems depending on service and/or locations</b></p> <p>(1) Fire endurance</p> <p>(A) Pipes and their associated fittings whose integrity is essential to the safety of ships are required to meet the <u>minimum fire endurance requirements of Appendix 1 or 2, as applicable, of IMO Res A.753 (18).</u></p> <p>(B) <u>Depending on the capability of a piping system to maintain its strength and integrity, there exist three different levels of fire endurance for piping systems.</u></p> <p>(a) <u>Level 1(L1) : Piping having passed the fire endurance test specified in Appendix 1 of IMO Res. A. 753 (18) for a duration of a minimum of one hour without loss of integrity in the dry condition is considered to meet level 1 fire endurance standard.</u></p> <p>(b) <u>Level 2(L2) : Piping having passed the fire endurance test specified in Appendix 1 of IMO Res. A 753 (18) for a duration of a minimum of 30 minutes in the dry condition is considered to meet level 2 fire endurance standard.</u></p> <p style="text-align: center;">&lt;omitted&gt;</p>	<p style="text-align: center;">&lt;same as present&gt;</p> <p>(4) Temperature</p> <p>(A) The design temperature depending on the working pressure is to be in accordance with Manufacturer's recommendations, but in each case it is to be at least 20 °C lower than the minimum heat <u>distortion/deflection</u> temperature of the pipe material, determined according to <i>ISO 75</i> method A, or equivalent.</p> <p>(B) The minimum heat <u>distortion/deflection</u> temperature is to be not less than 80 °C.</p> <p><b>5. Requirements for pipes/piping systems depending on service and/or locations</b></p> <p>(1) Fire endurance</p> <p>(A) <u>Pipes and their associated fittings whose integrity is essential to the safety of ships are required to meet the minimum fire endurance requirements of Appendix 1 or 2, as applicable, of IMO Res A.753 (18).</u></p> <p>(B) <u>Depending on the capability of a piping system to maintain its strength and integrity, there exist three different levels of fire endurance for piping systems.</u></p> <p>(a) <u>Level 1(L1) : Piping having passed the fire endurance test specified in Appendix 1 of IMO Res. A.753(18), as amended by IMO Res. MSC. 313(88) and IMO Res. MSC. 399(95) for a duration of a minimum of one hour without loss of integrity in the dry condition is considered to meet level 1 fire endurance standard (L1).</u>  <u>Level 1W – Piping systems similar to Level 1 systems except these systems do not carry flammable fluid or any gas and a maximum 5% flow loss in the system after exposure is acceptable (L1W).</u></p> <p>(b) <u>Level 2(L2) : Piping having passed the fire endurance test specified in Appendix 1 of IMO Res. A.753(18), as amended by IMO Res. MSC. 313(88) and IMO Res. MSC. 399(95) for a duration of a minimum of 30 minutes in the dry condition is considered to meet level 2 fire endurance standard (L2).</u>  <u>Level 2W – Piping systems similar to Level 2 systems except a maximum 5% flow loss in the system after exposure is acceptable (L2W).</u></p> <p style="text-align: center;">&lt;same as present&gt;</p>

<b>Present</b>	<b>Amendment</b>
<p><u>(D &lt;Newly added&gt;</u></p>	<p><u>(D) For Safe Return to Port purposes (SOLAS II-2, Reg.21.4), plastic piping can be considered to remain operational after a fire casualty if the plastic pipes and fittings have been tested to L1 standard.</u></p>

# Present

**Table 1 Fire Endurance Requirements Matrix**

Piping system	Location										
	A	B	C	D	E	F	G	H	I	J	K
	Machinery spaces of category A	Other machinery spaces & pump rooms	Cargo pump rooms	Ro/Ro cargo holds	Other dry cargo holds	Cargo tanks	Fuel oil tanks	Ballast water tanks	Cofferdams void spaces pipe tunnel & ducts	Accommodation service & control spaces	Open decks
Cargo (Flammable cargos, f.p ≤ 60 °C)											
1. Cargo lines	NA	NA	L1	NA	NA	O	NA	O <sup>10</sup>	O	NA	L1 <sup>2</sup>
2. Crude oil washing lines	NA	NA	L1	NA	NA	O	NA	O <sup>10</sup>	O	NA	L1 <sup>2</sup>
3. Vent lines	NA	NA	NA	NA	NA	O	NA	O <sup>10</sup>	O	NA	X
Inert gas											
4. Water seal effluent lines	NA	NA	O <sup>1</sup>	NA	NA	O <sup>1</sup>	O <sup>1</sup>	O <sup>1</sup>	O <sup>1</sup>	NA	O
5. Scrubber effluent lines	O <sup>1</sup>	O <sup>1</sup>	NA	NA	NA	NA	NA	O <sup>1</sup>	O <sup>1</sup>	NA	O
6. Main lines	O	O	L1	NA	NA	NA	NA	NA	O	NA	L1 <sup>6</sup>
7. Distribution lines	NA	NA	L1	NA	NA	O	NA	NA	O	NA	L1 <sup>2</sup>
Flammable liquids (f.p > 60 °C)											
8. Cargo lines	X	X	L1	X	X	NA <sup>3</sup>	O	O <sup>10</sup>	O	NA	L1
9. Fuel oil	X	X	L1	X	X	NA <sup>3</sup>	O	O	O	L1	L1
10. Lubricating oil	X	X	L1	X	X	NA	NA	NA	O	L1	L1
11. Hydraulic oil	X	X	L1	X	X	O	O	O	O	L1	L1
Seawater <sup>1</sup>											
12. Bilge main & branches	L1 <sup>7</sup>	L1 <sup>7</sup>	L1	X	X	NA	O	O	O	NA	L1
13. Fire main water spray	L1	L1	L1	X	NA	NA	NA	O	O	NA	L1
14. Foam system	<u>L1</u>	<u>L1</u>	<u>L1</u>	NA	NA	NA	NA	NA	O	<u>L1</u>	<u>L1</u>
15. Sprinkler system	<u>L1</u>	<u>L1</u>	L3	X	NA	NA	NA	O	O	L3	L3
16. Ballast	L3	L3	L3	L3	X	O <sup>10</sup>	O	O	O	<u>L2</u>	<u>L2</u>
17. Cooling water, essential services	L3	L3	NA	NA	NA	NA	NA	O	O	NA	<u>L2</u>
18. Tank cleaning services fixed machines	NA	NA	L3	NA	NA	O	NA	O	O	NA	L3 <sup>2</sup>
19. Non-essential system	O	O	O	O	O	NA	O	O	O	O	O
Freshwater											
20. Cooling water essential services	L3	L3	NA	NA	NA	NA	O	O	O	L3	L3
21. Condensate return	L3	L3	L3	O	O	NA	NA	NA	O	O	O
22. Non-essential system	O	O	O	O	O	NA	O	O	O	O	O
Sanitary/Drain/Scuppers											
23. Deck drains (internal)	<u>L1<sup>4</sup></u>	<u>L1<sup>4</sup></u>	NA	<u>L1<sup>4</sup></u>	O	NA	O	O	O	O	O
24. Sanitary drains (internal)	O	O	NA	O	O	NA	O	O	O	O	O



## Amendments

**Table 1 Fire Endurance Requirements Matrix**

Piping system	Location <sup>13</sup>										
	A	B	C	D	E	F	G	H	I	J	K
	Machinery spaces of category A	Other machinery spaces & pump rooms	Cargo pump rooms	Ro/Ro cargo holds	Other dry cargo holds	Cargo tanks	Fuel oil tanks	Ballast water tanks	Cofferdams void spaces pipe tunnel & ducts	Accommodation service & control spaces	Open decks
Cargo (Flammable cargos, f.p ≤ 60 °C)											
1. Cargo lines	NA	NA	L1	NA	NA	O	NA	O <sup>10</sup>	O	NA	L1 <sup>2</sup>
2. Crude oil washing lines	NA	NA	L1	NA	NA	O	NA	O <sup>10</sup>	O	NA	L1 <sup>2</sup>
3. Vent lines	NA	NA	NA	NA	NA	O	NA	O <sup>10</sup>	O	NA	X
Inert gas											
4. Water seal effluent lines	NA	NA	O <sup>1</sup>	NA	NA	O <sup>1</sup>	O <sup>1</sup>	O <sup>1</sup>	O <sup>1</sup>	NA	O
5. Scrubber effluent lines	O <sup>1</sup>	O <sup>1</sup>	NA	NA	NA	NA	NA	O <sup>1</sup>	O <sup>1</sup>	NA	O
6. Main lines	O	O	L1	NA	NA	NA	NA	NA	O	NA	L1 <sup>6</sup>
7. Distribution lines	NA	NA	L1	NA	NA	O	NA	NA	O	NA	L1 <sup>2</sup>
Flammable liquids (f.p > 60 °C)											
8. Cargo lines	X	X	L1	X	X	NA <sup>3</sup>	O	O <sup>10</sup>	O	NA	L1
9. Fuel oil	X	X	L1	X	X	NA <sup>3</sup>	O	O	O	L1	L1
10. Lubricating oil	X	X	L1	X	X	NA	NA	NA	O	L1	L1
11. Hydraulic oil	X	X	L1	X	X	O	O	O	O	L1	L1
Seawater <sup>1</sup>											
12. Bilge main & branches	L1 <sup>7</sup>	L1 <sup>7</sup>	L1	X	X	NA	O	O	O	NA	L1
13. Fire main water spray	L1	L1	L1	X	NA	NA	NA	O	O	NA	L1
14. Foam system	<u>L1W</u>	<u>L1W</u>	<u>L1W</u>	NA	NA	NA	NA	NA	O	<u>L1W</u>	<u>L1W</u>
15. Sprinkler system	<u>L1W</u>	<u>L1W</u>	L3	X	NA	NA	NA	O	O	L3	L3
16. Ballast	L3	L3	L3	L3	X	O <sup>10</sup>	O	O	O	<u>L2W</u>	<u>L2W</u>
17. Cooling water, essential services	L3	L3	NA	NA	NA	NA	NA	O	O	NA	<u>L2W</u>
18. Tank cleaning services fixed machines	NA	NA	L3	NA	NA	O	NA	O	O	NA	L3 <sup>2</sup>
19. Non-essential system	O	O	O	O	O	NA	O	O	O	O	O
Freshwater											
20. Cooling water essential services	L3	L3	NA	NA	NA	NA	O	O	O	L3	L3
21. Condensate return	L3	L3	L3	O	O	NA	NA	NA	O	O	O
22. Non-essential system	O	O	O	O	O	NA	O	O	O	O	O
Sanitary/Drain/Scuppers											
23. Deck drains (internal)	<u>L1W<sup>4</sup></u>	<u>L1W<sup>4</sup></u>	NA	<u>L1W<sup>4</sup></u>	O	NA	O	O	O	O	O
24. Sanitary drains (internal)	O	O	NA	O	O	NA	O	O	O	O	O

## Present

**Table 1 Fire Endurance Requirements Matrix (continued)**

Piping system	Location										
	A	B	C	D	E	F	G	H	I	J	K
	Machinery spaces of category A	Other machinery spaces & pump rooms	Cargo pump rooms	Ro/Ro cargo holds	Other dry cargo holds	Cargo tanks	Fuel oil tanks	Ballast water tanks	Cofferdams void spaces pipe tunnel & ducts	Accommodation service & control spaces	Open decks
25. Scuppers and discharges (overboard)	O <sup>1.8</sup>	O <sup>1.8</sup>	O <sup>1.8</sup>	O <sup>1.8</sup>	O <sup>1.8</sup>	O	O	O	O	O <sup>1.8</sup>	O
Sounding/Air											
26. Watertanks/dry spaces	O	O	O	O	O	O <sup>10</sup>	O	O	O	O	O
27. Oil tanks (f.p > 60 °C)	X	X	X	X	X	X <sup>3</sup>	O	O <sup>10</sup>	O	X	X
Miscellaneous											
28. Control air	L1 <sup>5</sup>	L1 <sup>5</sup>	L1 <sup>5</sup>	L1 <sup>5</sup>	L1 <sup>5</sup>	NA	O	O	O	L1 <sup>5</sup>	L1 <sup>5</sup>
29. Service air (non-essential)	O	O	O	O	O	NA	O	O	O	O	O
30. Brine	O	O	NA	O	O	NA	NA	NA	O	O	O
31. Auxiliary low pressure steam (≤ 7 MPa)	<u>L</u> <sup>2</sup>	<u>L</u> <sup>2</sup>	O <sup>9</sup>	O <sup>9</sup>	O <sup>9</sup>	O	O	O	O	O <sup>9</sup>	O <sup>9</sup>
32.-34. <Newly added>											
Abbreviations :											
L1 Fire endurance test (IMO Resolution A.753(18), Appendix 1) in dry conditions, 60 min.											
L2 Fire endurance test (IMO Resolution A.753(18), Appendix 1) in dry conditions, 30 min.											
L3 Fire endurance test (IMO Resolution A.753(18), Appendix 2) in wet conditions, 30 min.											
0 No fire endurance test required											
NA Not applicable											
X Metallic materials having a melting point greater than 925 °C											
Footnotes :											
1. Where non-metallic piping is used, remotely controlled valves to be provided at ship's side (valve is to be controlled from outside space).											
2. Remote closing valves to be provided at the cargo tanks.											
3. When cargo tanks contain flammable liquids with f.p. > 60 °C, "O may replace "NA or "X".											
4. For drains serving only the space concerned, "O may replace "L1"											
5. When controlling functions are not required by statutory requirements or guidelines, "O may replace "L1"											
6. For pipe between machinery space and deck water seal, "O may replace "L1"											
7. For passenger vessels, "X is to replace "L1".											

## Amendments

**Table 1 Fire Endurance Requirements Matrix (continued)**

Piping system	Location <sup>13</sup>										
	A	B	C	D	E	F	G	H	I	J	K
	Machinery spaces of category A	Other machinery spaces & pump rooms	Cargo pump rooms	Ro/Ro cargo holds	Other dry cargo holds	Cargo tanks	Fuel oil tanks	Ballast water tanks	Cofferdams void spaces pipe tunnel & ducts	Accommodation service & control spaces	Open decks
25. Scuppers and discharges (overboard)	O <sup>1.8</sup>	O <sup>1.8</sup>	O <sup>1.8</sup>	O <sup>1.8</sup>	O <sup>1.8</sup>	O	O	O	O	O <sup>1.8</sup>	O
Sounding/Air											
26. Watertanks/dry spaces	O	O	O	O	O	O <sup>10</sup>	O	O	O	O	O
27. Oil tanks (f.p > 60 °C)	X	X	X	X	X	X <sup>3</sup>	O	O <sup>10</sup>	O	X	X
Miscellaneous											
28. Control air	L1 <sup>5</sup>	L1 <sup>5</sup>	L1 <sup>5</sup>	L1 <sup>5</sup>	L1 <sup>5</sup>	NA	O	O	O	L1 <sup>5</sup>	L1 <sup>5</sup>
29. Service air (non-essential)	O	O	O	O	O	NA	O	O	O	O	O
30. Brine	O	O	NA	O	O	NA	NA	NA	O	O	O
31. Auxiliary low pressure steam (≤ 7 MPa)	<u>L2W</u>	<u>L2W</u>	O <sup>9</sup>	O <sup>9</sup>	O <sup>9</sup>	O	O	O	O	O <sup>9</sup>	O <sup>9</sup>
32. Central vacuum Cleaners	NA	NA	NA	O	NA	NA	NA	NA	O	O	O
33. Exhaust Gas Cleaning System Effluent line	L3 <sup>1</sup>	L3 <sup>1</sup>	NA	NA	NA	NA	NA	NA	NA	NA	L3 <sup>1,11</sup> NA
34. Urea transfer/Supply System (SCR installation)	L1 <sup>12</sup>	L1 <sup>12</sup>	NA	NA	NA	NA	NA	NA	O	L3 <sup>1,11</sup> NA	NA
Abbreviations :											
<u>L1 Fire endurance test (IMO Resolution A.753(18), Appendix 1, as amended by IMO Res. MSC. 313(88) and IMO Res. MSC. 399(95)) in dry conditions, 60 min.</u>											
<u>L1W Fire endurance test(5.(1))</u>											
<u>L2 Fire endurance test (IMO Resolution A.753(18), Appendix 1, as amended by IMO Res. MSC. 313(88) and IMO Res. MSC. 399(95)) in dry conditions, 30 min.</u>											
<u>L2W Fire endurance test(5.(1))</u>											
<u>L3 Fire endurance test (IMO Resolution A.753(18), Appendix 2, as amended by IMO Res. MSC. 313(88) and IMO Res. MSC. 399(95)) in wet conditions, 30 min.</u>											
<u>0 No fire endurance test required</u>											
NA Not applicable											
X Metallic materials having a melting point greater than 925 °C											
Footnotes :											
1. Where non-metallic piping is used, remotely controlled valves to be provided at ship's side (valve is to be controlled from outside space).											
2. Remote closing valves to be provided at the cargo tanks.											
3. When cargo tanks contain flammable liquids with f.p. > 60 °C, "O may replace "NA or "X".											
4. For drains serving only the space concerned, "O may replace "L1W"											
5. When controlling functions are not required by statutory requirements or guidelines, "O may replace "L1"											
6. For pipe between machinery space and deck water seal, "O may replace "L1"											
7. For passenger vessels, "X is to replace "L1".											

# Present

**Table 1 Fire Endurance Requirements Matrix (continued)**

8. Scuppers serving open decks in positions 1 and 2, as defined in regulation 13 of the International Convention on Load Lines, 1966, are to be "X throughout unless fitted at the upper end with the means of closing capable of being operated from a position above the freeboard deck in order to prevent downflooding.
9. For essential services, such as fuel oil tank heating and ship's whistle, "X is to replace "O".
10. For tankers where compliance with paragraph 3 (f) of regulation 13F of Annex I of MARPOL 73/78 is required, "NA is to replace "O".
- 11.~13. <Newly added>

Location definitions

- A (Machinery spaces of category A) : Machinery spaces of category A as defined in SOLAS\* regulation II-2/3.19.
- B (Other machinery spaces and pump rooms) : Spaces, other than category A machinery spaces and cargo pump rooms, containing propulsion machinery, boilers, steam and internal combustion engines, generators and major electrical machinery, pumps, oil filling stations, refrigerating, stabilizing, ventilation and air-conditioning machinery, and similar spaces, and trunks to such spaces.
- C (Cargo pump rooms) : Spaces containing cargo pumps and entrances and trunks to such spaces.
- D (Ro-ro cargo holds) : Ro-Ro cargo holds are Ro-Ro cargo spaces and special category spaces as defined in SOLAS\* regulation II-2/3.14 and 3.18.
- E (Other dry cargo holds) : All spaces other than Ro-Ro cargo holds used for non-liquid cargo and trunks to such spaces.
- F (Cargo tanks) : All spaces used for liquid cargo and trunks to such spaces.
- G (Fuel oil tanks) : All spaces used for fuel oil (excluding cargo tanks) and trunks to such spaces.
- H (Ballast water tanks) : All spaces used for ballast water and trunks to such spaces.
- I (Cofferdams, voids, etc.) : Cofferdams and voids are those empty spaces between two bulkheads separating two adjacent compartments.
- J (Accommodation, service) : Accommodation spaces, service spaces and control stations as defined in SOLAS \* regulation II-2/3.10, 3.12, 3.22.
- K (Open decks) : Open deck spaces as defined in SOLAS\* regulation II-2/9.2.2.3.2.2.(5).

\* SOLAS 74 as amended by the 1978 SOLAS Protocol and the 1981 and 1983 amendments (consolidated text).

## Amendments

**Table 1 Fire Endurance Requirements Matrix (continued)**

8. Scuppers serving open decks in positions 1 and 2, as defined in regulation 13 of the International Convention on Load Lines, 1966, are to be "X throughout unless fitted at the upper end with the means of closing capable of being operated from a position above the freeboard deck in order to prevent downflooding.
9. For essential services, such as fuel oil tank heating and ship's whistle, "X is to replace "O".
10. For tankers where compliance with paragraph 3.6 of regulation 19 of Annex I of MARPOL 73/78 as amended is required, "NA is to replace "O".
11. L3 in service spaces, NA in accommodation and control spaces.
12. Type Approved plastic piping without fire endurance test(0) is acceptable downstream of the tank valve, provided this valve is metal seated and arranged as fail-to-closed or with quick closing from a safe position outside the space in the event of fire.
13. For Passenger Ships subject to SOLAS II-2, Reg.21.4 (Safe return to Port), plastic pipes for services required to remain operative in the part of the ship not affected by the casualty thresholds, such as systems intended to support safe areas, are to be considered essential services. In accordance with MSC Circular MSC.1/Circ.1369, interpretation 12, for Safe Return to Port purposes, plastic piping can be considered to remain operational after a fire casualty if the plastic pipes and fittings have been tested to L1 standard.

Location definitions

- A (Machinery spaces of category A) : Machinery spaces of category A as defined in SOLAS\* regulation II-2/3.31.
- B (Other machinery spaces and pump rooms) : Spaces, other than category A machinery spaces and cargo pump rooms, containing propulsion machinery, boilers, fuel oil unit, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilation and air-conditioning machinery, and similar spaces, and trunks to such spaces.
- C (Cargo pump rooms) : Spaces containing cargo pumps and entrances and trunks to such spaces.
- D (Ro-ro cargo holds) : Ro-Ro cargo holds are Ro-Ro cargo spaces and special category spaces as defined in SOLAS\* regulation II-2/3.41 and 3.46.
- E (Other dry cargo holds) : All spaces other than Ro-Ro cargo holds used for non-liquid cargo and trunks to such spaces.
- F (Cargo tanks) : All spaces used for liquid cargo and trunks to such spaces.
- G (Fuel oil tanks) : All spaces used for fuel oil (excluding cargo tanks) and trunks to such spaces.
- H (Ballast water tanks) : All spaces used for ballast water and trunks to such spaces.
- I (Cofferdams, voids, etc.) : Cofferdams and voids are those empty spaces between two bulkheads separating two adjacent compartments.
- J (Accommodation, service) : Accommodation spaces, service spaces and control stations as defined in SOLAS \* regulation II-2/3.1, 3.45, 3.18
- K (Open decks) : Open deck spaces as defined in SOLAS\* regulation II-2/9.2.2.3.2.(5).

\* SOLAS 1974 Convention, as amended.

Present	Amendment
<p>(2) Flame spread</p> <p>(A) <u>All pipes, except those fitted on open decks and within tanks, cofferdams, pipe tunnels and ducts are to have low surface flame spread characteristics not exceeding average values specified in <b>Ch 3, 2604. 3</b> of the "Guidance for Approval of Manufacturing Process and Type Approval, etc."</u>.</p> <p style="text-align: center;">&lt;omitted&gt;</p> <p><b>6. Installation</b></p> <p>(1) Supports</p> <p>(A) <u>Selection and spacing of pipe supports in shipboard systems are to be determined as a function of allowable stresses and maximum deflection criteria. Support spacing is not to be greater than the pipe Manufacturer's recommended spacing. The selection and spacing of pipe supports are to take into account pipe dimensions, mechanical and physical properties of the pipe material, mass of pipe and contained fluid, external pressure, operating temperature, thermal expansion effects, loads due to external forces, thrust forces, water hammer, vibrations, maximum accelerations to which the system may be subjected. Combination of loads is to be considered.</u></p> <p style="text-align: center;">&lt;omitted&gt;</p> <p>(7) Penetration of divisions</p> <p style="text-align: center;">&lt;omitted&gt;</p> <p>(B) <u>When plastic pipes pass through watertight bulkheads or decks, the watertight integrity of the bulkhead or deck is to be maintained.</u></p> <p style="text-align: center;">&lt;omitted&gt;</p>	<p>(2) Flame spread</p> <p>(A) <u>All pipes, except those fitted on open decks and within tanks, cofferdams, pipe tunnels and ducts if separated from accommodation, permanent manned areas and escape ways by means of an A class bulkhead are to have low surface flame spread characteristics not exceeding average values specified in <b>Ch 3, 2604. 3</b> of the "Guidance for Approval of Manufacturing Process and Type Approval, etc."</u>.</p> <p style="text-align: center;">&lt;same as present&gt;</p> <p><b>6. Installation</b></p> <p>(1) Supports</p> <p>(A) <u>Selection and spacing of pipe supports in shipboard systems are to be determined as a function of allowable stresses and maximum deflection criteria. Support spacing is not to be greater than the pipe Manufacturer's recommended spacing. The selection and spacing of pipe supports are to take into account pipe dimensions, length of piping, mechanical and physical properties of the pipe material, mass of pipe and contained fluid, external pressure, operating temperature, thermal expansion effects, loads due to external forces, thrust forces, water hammer, vibrations, maximum accelerations to which the system may be subjected. Combination of loads is to be considered.</u></p> <p style="text-align: center;">&lt;same as present&gt;</p> <p>(7) Penetration of divisions</p> <p style="text-align: center;">&lt;same as present&gt;</p> <p>(B) <u>When plastic pipes pass through watertight bulkheads or decks, the watertight integrity of the bulkhead or deck is to be maintained. For pipes not able to satisfy the requirements in 4.(1).(E), a metallic shut-off valve operable from above the freeboard deck should be fitted at the bulkhead or deck.</u></p> <p style="text-align: center;">&lt;same as present&gt;</p>