United Nations ECE/TRANS/WP.29/GRSG/2015/32

Economic and Social Council

Distr.: General
13 July 2015

Original: English

Economic Commission for Europe

Inland Transport Committee

World Forum for Harmonization of Vehicle Regulations

Working Party on General Safety Provisions

109th session
Geneva, 29 September – 2 October 2015
Item 2(a) of the provisional agenda
Regulation No. 107 (M_2 and M_3 vehicles) – Proposals for further amendments

Proposal for the 07 series of amendments to Regulation No. 107 (M_2 and M_3 vehicles)

Submitted by the expert from the International Organization of Motor Vehicle Manufacturers*

The text reproduced below was prepared by the expert from the International Organization of Motor Vehicle Manufacturers (OICA) aimed at mandating fire suppression systems on vehicles of Classes I and II as a new 07 series of amendments to the Regulation. It is mainly based on ECE/TRANS/WP.29/GRSG/2014/6/Rev.1, amended as reproduced in GRSG-108-51, submitted to WP.29 and AC.1 for consideration at their November 2015 sessions, as draft Supplement 4 to the 06 series of amendments to Regulation No. 107 (ECE/TRANS/WP.29/2015/88). The modifications are marked in bold for new characters and strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2012–2016 (ECE/TRANS/224, para. 94 and ECE/TRANS/2012/12, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

I. Proposal

Insert a new paragraph 2.2.3., to read:

"2.2.3. "*Fire suppression system type*" for the purpose of type approval as a component means ~~a category of~~ systems which do~~es~~ not essentially differ in the following aspects:

(a) fire suppression system manufacturer;

(b) extinguishing agent;

(c) type of discharge point(s) used (e.g. type of nozzle, extinguishing agent generator or extinguishing agent discharge tube);

(d) type of propellant gas, if applicable."

Paragraph 2.3., amend to read:

"2.3. *"Approval of a vehicle, a separate technical unit or a component"* means the approval of a vehicle type, of a bodywork **type** or of a component type as defined in paragraph 2.2. with regard to the constructional features specified in this Regulation;"

Paragraph 4.2., amend to read:

"4.2. An approval number shall be assigned to each type approved. Its first two digits (at present **[07]**, corresponding to the **[07]** series of amendments) shall indicate the series of amendments incorporating the most recent major technical amendment made to the Regulation at the time of issue of the approval. The same Contracting Party shall not assign the same number to another vehicle, bodywork or fire suppression system type within the meaning of paragraph 2.2."

Paragraph 5.1., amend to read:

"5.1. All vehicles shall comply with the provisions set out in Annex 3 to this Regulation. Bodywork approved separately shall comply with Annex 10. The approval of a vehicle incorporating ~~a~~ bodywork approved in accordance with Annex 10 shall be completed in accordance with ~~that annex~~ **Annex 3**. Fire suppression systems approved separately shall comply with Annex 13, Part 1. In the case of an approval of a vehicle with a fire suppression system installed in a specific engine compartment, it shall comply with the requirements of Annex 13, Part 2."

Insert new paragraph 10.13. to 10.17. (Transitional provisions), to read:

"**10.13. As from the official date of entry into force of the 07 series of amendments, no Contracting Party applying this Regulation shall refuse to grant or refuse to accept type approvals under this Regulation as amended by the 07 series of amendments.**

10.14. As from 01 September [2020], Contracting Parties applying this Regulation shall grant type approvals to vehicle types of Classes I and II, only if the vehicle type to be approved meets the requirements of this Regulation as amended by the 07 series of amendments.

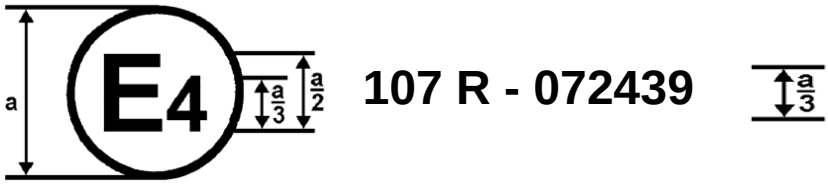
10.15. Contracting Parties applying this Regulation shall not refuse to grant extensions of type approvals for existing types which have been granted according to the 06 series of amendments to this Regulation.

10.16. **As from 01 September [2022], Contracting Parties applying this Regulation shall not be obliged to accept, for the purpose of national or regional type approval, a vehicle of Class I or II type approved to the 06 series of amendments to this Regulation.**

10.17. **Notwithstanding paragraphs 10.14. and 10.16., Contracting Parties applying this Regulation shall continue to accept type approvals granted to the 06 series of amendments to vehicles which are not affected by the 07 series of amendments.**"

Annex 2, Model D, amend to read:

"**Model D**



a = 8 mm min.

The above approval mark affixed to a fire suppression system shows that the fire suppression system type has been approved in the Netherlands (E4) as a component, pursuant to Regulation No. 107 under approval number **07**2439. The approval number indicates that the approval was granted according to the requirements of Regulation No. 107 as amended by the **07** series of amendments."

Annex 3, paragraphs 7.5.1.5.4.2. and 7.5.1.5.4.3., amend to read:

"7.5.1.5.4.2. An analysis shall be conducted prior to the installation in order to determine the location and direction of the suppression agent discharge point(s) (e.g. nozzles, extinguishing agent generators or extinguishing agent discharge tube or other distribution points). Potential fire hazards within the engine compartment and each compartment where a combustion heater is located, shall be identified and the discharge point(s) located such that the suppression agent will be distributed to cover the fire hazard when the system activates. The spray pattern and direction of discharge points, as well as the ~~throwing~~ **discharge** distance, shall be ensured to cover identified fire hazards. The system shall also be ensured to work properly regardless of the vehicle's altitude.

The fire hazard analysis shall, as a minimum, take into account the following components:

(a) **those** ~~fire hazards to be taken into account in the analysis shall at least consist of the following: Components~~ whose surface may reach temperatures above the auto-ignition temperature for fluids, gases or substances that are present within the compartment,

(b) ~~and~~ electrical components and cables with a current or voltage high enough for an ignition to occur,

(c) ~~as well as~~ hoses and containers with flammable liquid or gas (in particular if those are pressurized).

The analysis shall be fully documented.

7.5.1.5.4.3. The suppression system shall be scaled from the tested system, based on the total gross volume of the engine and **combustion**~~auxiliary~~ heater compartments where the system is to be installed. When measuring the engine compartment and the **combustion**~~auxiliary~~ heater compartments, the gross volume of these compartments shall be measured, i.e. the volume of the engine and its components shall not be subtracted.

The scaling of the system includes the mass of the suppression agent, all discharge points and the mass of the propellant gas container, if applicable. The system pressure shall remain the same as in the tested system. If the system includes a discharge tube for the extinguishing agent, the length of the tube shall be scaled without nozzles. It is acceptable if the suppression system has more extinguishing agent and/or more discharge points and/or a longer discharge tube for the extinguishing agent and/or more propellant gas than required according to the scaling models found below.

If the gross volume of the engine and **combustion**~~auxiliary~~ heater compartments exceed**s** 4 m^3, the suppression system shall be scaled up using the following scaling factor calculated in (1) below. If the gross volume is less than 4 m^3, it is allowed to scale down the suppression system using the scaling factor (2) below. S_x denotes the scaling factor and x denotes the total gross volume including the engine and combustion heater compartments [m^3].

$S_x = 0.1 \cdot x + 0.6$ (1)

$Sx = 0.15 \cdot x + 0.4$ (2)

The scaled number of nozzles or other discharge points, if the suppression system has more than one discharge point, may be rounded to the closest whole number."

Annex 13, amend to read:

"Annex 13 – Part 1

Fire suppression system approved as a component

1. Specifications

1.1. Fire suppression systems shall be tested for high-**load** fire-~~load~~, low-**load** fire ~~load~~, high-**load** fire-~~load~~ with fan and re-ignition.

1.2. The test apparatus, test fires and general test conditions are described in Appendix 1 of this annex.

1.3. High-**load** fire-~~load~~

1.3.1. The ~~high fire load~~ test shall be conducted in accordance with Appendix 2 of this annex.

1.3.2. The test shall be conducted with the extinguishing agent and the propellant gas vessel or the suppression agent generator cooled to the minimum operating temperature for the fire suppression system, as declared by the manufacturer.

1.3.3. The fires shall be fully extinguished, ~~either~~ **at the latest** in the minute after activation or **before the extinguishing agent has been fully used, whichever happens first** ~~upon end of the discharge of the suppression system~~.

1.3.4. The test is considered passed either after success at first attempt or at two of three attempts in a case when first of these attempts fails.

1.4. Low-**load** fire ~~load~~

1.4.1. The ~~low fire load~~ test shall be conducted in accordance with Appendix 3 of this annex.

1.4.2. The fires shall be fully extinguished, ~~either~~ **at the latest** in the minute after activation or **before the extinguishing agent has been fully used, whichever happens first** ~~upon end of the discharge of the suppression system~~.

1.4.3. The test is considered passed if success was achieved at the first attempt or at two of three attempts in a case when first of these attempts fails.

1.5. High-**load** fire ~~load~~ with fan

1.5.1. The ~~high fire load~~ test ~~with fan~~ shall be conducted in accordance with Appendix 4 of this annex.

1.5.2. The fires shall be fully extinguished either in the minute after activation or upon end of the discharge of the suppression system.

1.5.3. The test is considered passed if success was achieved at the first attempt or at two of three attempts in a case when first of these attempts fails.

1.6. Re-ignition test

1.6.1. The ~~re ignition~~ test shall be conducted in accordance with Appendix 5 of this annex.

1.6.2. **Re-ignition shall not occur within 45 seconds of the fire being fully extinguished**.~~The fire shall be fully extinguished and no re ignition shall occur 45 seconds after the extinguishing of the fire.~~

1.6.3. The test is considered passed either if success was achieved at the first attempt or at two of three attempts in a case when first of these attempts fails.

Annex 13 – Part 2

Fire suppression system installed in a specific engine compartment

1. Specifications

1.1. A specific engine compartment means engine compartments which do not differ in the following essential aspects:

(a) **The position of the engine compartment;** ~~Engine compartments position in the vehicle;~~

(b) Maximum gross volume;

(c) General layout of components in the compartment (i.e. position of **the determined** fire hazards) ~~determined)~~.

For compartments where a combustion heater is located items ~~placed aspects~~ (b) and (c) apply.

1.2. The fire suppression systems shall be tested for high-**load** fire ~~load~~, low-**load** fire ~~load~~, high-**load** fire ~~load~~ with fan (to be applied if a fan is fitted in the engine compartment and/or combustion heater compartment) and re-ignition.

1.3. The test apparatus, test fires and general test conditions are described in Appendix 1 of this annex.

In order to facilitate the positioning of the fire trays within the engine and combustion heater compartment additional supports may be used and the height of the prescribed test fire may be lowered to a minimum of 40 mm.

The test conditions in Appendices 2 to 5 may be adapted for the specific engine compartment and combustion heater compartment. The adaptation shall be based on the provisions given in Annex 3, paragraphs 7.5.1.5.4.2. and 7.5.1.5.4.3., determining the fire hazards within the compartment and the scaling of the fire suppression system. The adaptation shall provide an equivalent level of safety. The principles for the adaptation shall be verified by the Technical Service responsible for the tests. The principle of adaption shall be documented and added to the test report.

1.4. High-**load** fire ~~load~~

1.4.1. The ~~high fire load~~ test shall be conducted in accordance with Appendix 2 of this annex.

1.4.2. The test shall be conducted with the extinguishing agent and the propellant gas vessel or the suppression agent generator cooled to the minimum operating temperature for the fire suppression system, as declared by the manufacturer.

1.4.3. The fires shall be fully extinguished, either, in the minute after activation or upon end of the discharge of the suppression system.

1.4.4. The test is considered passed either after success at the first attempt or after success at the second and third attempts in case of failure at the first attempt.

1.5. Low-**load** fire ~~load~~

1.5.1. The ~~low fire load~~ test shall be conducted in accordance with Appendix 3 of this annex.

1.5.2. The fires shall be fully extinguished either in the minute after activation or upon end of the discharge of the suppression system.

1.5.3. The test is considered passed either after success at the first attempt or after success at the second and third attempts in case of failure at the first attempt.

1.6. High-**load** fire ~~load~~ with fan (if a fan is fitted in the engine and/or combustion heater compartment)

1.6.1. The ~~high fire load~~ test ~~with fan~~ shall be conducted in accordance with Appendix 4 of this annex.

1.6.2. The fires shall be fully extinguished either in the minute after activation or upon end of the discharge of the suppression system.

1.6.3. The test is considered passed either after success at the first attempt or after success at the second and third attempts in case of failure at the first attempt.

1.7. Re-ignition test

1.7.1. The re-ignition test shall be conducted in accordance with Appendix 5 of this annex.

1.7.2. **Re-ignition shall not occur within 45 seconds of the fire being fully extinguished**.~~The fire shall be fully extinguished and no re-ignition shall occur 45 seconds after the extinguishing of the fire.~~

1.7.3. The test is considered passed either after success at the first attempt or after success at the second and third attempts in case of failure at the first attempt.

Annex 13 - Appendix 1

Test apparatus, test fires and general test specifications

1. Test apparatus

1.1. The test apparatus is to be made of steel plate. The thickness of the steel plate shall be in accordance with Table 1. Figure 1 shows the test apparatus from the front side, Figure 2 from the rear side and Figure 3 from above. The front side of the test apparatus simulates the rear side of a real engine compartment.

Figure 1

Co-ordinate system for the positioning of objects in the test apparatus (view from front side)

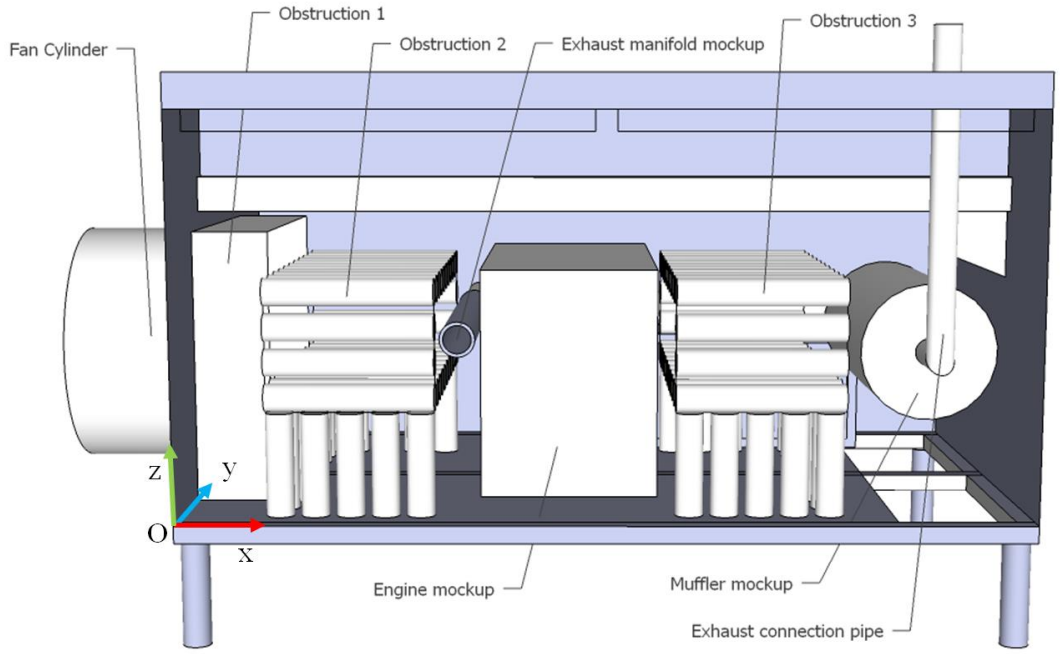


Figure 2
Test apparatus seen from the rear

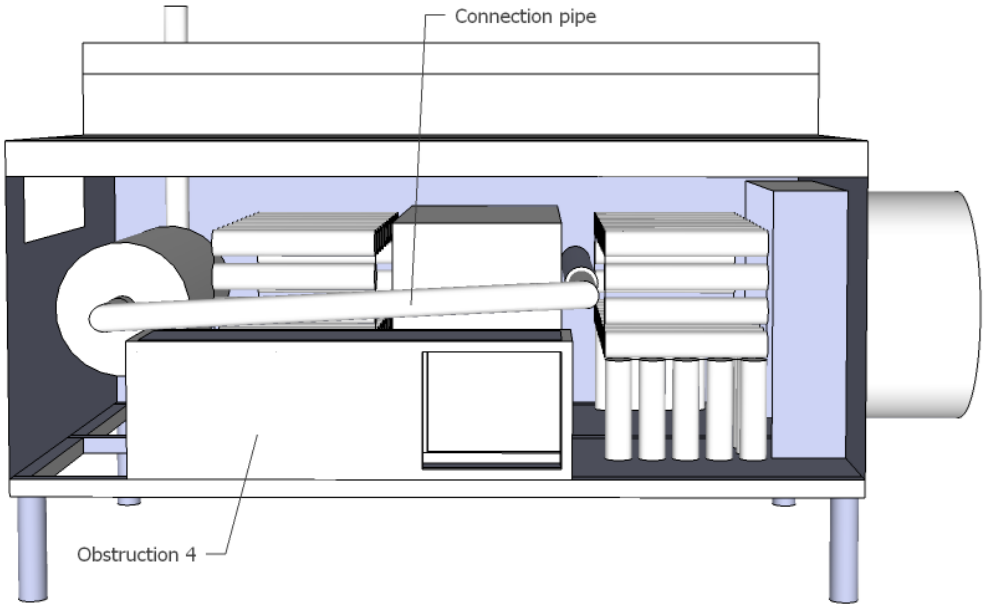


Figure 3
Test apparatus seen from above

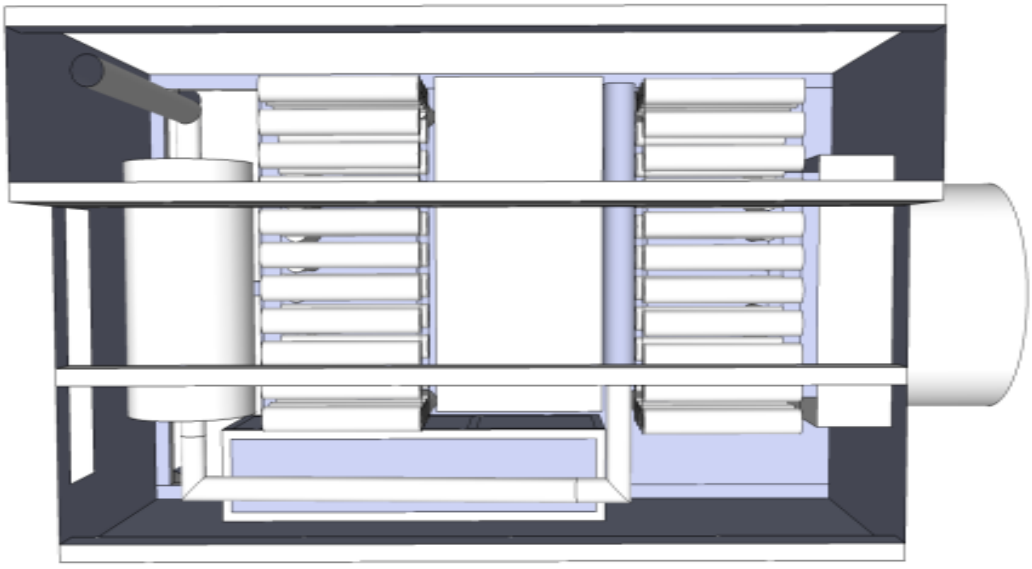


Table 1
Test apparatus objects

Objects	*Plate thickness*
Fan cylinder	1.5 – 2 mm
Obstructions	1.5 – 2 mm
Exhaust manifold mock-up	8 mm
Engine mock-up	2 – 3 mm
Silencer~~Muffler~~ mock-up	2 – 3 mm
Exhaust pipe	2 – 3 mm
Connection pipe	2 – 3 mm
Walls, ceiling and floor	1.5 – 3 mm

1.2. Object locations

1.2.1. All objects in the test apparatus are positioned according to co-ordinates (x, y, z) as shown in Table 2. Origin is the position marked (O) in Figure 1. The value of the co-ordinates is the distance in metres from the origin (see Figure 1), i.e. left-front-bottom corner.

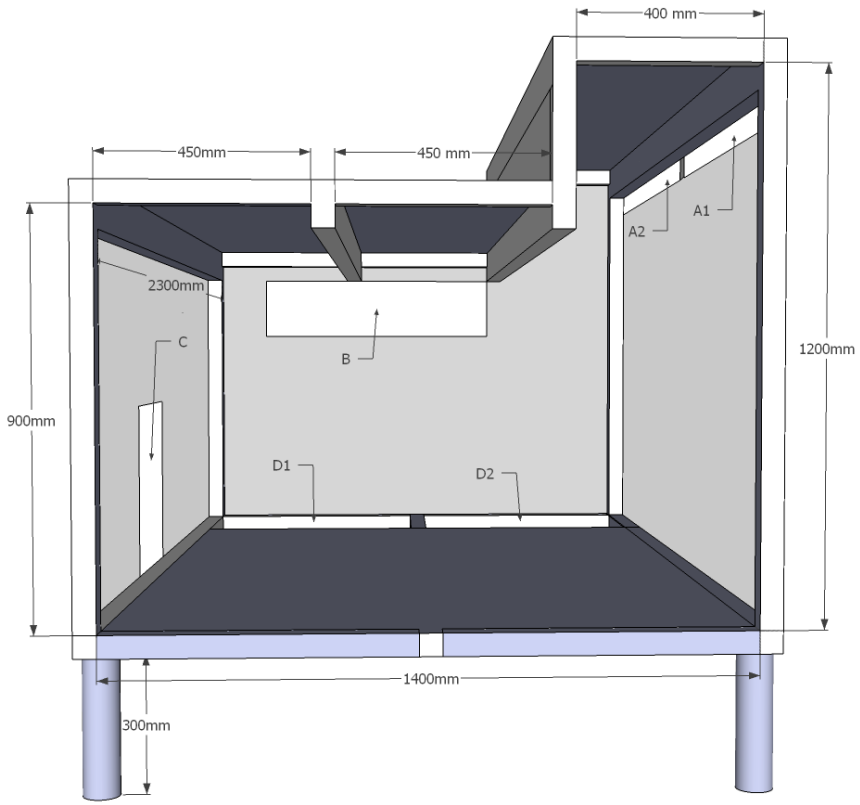
Table 2
Co-ordinates of objects

Objects	*Co-ordinates [x; y; z]*
Fan cylinder	[-0.60; 0.40; 0.10]
Obstruction 1	[0.0; 0.26; 0.0]
Obstruction 2	[0.26; 0.05; 0.02]
Exhaust manifold mock-up	[0.76; 0.05; 0.47]
Engine mock-up	[0.87; 0.05; 0.04]
Obstruction 3	[1.44; 0.05; 0.02]
Obstruction 4	[0.82; 1.2; 0.0]
Silencer~~Muffler~~ mock-up	[2.0; 0.28; 0.23]

1.3. Framework

1.3.1. The framework of the test apparatus shall be constructed according to Figure 4. The **dimensions**~~sizes~~ of the beams are 50 mm × 50 mm and 100 mm × 50 mm respectively. The framework shall be 300 mm above the ground.

Figure 4
Framework for the test apparatus



1.4. Apertures

1.4.1. In addition to the opening for the fan, the test apparatus includes six apertures. The dimensions and position**ings** ~~s~~ of the apertures are ~~ given~~ according to the co-ordinates in Table 3. The positions are **referenced** ~~given by referring~~ **from** ~~to~~ two diagonally opposite corners (all apertures are rectangular in shape). The apertures are shown in Figure 4.

Table 3
Co-ordinates of apertures in the test apparatus

Aperture	*Co-ordinates [x; y; z] – [x; y; z]*	*Area of aperture*
A1	[0.03; 0.00; 1.08] – [1.18; 0.00; 1.13]	0.06 m^2
A2	[1.22; 0.00; 1.08] – [2.37; 0.00; 1.13]	0.06 m^2
B	[2.40; 0.50; 0.70] – [2.40; 1.30; 0.90]	0.16 m^2
C	[0.85; 1.50; 0.03] – [1.24; 1,50; 0.36]	0.13 m^2
D1	[2.00; 0.05; 0.00] – [2.35; 0.73; 0.00]	0.27 m^2
D2	[2.00; 0.78; 0.00] – [2.35; 1.20; 0.00]	0.26 m^2
	Total area of aperture:	0.94 m^2

1.5. Fan

1.5.1. An axial fan with a diameter of 710 mm shall be mounted on the left side of the fan cylinder. The diameter of the cylinder shall be equal to the diameter of the fan. The fan shall produce a certain rate of air flow through the cylinder according to the test scenarios in Appendices 2 to 5. A frequency converter may be used to adjust the fan speed.

1.6. Mock-up components

1.6.1. The dimensions of the engine mock-up are 1,000 mm × 650 mm × 500 mm. The dimensions of the **silencer**~~muffler~~ mock-up are diameter 400 mm × 800 mm. The exhaust manifold mock-up shall have the inner dimensions of diameter 80 mm × 900 mm. The mock-up components shall be **hollow**~~hollowed~~. The exhaust manifold mock-up shall be connected to the **silencer**~~muffler~~ mock-up through a pipe with a diameter of 76 mm. A pipe from the **silencer**~~muffler~~ mock-up shall also be used to carry the exhaust gases from the pre-warming system out from the test apparatus.

1.7. Thermocouples

1.7.1. Seven thermocouples (Tc) shall be mounted on the exhaust manifold mock-up, drilled 2 mm into the tube from the outside. Thermocouples Tc1 to Tc4 shall be located on top of the mock-up at the distances from the mock-up inlet according to Table 4. Thermocouples Tc5 to Tc7 shall be located around the mock-up at the same distance from the inlet as Tc2. The location of the thermocouples is illustrated in Figures 5 and 6.

Table 4
Distance to thermocouple from inlet of exhaust manifold mock-up

Thermocouple	*Distance from inlet*
Tc1	250 mm
Tc2	300 mm
Tc3	350 mm
Tc4	600 mm
Tc5	300 mm
Tc6	300 mm
Tc7	300 mm

Figure 5
Thermocouples on the exhaust manifold mock-up

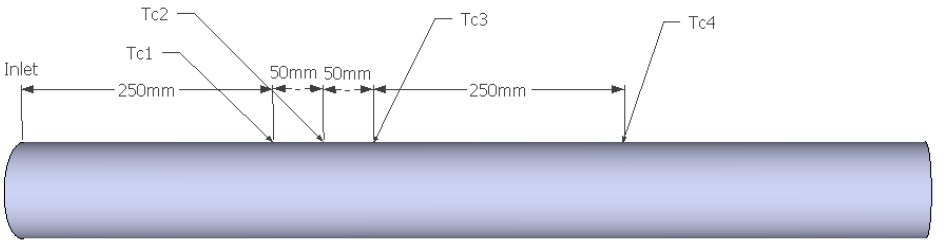
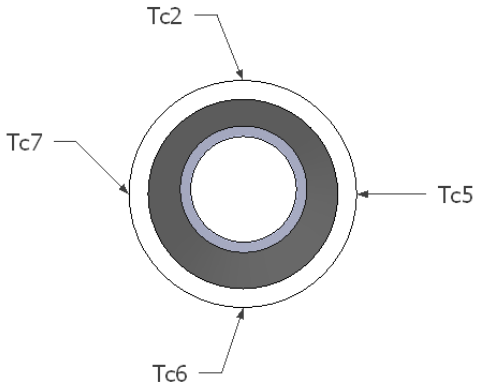


Figure 6
Thermocouples on the exhaust manifold mock-up (the inlet of the mock-up is on the left side)



1.8. Propane burner

1.8.1. The propane burner used to pre-warm the exhaust system shall be chosen as to fulfil the requirements on achieved temperatures specified in paragraph 3.4.6.

1.9. Obstructions

1.9.1. Obstruction 1 has the dimensions of 900 mm × 840 mm × 230 mm, as shown in Figure 7. Obstructions 2 and 3 consist of horizontal and vertical obstruction tubes as shown in Figure 8. The horizontal obstruction tubes are closed and hollow, with a diameter of 80 mm and a length of 480 mm. The vertical tubes are hollow and open in the bottom, with a diameter of 80 mm and a length of 230 mm. The open distance between every tube is 20 mm. Obstruction 4 is a box measuring 1,250 mm × 300 mm × 390 mm as shown in Figure 9.

Figure 7
Obstruction 1

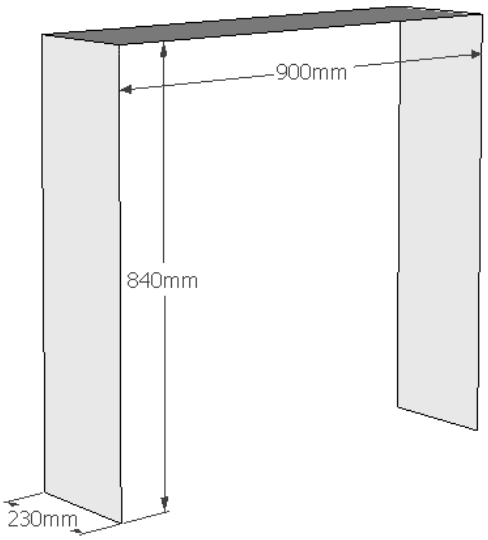


Figure 8
Obstruction 2 and 3

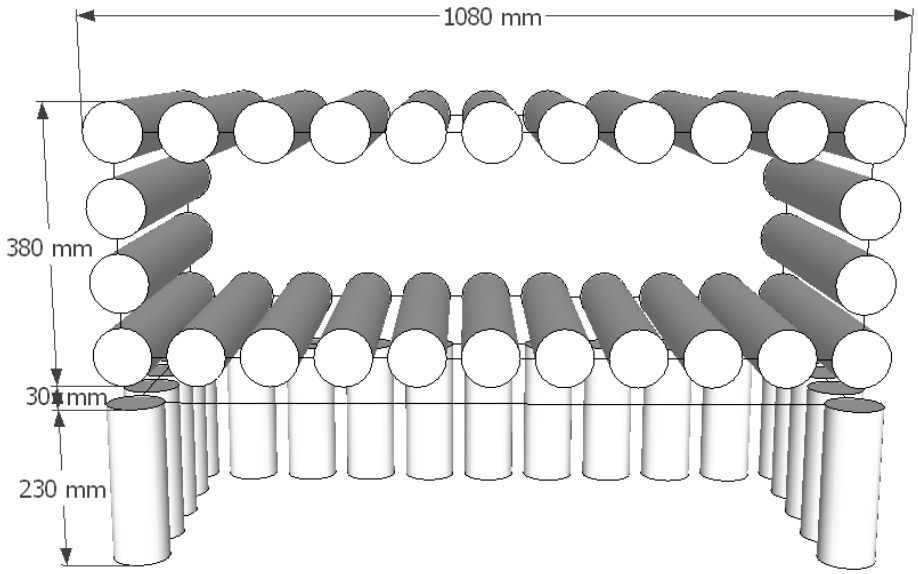
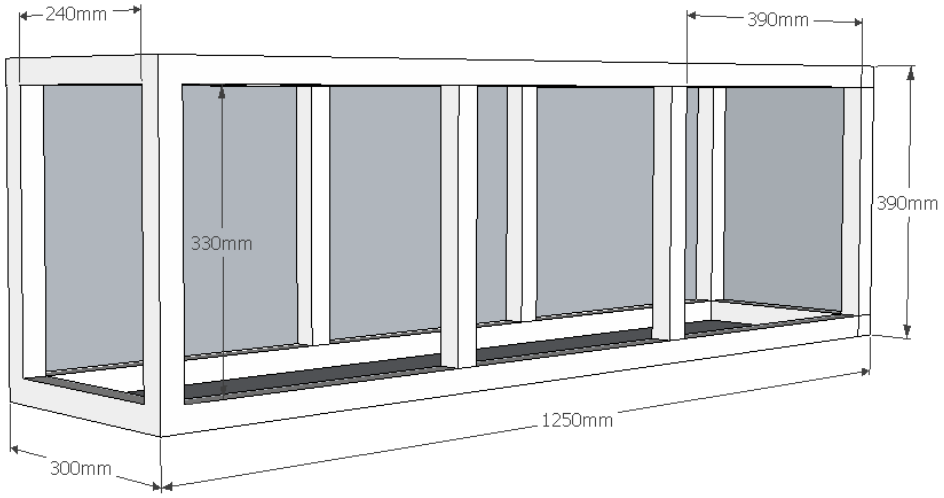


Figure 9
Obstruction 4



1.10. Pool fire trays

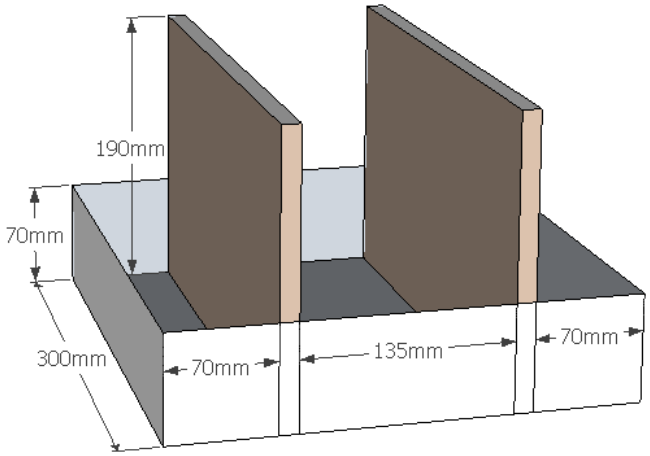
1.10.1. Detailed descriptions of these trays are given in Table 5. Three different types of pool fire trays are applied in Table 6: square, rectangular and circular.

Table 5
Specification of pool fire trays

Dimensions	*Rim height*	*Nominal thickness*	*Used for test fire*
300 mm × 300 mm	**70 mm**	**1.5 mm**	**#1, #2**
200 mm × 300 mm	**70 mm**	**2 mm**	**#3**
Diameter 150 mm	**100 mm**	**1.5 mm**	**#4**

1.10.**~~21~~.** The square pool fire trays with fibreboards and the rectangular pool fire trays shall be positioned in its orientation according to the test scenarios in Appendices 2 to 4. Figure 10 shows the dimensions for test fire #2. The test fire shall be positioned perpendicular to the long edge of the test apparatus.

Figure 10
Distances for test fire #2



2. Test fires

2.1. The test fires in Table **6~~5~~** are to be **conducted as** ~~used in the different test scenarios~~ described in Appendices 2 to 5. Diesel oil (commercial fuel oil or light diesel oil), heptane (C_7H_{16}) and engine oil 15W-40 with a flash point COC of 230 °C and viscosity at 40 °C of 107 mm²/s shall be used as test fuels.

Table **6**~~5~~
Test fires

Test fire	*Description*	*Fuel*	*Approximate peak Heat Release Rate 60 sec after ignition*
#1	Pool fire 300 mm × 300 mm	Diesel oil and heptane	60 kW
#2	Pool fire 300 mm × 300 mm and 2 fibreboards	Diesel oil and heptane	110 kW
#3	Pool fire 200 mm × 300 mm	Diesel oil and heptane	40 kW
#4	Pool fire diameter 150 mm	Diesel oil and heptane	7 kW
#5	Spray fire (450 kPa, 0.73 kg/min ±10%)	Diesel oil	520 kW
#6	Spray fire (450 kPa, 0.19 kg/min ±10%)	Diesel oil	140 kW
#7	Dripping oil fire (40 droplets/min ±10)	Engine oil	5 kW

~~2.2. Three different types of pool fire trays are applied in Table 5: square, rectangular and circular. Detailed descriptions of these trays are given in Table 6.~~

~~Table 6~~
~~**Specification of pool fire trays**~~

~~*Dimensions*~~	~~*Rim height*~~	~~*Nominal thickness*~~	~~*Used for test fire*~~
~~300 mm × 300 mm~~	~~70 mm~~	~~1.5 mm~~	~~#1, #2~~
~~200 mm × 300 mm~~	~~70 mm~~	~~2 mm~~	~~#3~~
~~Diameter 150 mm~~	~~100 mm~~	~~1.5 mm~~	~~#4~~

2.**2.**~~3.~~ The amount of water, diesel and heptane used in the tests shall be in accordance with Table 7.

Table 7
Amount of fuel used in pool fire trays

Dimensions	*Water*	*Diesel*	*Heptane*	*Used for test fire*
300 mm × 300 mm	1.0 l	0.5 l	0.2 l	#1, #2,
200 mm × 300 mm	0.5 l	0.5 l	0.2 l	#3
Diameter 150 mm	0.2 l	0.2 l	0.1 l	#4

2.**3.4.** Test fire #2 consists of a heptane pool and two diesel soaked fibreboards with a dry density of 3.5 kg/m^3. The dimensions of the fibreboards shall be 12 mm × 295 mm × 190 mm. The fibreboards shall consist of at least 90 per cent raw material from wood. The moisture content in the boards before they are soaked in diesel oil shall not exceed 7 per cent. The fibreboards shall be completely immersed in diesel oil for at least 10 minutes prior to the test and mounted vertically in the pool fire tray not more than10 minutes before the start of the test.

2.**4**~~5~~. Test fire #5 and #6 consist of diesel oil spray fires while Test fire #7 consists of a dripping oil fire (by hot surface ignition).

The spray nozzle for test fire #5 shall be a Lechler 460.368.30 or an equivalent. The spray nozzle for test fire #6 shall be a Lechler 212.245.11 or an equivalent. The spray nozzle for test fire #7 shall be a Danfoss 0.60X80H or an equivalent.

3. Installation of the fire suppression system

3.1. To obtain the minimum discharge rate condition, an extinguishing system is to be assembled **to its maximum dimensional capability** ~~using its maximum piping limitations~~ with respect to the number of fittings and size and length of pipe, if relevant. The cylinder is to be used with its rated capacity and the cylinder or gas cartridge pressurized with propellant gas to the normal operating pressure, if relevant.

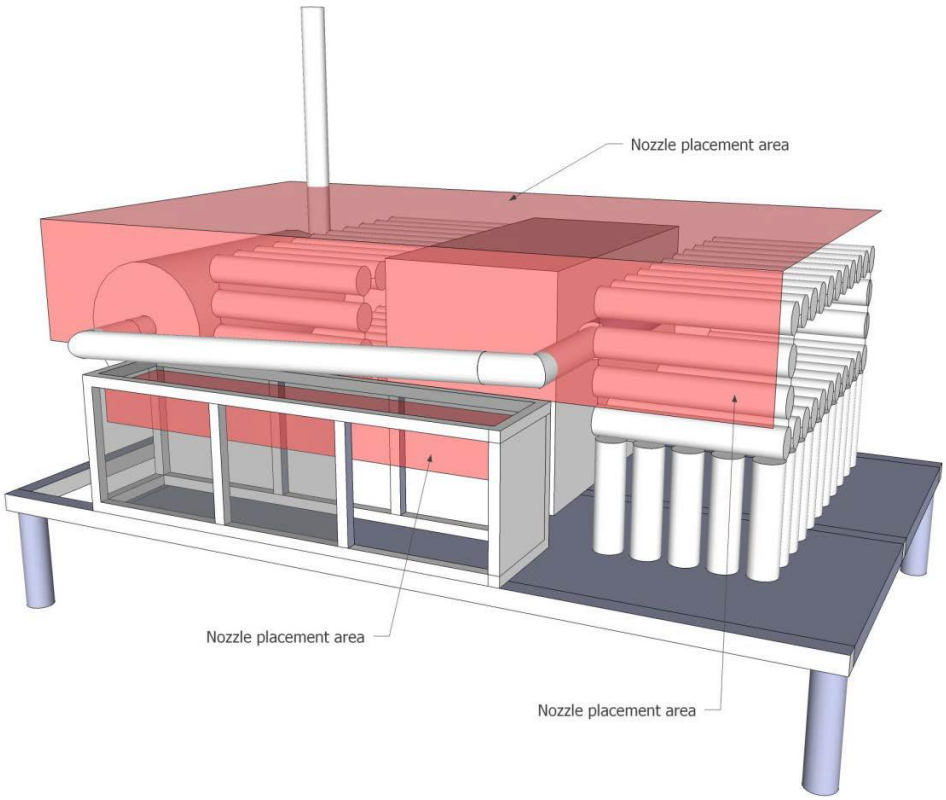
3.2. The fire suppression system shall be installed by the system manufacturer or supplier. Figure 11 shows the area where extinguishing agent discharge points such as of nozzles, extinguishing agent generators or extinguishing agent discharge tubes may be located. The discharge points shall be positioned inside the test apparatus, at two different areas:

(a) In the ceiling and at the rear wall. Discharge points positioned in the ceiling shall be positioned at a minimum of 750 mm above the floor level ($z \geq 0.75$) and outside of Obstruction 1. Nozzles positioned at the rear wall shall be positioned within 350 mm from the rear wall ($y \geq 1.15$) and minimum 450 mm from the floor level ($z \geq 0.45$). Figures 17 and 18 show the area where the nozzles may be located.

(b) Inside the small box (referred to as Obstruction 4) in the rear side of the test apparatus. Nozzles shall be located in the ceiling of the box with a minimum of 290 mm from the floor ($z \geq 0.29$).

Figure 11

Nozzle positioning seen from the rear side of test apparatus



3.3. The system set-up and configuration shall be observed and documented prior to the test (e.g. amount of suppression agent and propellant gas, system pressure, number, type and location of discharge points, length of pipes and number of fittings).

Temperature shall be measured during the re-ignition tests at locations specified in Appendix 1.

3.4. **Test method**~~Practical conduct of a test~~

3.4.1. The pool fire trays are to be filled with diesel and heptane on a base of water according to Table 7. **Where**~~If~~ fibreboards are **required** to be used as the fire source, **they**~~the fibreboards~~ shall be soaked in diesel oil, prior to the test, according to instructions in paragraph 2.**3.4.** ~~.~~ above.

3.4.2. A pre-burn time based on the information in Appendices 2 to 5 is required. The pre-burn time is measured ~~beginning~~ from the time the first fire is ignited. All pool fires in the test scenarios shall be ignited within the allowed ignition-time, according to Appendices 2 to 5, using a suitable ignition source. The low-**load** fire ~~load~~ **tests** ~~scenario~~ in **Table 1 in** Appendix 3 may be performed either **individually or concurrently** ~~with one test fire at a time or the test fires combined with the suppression system showing its ability to extinguish all~~ ~~test fires, separately or merged~~.

3.4.3. A fan is used in some of the test scenarios to obtain a specific air flow rate into the test apparatus. The fan shall be engaged 30 seconds before the suppression system is activated. The fan shall remain active until the ~~result of~~

~~the~~ test is **determined**. ~~complete, i.e. until it is determined whether the test is passed or failed.~~

3.4.4. A diesel spray is used in some of the test scenarios. The diesel spray shall be activated 10 seconds prior to activation of the suppression system. The diesel spray shall remain active until the **result of the** test is **determined**. ~~completed, i.e. until it is clarified if the test is passed or failed.~~

3.4.5. After the stipulated pre-burn time, the suppression system shall be manually or automatically activated.

3.4.6. In the test for re-ignition, the exhaust manifold mock-up tube is pre-heated **with a burner** prior to the test ~~with a burner~~. Pressurized air may be added to the flame for better combustion. The tube shall be heated from the inner side until the temperature of Tc2 is above 600 °C and Tc1 is above 570 °C and the temperatures of Tc5, Tc6 and Tc7 not are less than 520 °C. When the pre-defined temperatures are reached the pre-heating procedure stops. After 30 seconds the engine oil shall start dripping and the suppression system activate**d** 15 seconds later. The engine oil shall ignite before activation of the suppression system. The oil shall continue to drip on to the tube until **the result of the test is determined**.~~it is clarified if the test is passed or failed.~~

4. Tolerances

4.1. A tolerance of ±5 per cent of the stipulated values shall apply (for time values: ±5 seconds).

Appendix 2

High-**load** fire ~~load scenario~~

Table 1
Test fires ~~in high fire load scenario~~

Test fire *(see Table ~~6~~5 in Appendix 1)*	*Description*	*Co-ordinates [x; y; z]* *(see Figure 1 in Appendix 1)*
#6	Spray fire (**0.45 MPa**, 0.19 kg/min)	[1.47; 0.73; 0.46]
#3	Pool fire 200 mm × 300 mm	[0.97; 0.85; 0.70]
#4	Pool fire diameter 150 mm	[0.97; 1.28; 0.00]
#3	Pool fire 200 mm × 300 mm	[1.54; 0.57; 0.36]
#2	Pool fire 300 mm × 300 mm and 2 Fibreboards	[1.54; 0.77; 0.36]
#3	Pool fire 200 mm × 300 mm	[1.54; 0.13; 0.00]

Note: The fan is not used

Table 2
Test procedure ~~for high fire load scenario~~

Time	*Action*
00:00	Start measuring time
01:20	Ignite pool fires (within 20 seconds)
01:50	Start diesel spray
02:00	Activate suppression system

Figure 1
Test fire positioning, view from the front side

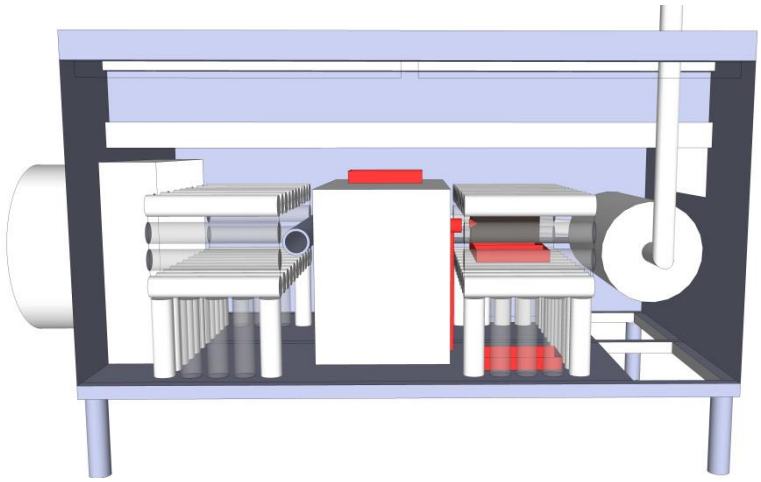
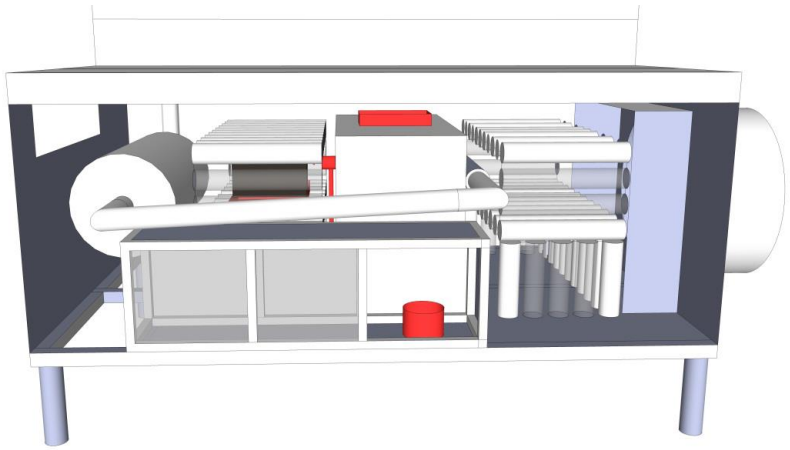


Figure 2
Test fire positioning, view from the rear side



Appendix 3

Low-**load** fire ~~load scenario~~

Table 1
Test fires ~~in low fire load scenario~~

Test fire *(see Table ~~6~~5 in Appendix 1)*	*Description*	*Co-ordinates [x; y; z]* *(see Figure 1 in Appendix 1)*
#4	Pool fire diameter 150 mm	[0.02; 0.08; 0.00]
#3	Pool fire 200 mm × 300 mm	[0.37; 0.57; 0.00]
#4	Pool fire diameter 150 mm	[0.45; 1.20; 0.00]
#4	Pool fire diameter 150 mm	[0.97; 1.28; 0.00]
#4	Pool fire diameter 150 mm	[1.54; 0.57; 0.00]

Note: The fan is **required to produce** ~~producing~~ an air flow of 1.5 m^3/s.

Table 2
Test procedure ~~for low fire load scenario~~

Time	*Action*
00:00	Start measuring time
01:00	Ignite pool fires (within 30 seconds)
01:30	Engage the fan
02:00	Activate suppression system

Figure 1
Test fire positioning, view from the front side

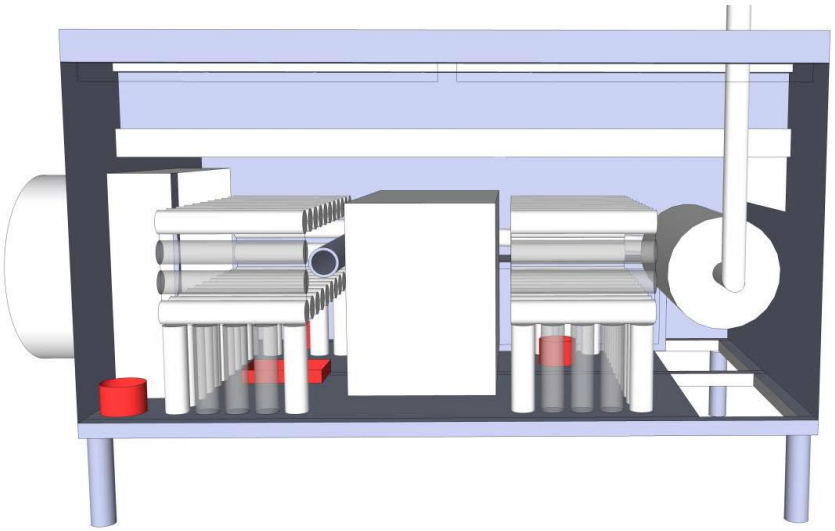
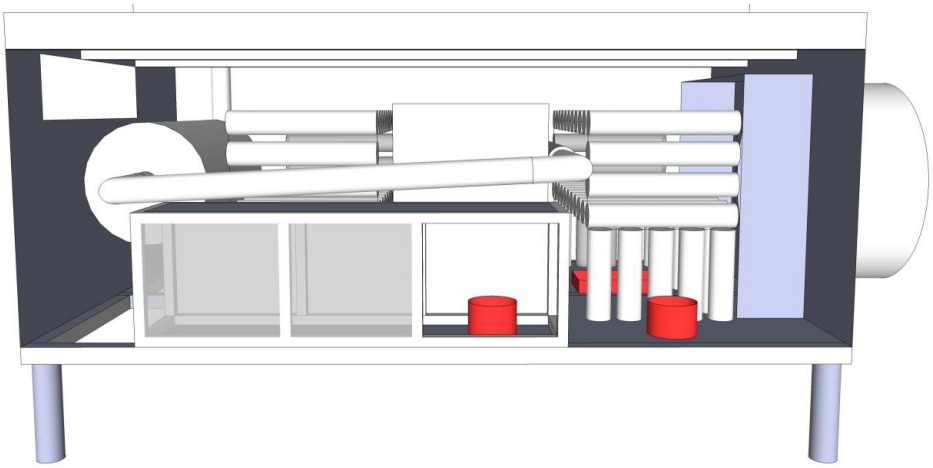


Figure 2
Test fire positioning, view from the rear side



Appendix 4

High-**load** fire ~~load scenario~~ with fan

Table 1
Test fires ~~in high fire load scenario with fan~~

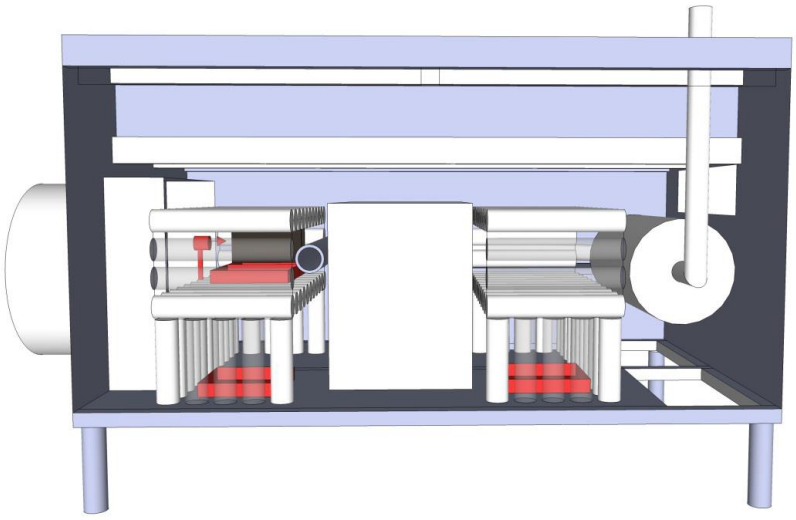
Test fire (see Table ~~6~~5 in Appendix 1)	*Description*	*Co-ordinates [x; y; z] (see Figure 1 in Appendix 1)*
#5	Spray fire (**0.45 MPa**, 0.73 kg/min)	[0.37; 0.70; 0.46]
#1	Pool fire 300 mm × 300 mm	[0.37; 0.47; 0.36]
#2	Pool fire 300 mm × 300 mm and 2 fibreboards	[0.37; 0.77; 0.36]
#1	Pool fire 300 mm × 300 mm	[0.37; 0.13; 0.00]
#1	Pool fire 300 mm × 300 mm	[1.54; 0.13; 0.00]

Note: The fan is **required to produce**~~producing~~ an air flow of 1.5 m^3/s.

Table 2
Test procedure ~~for high fire load scenario with fan~~

Time	*Action*
00:00	Start measuring time
01:00	Ignite pool fires (within 20 seconds)
01:30	Engage the fan
01:50	Start diesel spray
02:00	Activate suppression system

Figure 1
Test fire positioning, view from the front side



Appendix 5

Re-ignition **test** ~~scenario~~

Table 1
Test fires ~~in re-ignition scenario~~

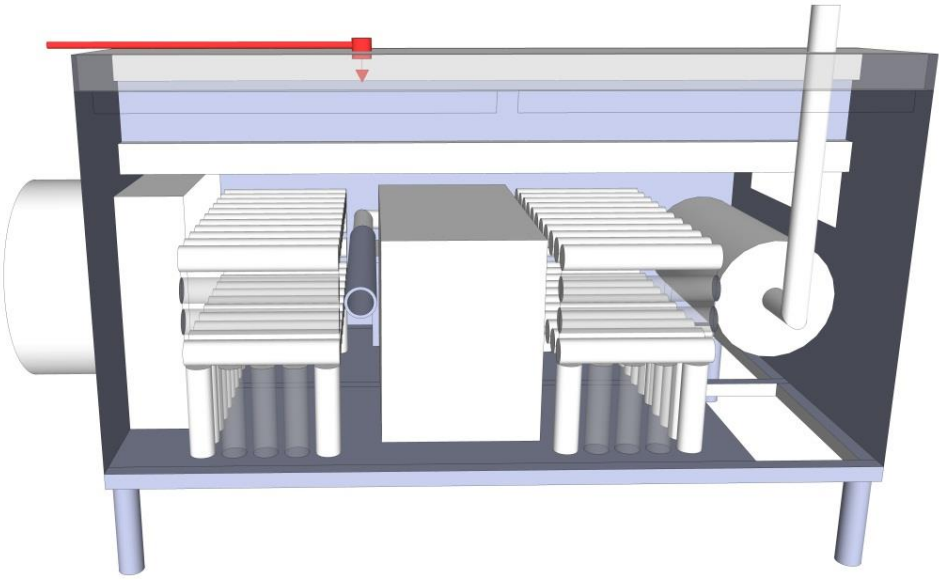
Test fire *(see Table ~~6~~5 in Appendix 1)*	*Description*	*Co-ordinates [x; y; z]* *(see Figure 1 in Appendix 1)*
#7	Dripping oil fire (**0.2 MPa**, 0.01 kg/min)	[0.82; 0.28; 1.22]

Note: The fan is not used.

Table 2
Test procedure ~~for re-ignition scenario~~

Time	*Action*
Prior to test	Pre-heat tube
00:00	Pre-defined temperatures are reached
00:30	Start oil dripping
00:45	Activate suppression system (the oil shall ignite before **activation**)

Figure 1
Test fire positioning, view from the front side



"

II. Justification

The proposed amendments aim at mandating fire suppression systems on vehicles of Classes I and II as a new 07 series of amendments to the Regulation. In addition, this proposal includes editorial corrections and clarifications compared to draft Supplement 4 to the 06 series of amendments to Regulation No. 107 (ECE/TRANS/WP.29/2015/88).