U.S. Department of Transportation
**United States Coast Guard**

# Memorandum

Subject: **POLICY FILE MEMORANDUM ON THE FIRE PERFORMANCE REQUIREMENTS FOR PLASTIC PIPE PER IMO RESOLUTION A.753(18)**

Date: 28 MAY 1998
PFM 1-98
16714

From: Chief, Office of Design and Engineering Standards

Reply to Attn. of: G-MSE-4
C.S. Myskowski
202-267-0169

To: Distribution

**1. PURPOSE:** This Policy File Memorandum (PFM) provides guidance on the fire test requirements for type approval of plastic pipes for use on ships as set forth in IMO Resolution A.753(18), Guidelines for the Application of Plastic Pipes on Ships, and as required by 46 CFR 56.60-25(a). This PFM also provides guidance on fire test requirements for plastic piping for use in specific locations unique to offshore oil platforms.

**2. APPLICABILITY:** This Policy File Memorandum addresses the fire performance of plastic piping for use on inspected vessels, including mobile offshore drilling units (MODUs) and floating production platforms. It is not intended to eliminate any other design criteria or requirements pertaining to the material, construction, or performance of the plastic piping in the non-fire condition, nor is it intended to be applied retroactively to applications that have previously received approval on a case-by-case basis. The MODUs and floating production platforms affected by this PFM include all those subject to the MODU regulations per 46 CFR, Subchapter I-A and/or the IMO Code for the Construction and Equipment of Mobile Offshore Drilling Units, 1989.

**3. BACKGROUND:** The International Maritime Organization (IMO), recognizing that there is an increasing interest within the marine industry to use materials other than steel for pipes and that there were no specific requirements for plastic pipes in the existing international regulations, adopted Resolution A.753(18) on 4 November, 1993, Guidelines for the Application of Plastic Pipes on Ships. Subsequently, the Coast Guard adopted the IMO Guidelines as an option to the existing federal regulations on nonmetallic piping materials in 46 CFR 56.60-25. In application of these Guidelines to actual test procedures and data, the Coast Guard has determined that there are certain areas which need further consideration and clarification.

**4. DISCUSSION:** This policy file memorandum addresses qualification and testing of piping for fire endurance, flame spread, smoke, and toxicity. The guidelines given in enclosures (1) and (2) are intended to clarify and supplement IMO Resolution A.753(18).

SUBJ: POLICY FILE MEMORANDUM ON THE FIRE PERFORMANCE REQUIREMENTS FOR PLASTIC PIPE PER IMO RESOLUTION A.753(18)

Enclosure (1) provides information of a general nature with respect to the fire testing and type approval of plastic piping per IMO Resolution A.753(18). Enclosure (2) provides information specific to certain MODUs and floating production platforms and allows deviation from A.753(18) based on their unique layout and operating conditions.

**5. ACTION:**

**5.1** The enclosed guidelines shall be used for the testing and approval of plastic piping, fittings and joints intended for use on inspected vessels, including MODUs and floating production platforms, in accordance with 46 CFR 56.60-25(a) and IMO Resolution A.753(18).

**5.2** Questions arising which pertain to specific issues not addressed in this policy should be referred to the Commandant (G-MSE-4), U.S. Coast Guard Headquarters, 2100 Second St., S.W., Washington, DC 20593-0001.

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| G-MSO | G-MSE-4 |

Encl: (1) Guidelines on the Fire Testing Requirements for Plastic Pipe per IMO Resolution A.753(18)

(2) Guidelines on the Fire Endurance Requirements for Plastic Pipe for Use on Mobile Offshore Drilling Units and Floating Production Platforms

# GUIDELINES ON THE FIRE TESTING REQUIREMENTS FOR PLASTIC PIPE PER IMO RESOLUTION A.753(18)

## 1 General

**1.1** As part of the Coast Guard's ongoing harmonization of federal regulations with international safety standards, IMO Resolution A.753(18) was adopted into Title 46 of the Code of Federal Regulations, Subchapter F, on September 30, 1997. In application of IMO Resolution A.753(18) to actual test procedures and data, the Coast Guard has determined that there are certain areas which need further consideration and clarification. These guidelines are intended to accomplish this need in the area of fire performance testing and type approval of plastic pipe.

## 2 Testing Laboratories

**2.1** The laboratory conducting the testing discussed below shall be an accepted independent laboratory in accordance with 46 CFR 159.010. In addition, when conducting the flame spread, smoke and toxicity tests detailed in these guidelines, the laboratory must be in compliance with IMO Resolution MSC.61(67), The International Code for Application of Fire Test Procedures (FTP Code).

**2.2** The results of fire endurance testing conducted by a laboratory not in compliance with section 2.1 above may be used in an application for approval under these guidelines if:

**2.2.1** the testing was conducted prior to the promulgation of these guidelines; and,

**2.2.2** it is demonstrated that the testing laboratory would have complied with the requirements of 46 CFR 159.010-3 at the time the testing was conducted.

## 3 Piping Material Systems

**3.1** All fire endurance, flame spread, smoke, and toxicity testing, where required, shall be conducted on each piping material system.

**3.2** Changes in either the type, amount, and/or architecture, of either the reinforcement materials, resin matrix, liners, coatings, or manufacturing processes shall require separate testing in accordance with the requirements of IMO Resolution A.753(18) and of these guidelines.

## GUIDELINES ON THE FIRE TESTING REQUIREMENTS FOR PLASTIC PIPE PER IMO RESOLUTION A.753(18)

### 4 Fire Protective Coatings[ψ]

**4.1** Where a fire protective coating is necessary for achieving either the fire endurance, flame spread, or smoke and toxicity criteria, the following requirements apply:

**4.1.1** Pipes shall be delivered from the manufacturer with the protective coating on, in which case on-site application of protection would be limited to what is necessary for installation purposes (e.g. joints). Alternatively, pipes may be coated onsite in accordance with the approved procedure for each combination, using the approved materials of both pipes and insulation, subject to onsite inspection and verification.

**4.1.2** The liquid-absorption properties of the coating and piping should be considered. The fire protection properties (e.g. fire endurance, flame spread, smoke production, etc.) of the coating should not be diminished when exposed to salt water, oil or bilge slops.

**4.1.3** Fire protective properties of coatings should not degrade due to environmental effects over time, such as ultraviolet rays, exposure to salt water, temperature and humidity. Other areas to consider are thermal expansion, resistance against vibrations, and elasticity.

**4.1.4** The adhesion qualities of the coating should be such that the coating does not flake, chip, or powder when subjected to an adhesion test.

**4.1.5** The fire protective coating should be resistant to impact.

### 5 Level 3 Fire Endurance

**5.1** In order to demonstrate compliance with Appendix 2, Test method for fire endurance testing of water-filled plastic piping (Level 3), of IMO Resolution A.753(18), the following additional procedures should be followed:

**5.1.1** All typical joints and fittings intended to be used shall be tested. Elbows and bends need not be tested provided the same adhesive or method of joining utilized in straight piping tests will be used in the actual application.

**5.1.2** Qualification of piping systems of sizes different than those tested shall be allowed as provided for in Table 5.1.2 below. This applies to all pipe, fittings, system joints (including joints between non-metal and metal pipes and fittings), methods of joining, and any internal or external liners, coverings and coatings required to comply with the

[ψ] Because there are currently no widely accepted standards for fire protective coatings as applied to plastic piping, the Commandant(G-MSE-4) will evaluate test data and information and determine the acceptability of such testing and information on a case-by-case basis.

performance criteria.

**5.1.3** No alterations to couplings, fittings, joints, fasteners, insulation, or other components shall be made after the commencement of the fire endurance testing(e.g. flange bolts shall not be re-torqued after completion of the fire exposure testing, prior to hydrostatic testing; post fire hydrostatic testing shall be conducted without altering the component in any way).

**5.1.4** The acceptance criteria shall be as specified in IMO Resolution A.753(18), Appendix 2. In the case of deluge and sprinkler system piping required to meet the Level 3 requirements, these criteria need not be met provided the testing and design procedures set forth in Appendix A of these guidelines are followed. Appendix B of these guidelines provides an example of the additional reporting requirements if the alternative acceptance criteria are utilized. Sprinkler and deluge system piping required to meet Level 1 or Level 2 fire endurance requirements must meet the acceptance criteria per IMO Resolution A.753(18), Appendix 1.

**Table 5.1.2, Qualification of Piping Systems of Sizes Different than Tested**

| Size* Tested, mm | Minimum Size* Approved, mm | Maximum Size* Approved, mm |
|---|---|---|
| 0 to ≤50 | Size Tested | Size Tested |
| >50 to ≤152 | Size Tested | ≤152 |
| >152 to ≤300 | Size Tested | ≤300 |
| >300 to ≤600 | Size Tested | ≤600 |
| >600 to ≤900 | Size Tested | ≤900 |
| >900 to ≤1200 | Size Tested | ≤1200 |

* Size refers to the actual outside diameter of piping.

## 6 Flame Spread

**6.1** All pipes, except those fitted on open decks and within tanks, cofferdams, void spaces, pipe tunnels and ducts, should have low flame spread characteristics as determined by test procedures given in IMO Resolution A.653(16), Recommendation on Improved Fire Test Procedures for Surface Flammability of Bulkhead, Ceiling and Deck Finish Materials, and as modified for pipes in Appendix 3 of IMO Resolution A.753(18).

**6.2** When conducting flame spread testing of plastic piping in accordance with Appendix 3 of IMO Resolution A.753(18), testing need not be conducted on every pipe size. Testing should be conducted on piping sizes with the maximum and minimum wall thickness intended to be used. This will qualify all piping sizes for a specific piping material, provided that the wall thickness falls within the tested range.

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**6.3** The test specimens need not be wrapped in aluminum foil as required in section 8.1.1 of IMO Resolution A.653(16).

**7 Smoke and Toxicity Test Requirements**

**7.1** Piping systems meeting the smoke and toxicity classification criteria specified in Annex 1, Part 2 - Smoke and Toxicity Test, of IMO Resolution MSC.61(67), may be installed in concealed or inaccessible spaces in accommodation, service spaces and control stations and need not meet the additional requirements in 46 CFR 56.60-25(a)(2).

**7.2** When smoke and/or toxicity testing is conducted, the following shall be required:

**7.2.1** The test shall be conducted in accordance with Annex 1, Part 2 - Smoke and Toxicity Test, of IMO Resolution MSC.61(67) with the following modifications:

**7.2.2** Testing should be conducted on piping sizes with the maximum and minimum wall thicknesses intended to be used. This will qualify all piping sizes for a specific piping material, provided that the wall thickness falls within the tested range.

**7.2.3** The test sample should be fabricated by cutting pipes lengthwise into individual sections and then assembling the sections into a test sample as representative as possible of a flat surface. All cuts should be made normal to the pipe wall.

**7.2.4** The number of sections that must be assembled together to form a square test sample with sides measuring 75mm, should be that which corresponds to the nearest integral number of sections which will result in a test sample with an equivalent linearized surface width between 75mm and 90mm. The surface width is defined as the measured sum of the outer circumference of the assembled pipe sections normal to the lengthwise sections.

**7.2.5** The assembled test sample should have no gaps between individual sections.

**7.2.6** The assembled test sample should be constructed in such a way that the edges of two adjacent sections should coincide with the centerline of the test holder.

**7.2.7** The test samples should be mounted on calcium silicate board and held in place by the edges of the test frame and, if necessary, by wire.

**7.2.8** The individual pipe sections should be mounted so that the highest point of the exposed surface is in the same plane as the exposed flat surface of a normal surface.

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**7.2.9** The space between the concave unexposed surface of the test sample and the surface of the calcium silicate backing board should be left void.

**7.2.10** The void space between the top of the exposed test surface and the bottom edge of the sample holder frame should be filled with a high temperature insulating wool where the pipe extends under the frame.

**7.2.11** When the pipes are to include fireproofing or coatings, the composite structure consisting of the segmented pipe wall and fire proofing shall be tested and the thickness of the fireproofing should be the minimum thickness specified for the intended usage.

**7.2.12** The test sample should be oriented in the apparatus such that the pilot burner flame will be normal to the lengthwise piping sections.

**8 Information Required**

**8.1** In addition to the information required by the various standards referenced in this policy, the following information shall be provided to Commandant (G-MSE-4), 2100 Second St., S.W., Washington, DC 20593-0001:

**8.1.1** a test report containing the information required by 46 CFR 159.005-11

**8.1.2** maximum allowable working pressure of piping;

**8.1.3** piping sizes to be approved;

**8.1.4** locations and applications that approval is requested for;

**8.1.5** all piping system joints and fittings to be approved;

**8.1.6** piping system adhesives to be approved; and,

**8.1.7** the installation procedures manual.

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*APPENDIX A: ALTERNATIVE ACCEPTANCE CRITERIA FOR SPRINKLER AND DELUGE SYSTEM PIPING REQUIRED TO MEET LEVEL 3 FIRE ENDURANCE TESTING PER A.753(18), APPENDIX 2*

*TESTING*

1. During the test, no leakage from the sample(s) should occur except that slight weeping through the pipe wall may be accepted.

2. After termination of the burner regulation test, the test sample, together with fire protective coating, if any, should be allowed to cool to ambient temperature and then hydrostatically tested to the rated pressure of the pipe(s) as defined in paragraphs 2.1.2.2 and 2.1.3.2 of IMO Resolution A.753(18). Where practicable, the hydrostatic test should be conducted on bare pipe; i.e. pipe which has had all of its coverings, including fire protection insulation, removed, so that leakage will be readily apparent.

3. The pressure should be held for a minimum of 15 minutes and the average leakage rate per minute and the pressure shall be recorded.

4. From this information, a leak rate factor (LRF) shall be derived for each pipe section, fitting or joint in the following manner:

For pipe sections with no joints or fittings

$$LRF_{LP} = \frac{Q_{avg}}{1.4\sqrt{P_{mawp}}}$$

and for joints and fittings

$$LRF_{J} = \frac{Q_{avg}}{\sqrt{P_{mawp}}}$$

where

$LRF_{LP}$ is the Leak Rate Factor for pipe sections per linear foot of pipe,
$LRF_{J}$ is the Leak Rate Factor for joints and fittings,
$Q_{avg}$ is the average 15 minute leakage rate at the rated pressure in gpm, and
$P_{mawp}$ is the hydrostatic pressure during the test in psig.

5. From the leak rate factors, "K" factors and "K/L" factors shall be determined for the size range of pipe sections, joints, and fittings that may be qualified per section 5 of these guidelines, in the following manner:

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For pipe sections with no joints or fittings

$$K / L = \frac{D_{actual}}{D_{test}} LRF_{LP}$$

and for joints and fittings

$$K_J = \frac{D_{actual}}{D_{test}} LRF_J$$

where

$K / L$ is the "K/L" factor for pipe (gpm/psig$^{1/2}$/ft),
$K_J$ is the "K" factor for each joint type (gpm/psig$^{1/2}$),,
$D_{actual}$ is the inside diameter (inches) of pipe size for which a "K" factor is desired, and
$D_{test}$ is the inside diameter (inches) of the pipe subjected to the level 3 fire endurance test.

6. The "K" and "K/L" factors for pipe sections, fittings, and joints for the range of pipe sizes for which type approval is granted shall be listed on the type approval certificate.

*HYDRAULIC DESIGN PROCEDURES*

1. In the hydraulic design of a sprinkler system or deluge system, the following procedures shall be followed:

The system shall be designed per NFPA 13, NFPA 15, or another recognized industry standard applicable to the system, assuming no leakage from joints, fittings or pipe sections.

Virtual sprinkler heads shall be added (as discussed below) to account for the expected leakage rate from the pipe sections, joints and fittings. The hydraulic calculations for the system shall be re-calculated to ensure that the system will operate normally under the increased water demand. This can be verified by ensuring that the hydraulically most remote nozzle will operate at the minimum required pressure and flow rate when the virtual sprinkler heads are included in the calculations. A check should be made to ensure that the maximum working pressure of the sprinkler or deluge nozzles, pipes and fittings will not be exceeded when no leakage from the piping system occurs.

**The increased flow rate required for a system when the virtual sprinklers are added to the hydraulic calculations shall not exceed 110 % of the flow rate required for the system without the addition of the virtual sprinkler heads.**

2. Virtual sprinkler heads shall be added as follows:

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For each straight section of piping of a given diameter, a virtual sprinkler head shall be added at the mid-point of the pipe section. The "K" factor of the virtual sprinkler head shall be calculated as the product of the length of pipe and the "K/L" factor listed on the type approval.

For each joint or fitting for a given pipe diameter, a virtual sprinkler head shall be added at the location of the joint. The "K" factor of the virtual sprinkler head shall be as listed on the type approval certificate.

For deluge system piping, virtual sprinkler heads shall be added for all plastic piping downstream of the water supply valve.

For sprinkler system piping, with fusible heads, virtual sprinkler heads shall be added for all plastic piping located only in the hydraulically most remote required area of sprinkler operation.

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*APPENDIX B: EXAMPLE OF LEAKAGE RATE DATA REPORTING*

*Company:* ABC FRP MFG
*Pipe Tested:* Iceman, 2" Nominal Pipe Size (3 tests)
*Summary:* Three IMO level 3 fire endurance tests were performed to qualify pipe sizes from 2" up to 6" per section 4.2 of the guidelines. Test 1 was conducted on a straight section of pipe only. Test 2 was conducted on the permanent joint type. Test 3 was conducted on the flanged joint type. The results of the hydrostatic pressure tests are listed below. During the fire endurance tests, no leakage was noted from any of the samples.
*Measured Data:*

| | |
|---|---|
| Pressure Test (MAWP): | 250 psig |
| Leak Rate (straight pipe): | 0.5 gpm (Test 1) |
| Leak Rate (permanent joint): | 1.0 gpm (Test 2) |
| Leak Rate (flanged coupling): | 1.5 gpm (Test 3) |

*Calculated Data:*

| | |
|---|---|
| $LRF_{LP}$ (straight pipe): | 0.0226 |
| $LRF_J$ (permanent joint): | 0.0632 |
| $LRF_J$ (flanged coupling): | 0.0949 |

**PIPE QUALIFIED BASED ON TESTS ABOVE**

| Nominal Pipe Size, In. | Pipe Section/Joint | Inside Diameter, In. | $D_{actual}/D_{test}$ | K/L Factor (straight pipe) | K Factor (joints) |
|---|---|---|---|---|---|
| 2 | straight pipe | 2.067 | 1.0 | 0.0226 | - |
| | permanent joint | | 1.0 | - | 0.0632 |
| | flanged coupling | | 1.0 | - | 0.0949 |
| 2.5 | straight pipe | 2.469 | 1.19 | 0.0269 | - |
| | permanent joint | | 1.19 | - | 0.0752 |
| | flanged coupling | | 1.19 | - | 0.1129 |
| 3 | straight pipe | 3.068 | 1.48 | 0.0334 | - |
| | permanent joint | | 1.48 | - | 0.0935 |
| | flanged coupling | | 1.48 | - | 0.1404 |
| 3.5 | straight pipe | 3.548 | 1.72 | 0.0389 | - |
| | permanent joint | | 1.72 | - | 0.1087 |
| | flanged coupling | | 1.72 | - | 0.1632 |
| 4 | straight pipe | 4.026 | 1.95 | 0.0441 | - |
| | permanent joint | | 1.95 | - | 0.1232 |
| | flanged coupling | | 1.95 | - | 0.1851 |
| 5 | straight pipe | 5.047 | 2.44 | 0.0551 | - |
| | permanent joint | | 2.44 | - | 0.1542 |
| | flanged coupling | | 2.44 | - | 0.2316 |

# GUIDELINES ON THE FIRE ENDURANCE REQUIREMENTS FOR PLASTIC PIPE FOR USE ON MOBILE OFFSHORE DRILLING UNITS AND FLOATING PRODUCTION PLATFORMS

## 1 General

**1.1** IMO Resolution A.753(18) was developed and intended primarily for seagoing ships. These policy guidelines are intended to allow deviation from IMO Resolution A.753(18) based on the unique layout and operating conditions found on mobile offshore drilling units (MODUs) and floating production platforms. Deviations from IMO Resolution A.753(18) have previously been allowed on a case-by-case basis in certain fire main system and deluge system plastic piping applications. These guidelines have been developed as a result of several successful applications as well as extensive fire testing conducted by the Coast Guard, foreign regulatory agencies, and manufacturers of plastic pipe.

**1.2** The fire endurance requirements matrix, Appendix 4 of IMO Resolution A.753(18) does not adequately address the application and location of certain plastic fire main and deluge piping systems. These guidelines are intended to supplement IMO Resolution A.753(18) in the areas where it is lacking and are intended to be entirely consistent with the IMO document. Therefore, the expanded use of plastic piping on MODUs and floating production platforms is permitted subject to the limitations and testing requirements discussed below. During plan review, the Marine Safety Center (MSC) has the authority to determine the extent and application of these guidelines. The replacement of existing steel or metallic piping with plastic piping on existing MODUs and floating production platforms will require prior review and approval by the Officer in Charge of Marine Inspection (OCMI).

## 2 Definitions

*Deluge System:* A piping system employing open nozzles attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the nozzles. When this valve opens, water flows into the piping system and discharges from all nozzles attached thereto.

*Open Deck:* A deck which is completely exposed to the weather from above and from at least two sides.

*Semi-enclosed Location:* A location where natural conditions of ventilation are notably different from those on open decks due to the presence of structures such as roofs, windbreaks, and bulkheads, and which are so arranged that the dispersion of gas may not occur.

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## 3 Fire Main

**3.1** Plastic fire main system piping installed on offshore floating drilling and production platforms may meet the Level 3 fire endurance requirements as specified in IMO Resolution A.753(18), in lieu of the Level 1 or Level 2 requirements specified in IMO Resolution A.753(18), Appendix 4, when the below conditions are satisfied. In all other cases, plastic fire main system piping shall meet the fire endurance requirements specified in A.753(18), Appendix 4.

**3.1.1** Plastic piping must be located on the exterior perimeter of the platform and shielded by primary structural members from potential sources of fire which may occur on or emanate from the platform.

**3.1.2** Plastic piping must be located so that pooling of flammable liquids below the piping is not possible.

**3.1.3** The fire main system design shall be such that the plastic sections are continuously maintained in the wet condition.

**3.1.4** The fire main shall be equipped with an adequate number of isolation and cut-off valves such that, if a section of the system were to fail, it could be isolated and the remainder of the system would remain capable of supplying fire water.

## 4 Deluge System

**4.1** Deluge piping systems installed on offshore floating drilling and production platforms shall meet the fire endurance requirements for water spray systems as specified for various locations in IMO Resolution A.753(18), Appendix 4. Deviation from these requirements will be allowed for piping installed in open deck or semi-enclosed locations provided the piping and the piping system satisfy the requirements specified in sections 4.1.1 through 4.1.8 below.

**4.1.1** The deluge system piping must meet the Level 3 fire endurance requirements as specified in IMO Resolution A.753(18) and further clarified in Enclosure (1) of PFM 1-98.

**4.1.2** In addition to meeting the Level 3 fire endurance requirements, the deluge system piping must meet the requirements of the wet/dry fire endurance testing specified in section 4.9 below. Other wet/dry fire endurance test methods that may be equivalent to or more severe than the methods described herein will be considered on a case-by-case

basis. Other methods that have been accepted as of the date of this policy are described in the Appendix to these guidelines.

**4.1.3** An automatic fire detection system shall be installed in areas protected by the deluge system.

**4.1.4** The deluge system shall be designed to activate automatically, with no human action necessary to set it into operation, upon detection by the automatic fire detection system.

**4.1.5** Each section or area served by a deluge system should be capable of being isolated by one water supply valve only. The stop valve in each section should be readily accessible and its location should be clearly and permanently indicated.

**4.1.6** Means should be provided for preventing the water supply valves from being operated by an unauthorized person.

**4.1.7** The design of the deluge system shall be such that upon fire detection, the time required to have water flowing through the hydraulically most remote nozzle shall be less than one minute. This shall be verified by system testing at the time of installation and at subsequent annual inspections.

**4.1.8** The deluge system piping must be located downstream of the water supply valve. All piping upstream of the water supply valve must meet the requirements for fire main and water spray systems as specified in IMO Resolution A.753(18), Appendix 4.

**4.9** The wet/dry fire endurance testing shall consist of conducting the Level 3 fire endurance testing specified in Appendix 2 of IMO Resolution A.753(18) with the following modifications to the test conditions:

**4.9.1** For the first 5 minutes of the test, the piping shall be maintained in the dry condition at atmospheric pressure in lieu of containing stagnant water.

**4.9.2** After completion of the first 5 minutes of the test, the pipe specimen shall be completely filled with flowing water.

**4.9.3** Air shall be bled from the opposite end of the piping via a test connection until a steady flow of water at the specified flow rate and pressure is observed. The flow rate should not exceed the minimum pressure and flow rate that will be observed at the hydraulically most remote nozzle of the specific deluge system installation. The period from the time of first introducing water to the test specimen until the specified flow rate

and pressure is obtained, shall not exceed one minute. Testing at the specified flow rate and pressure will qualify the piping for all flow rates greater than that specified in the test.

**4.9.4** The total test time including dry and wet time shall be 30 minutes.

**4.9.5** All other requirements of Level 3 testing shall be followed without deviation. Alternative acceptance criteria as described in Enclosure (1) of this PFM, may be utilized in lieu of the Acceptance Criteria specified in Appendix 2 of IMO Resolution A.753(18).

# GUIDELINES ON THE FIRE ENDURANCE REQUIREMENTS FOR PLASTIC PIPE FOR USE ON MOBILE OFFSHORE DRILLING UNITS AND FLOATING PRODUCTION PLATFORMS

## *APPENDIX: ACCEPTABLE ALTERNATIVE WET/DRY FIRE ENDURANCE TEST METHOD*

### *Wet/Dry Jet-Fire Endurance Testing**

1 Test Method

The test method shall be as set forth by the U.K. Health & Safety Executive, Offshore Technology Report, OTI 95 634, Jet-Fire Resistance of Passive Fire Protection Materials, Sections 7, 8, 9, & 10, with the modifications and additions discussed herein. Where sections of OTI 95 634 refer to specific test specimens, the requirements for tubular sections shall be used.

The piping section, joints or fittings shall be centered in the box so as to be exposed to conditions of direct impingement from the jet flame.

2 Test Specimen

Each pipe should have a length of approximately 3 meters. The test pipe should be prepared with the permanent joint and/or fitting showing the most vulnerability (highest leakage rate) when tested to the Level 3 fire endurance test per IMO Resolution A.753(18). Additional test specimens may be tested, however, they will not be required provided that the piping system has been tested to the IMO Level 3 fire endurance requirements.

If the insulation contains, or is liable to absorb moisture, the specimen should not be tested until the insulation has reached an air-dry condition. This condition is defined as equilibrium with an ambient atmosphere of 50 % relative humidity at 20 ± 5 °C.

The outside diameter of piping shall not exceed 0.35 meters.

3 Test Conditions

The test conditions shall be as set forth in sections 4.9.1, 4.9.2, and 4.9.3 of these guidelines. The duration of the test shall be 20 minutes.

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* This test method is currently being refined by the Fire Endurance Section of ASTM Designation: F1173 and will be a referenced standard when completed.

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4 Acceptance Criteria

The acceptance criteria shall be the same as set forth in Appendix 2 of IMO Resolution A.753(18) except that the maximum leakage rate when hydrostatically tested to the rated pressure, after the jet-fire exposure shall not exceed 10% of the flow rate of water used during the test.