

**COMMITTEE OF EXPERTS ON THE TRANSPORT OF  
DANGEROUS GOODS AND ON THE GLOBALLY  
HARMONIZED SYSTEM OF CLASSIFICATION  
AND LABELLING OF CHEMICALS**

**Sub-Committee of Experts on the**

**Transport of Dangerous Goods**

**(Twenty-third session, 30 juin-4 July 2003**

**Agenda item 3 (a))**

**EXPLOSIVES, SELF REACTIVE SUBSTANCES AND ORGANIC PEROXIDES**

**Classification criteria for fireworks**

**Transmitted by the expert from the United Kingdom**

**Introduction**

1. During the twentieth session of the Sub-Committee of Experts on the Transport of Dangerous Goods, a discussion was held on the report of the UN Working Group on the Classification of Fireworks (UN/SCETDG/20/INF.9; ST/SG/AC.10/C3/2002/1). It was agreed that the default classification system for fireworks should be based on Test Series 6 results.
2. The United Kingdom has carried out a number of Test Series 6 trials on fireworks, as part of the audit process for the United Kingdom default firework classification system, and has reviewed previous UNITED KINGDOM trial data to assist the development of a UN default classification system.
3. The United Kingdom has carried out Test Series 6 trials on small flash report rockets without their flight stabilising sticks and the results are summarised below.

**Rockets containing flash report as principal effect**

4. Test Series 6(a) and 6(b) results on rockets with flight stabilising sticks ("sticked rockets") were presented by the United Kingdom at the last Working Group meeting (UN/SCETDG/21/INF.21). Tests were carried out on a small flash report rocket called Bad Boy "Sky Thunder" which contains a single aluminium/perchlorate flash unit (18.6g) and on WECO "Superblitzknall" rocket containing 37g loose perchlorate metal composition. The Bad Boy "Sky Thunder" rocket had previously been involved in an incident in the United Kingdom when a steel storage unit containing a number of cartons of the fireworks exploded damaging the storage unit.
5. In the Test 6(a) the Bad Boy "Sky Thunder" stucked rocket exploded almost instantaneously and 20% of the rockets were recovered from the test. The witness plate was bowed over the full length and sand used in the test was thrown less than 2 metres. In the 6(b) test the results were similar to the 6(a) but there were many separate explosions and a large number live rockets recovered in the test area. The WECO "Superblitzknall" test produced a similar result to the Bad Boy "Sky Thunder" stucked rocket. These two rockets could not be classified as Division 1.1G based on the test criteria and method of assessing the results.
6. In the United Kingdom, some rockets are brought into the country without the flight stabilising stick as this reduces the shipping costs for the importer. The United Kingdom had no data on the classification of these fireworks so Test Series 6 (a) and (b) were performed on the Bad Boy "Sky Thunder" with the sticks removed (stickless rockets), placed into a typical UN approved carton. The number of rockets in the carton was the same as the test for the stucked version (120 items). The 6(a) test produced a single explosion that consumed all the stickless rockets and threw the sand used in the test 25 metres from the test area. The 6(b) test produced a single explosion consuming all the stickless rockets, producing a larger deformation in the witness plate compared with the 6(a) test, and projecting the sand 70 metres from the test area. The United Kingdom has concluded that stickless flash report rockets should be classified as Division 1.1G

7. The increase in the explosive power for the stickless flash report rockets is likely to be due to: a) the change in the explosive density of the firework in the transport pack, and b) the lack of an air gap in the packing arrangement found in sticked rockets. The tests carried out by the United Kingdom demonstrate that in sticked flash report rockets the quantity of flash composition in the sticked rocket heads and the packing arrangement of the sticked rockets are significant parameters when assessing their classification.

8. The United Kingdom expert proposes an entry for rockets without flight stabilising sticks be included in the default classification list as follows:

Rocket with stick(s)	avalanche rocket, signal rocket, whistling rocket, bottle rocket, sky rocket, missile type rocket, table rocket	tube containing pyrotechnic composition and/or pyrotechnic units, equipped with stick(s) for stabilisation of flight, and designed to be propelled into the air	≥ 40g flash composition effect	1.1G
			< 40g flash composition effect	1.3G
			[Coloured star effect	1.3G]
			[Coloured star effect	1.4G]
Rocket without stick(s)	avalanche rocket, signal rocket, whistling rocket, bottle rocket, sky rocket, missile type rocket, table rocket	tube containing pyrotechnic composition and/or pyrotechnic units, not equipped with stick(s) for stabilisation of flight	Containing flash composition effect	1.1G
			[Coloured star effect	1.3G]
			[Coloured star effect	1.4G]

9. The expert from the United Kingdom does not have test data on rockets that use devices other than sticks to stabilise flight. Before these items are included in the default list the United Kingdom expert believes test data should be obtained to establish that the packing arrangement seen in sticked rockets produce similar Test Series 6 results.

### **Roman candles**

10. At the July 2002 Working Group meeting, the United Kingdom expert showed the results of 6(c) test carried out on Black Cat's 19 shot Roman candle combination. The inner diameter of the tube was 29mm (the maximum allowed by the United Kingdom 's default classification list for 1.4G Roman candles). The ejected star unit has a mass of 15g (total NEC for complete firework was 380g) there were three firework articles in a package and five packages were used in the test.

11. The 6(c) test on this firework produced fiery projections beyond 5 metres but only 4 projections beyond 15 metres. the witness screens had impact marks and indentations of approximately 3 to 5mm but there was no penetration. This test would support a default classification of 1.4G for 29mm i.d. Roman candles.

12. An examination of archived videos of Roman candles of 25-29mm i.d. in 6(c) tests has been carried out. Typical flash report single shot Roman Candles (e.g. Bazooka - effect mass = 15g, id 25mm) and Star and flash report Combinations (e.g. BX battery - effect mass = 18g, id 28mm) demonstrated 1.4G classification although 3 or 4 effects travelled beyond 15 metres. The United Kingdom believe that its test data demonstrate that Roman candles with a tube i.d. <30mm and with an effect of 20g or less can be classified as 1.4G.

### **Test data**

13. The series 6 test results and videos of the tests carried out by the United Kingdom will be available for the Working Group meeting. The United Kingdom will be carrying out further UN Test Series 6 trials on stickless coloured star rockets, small Roman candles, and bag and cylindrical mines designed to be projected from a mortar. These tests should be completed by Spring 2004.

14. The default table in the proposed paragraph "2.1.3.5.6" has been amended to include United Kingdom test data and is attached as Annex.

### Annex

Insert new text as 2.1.3.5 as follows and renumber 2.1.3.5 to 2.1.3.6.

#### **"2.1.3.5      *Assignment of fireworks to Hazard Divisions***

2.1.3.5.1      Fireworks shall normally be assigned to hazard divisions 1.1, 1.2, 1.3, and 1.4 on the basis of test data derived from Test Series 6. However, since the range of such articles is very extensive and the availability of test facilities may be limited, assignment to hazard divisions may also be made in accordance with the procedure in 2.1.3.5.2.

2.1.3.5.2      Assignment of fireworks to UN numbers 0333, 0334, 0335 or 0336 may be made on the basis of analogy, without the need for Test Series 6 testing, in accordance with the default table in 2.1.3.5.6. Such assignment shall be made with the agreement of the competent authority. Items not specified in the default table should be classified on the basis of test data derived from Test Series 6.

2.1.3.5.3      Where fireworks of more than one Hazard Division are packaged in the same package they shall be classified on the basis of the highest Hazard Division unless test data derived from Test Series 6 indicate otherwise.

2.1.3.5.4      The addition of other types of fireworks to column 1 of the default list in 2.1.3.5.6 shall only be made on the basis of full test data submitted to the UN Sub-Committee on the Transport of Dangerous Goods for consideration.

2.1.3.5.5      Test data derived by competent authorities which validates, or contradicts the assignment of Hazard Division to firework types and/or sub-divisions by calibre/weight in column 4 of the table in 2.1.3.5.6 to hazard divisions in column 5 shall be submitted to the UN Sub-Committee on the Transport of Dangerous Goods for information (see also note 3 in 2.1.3.2.3).

2.1.3.5.6      The classification shown in the Default table in 2.1.3.5.7 applies only for articles packed in fibreboard boxes (4G)."

2.1.3.5.1 Default table

Type	Includes: / Synonym:	Definition	Calibre /Weight	HD
shell, spherical or cylindrical	spherical display shell: aerial shell, colour shell, dye shell, multi-break shell, multi-effect shell, nautical shell, parachute shell, smoke shell, star shell; report shell: maroon, salute, sound shell, thunderclap	device with or without propellant charge, with delay fuse and bursting charge, pyrotechnic unit(s) or loose pyrotechnic composition and designed to be projected from a mortar	all report shells	1.1G
			colour shell: $\geq 200$ mm	1.1G
			colour shell: $< 200$ mm with $> 25\%$ perchlorate/ metal composition, as loose powder and/ or report effects	1.1G
			colour shell: $< 200$ mm with $\leq 25\%$ perchlorate/ metal composition, as loose powder and/ or report effects	1.3G
			colour shell: $\leq 50$ mm or $\leq 60$ g pyrotechnic composition with $> 2\%$ perchlorate/ metal composition as report effects	1.3G
			colour shell: $\leq 50$ mm or $\leq 60$ g pyrotechnic composition with $\leq 2\%$ perchlorate/ metal composition as report effects	1.4G
	cylindrical display shell: aerial shell, colour shell, dye shell, multi-break shell, multi-effect shell, nautical shell, parachute shell, smoke shell, star shell; report shell: maroon, salute, sound shell, thunderclap	device with or without propellant charge, with delay fuse and bursting charge, pyrotechnic unit(s) or loose pyrotechnic composition and designed to be projected from a mortar	as for spherical shells, longest dimension determines the classification	

Type	Includes: / Synonym:	Definition	Calibre /Weight	HD
	aerial shell kit, preloaded mortar, shell in mortar	assembly comprising a shell inside a mortar from which the shell is designed to be projected	all report shells	1.1G
			colour shell: $\geq 200$ mm	1.1G
			colour shell: $< 200$ mm	1.2G
	shell of shells (spherical) <i>(Reference to percentages for shell of shells are to the gross mass of the fireworks article)</i>	device without propellant charge, with delay fuse and bursting charge, containing report shells and inert materials and designed to be projected from a mortar	$>120$ mm	1.1G
		device without propellant charge, with delay fuse and bursting charge, containing report shells $\leq 25$ mm and/or report units, with $\leq 33\%$ perchlorate/metal pyrotechnic composition and $\geq 60\%$ inert materials and designed to be projected from a mortar	$\leq 120$ mm	1.3G
		device without propellant charge, with delay fuse and bursting charge, containing colour shells and/or pyrotechnic units and designed to be projected from a mortar	$>300$ mm	1.1G
		device without propellant charge, with delay fuse and bursting charge, containing colour shells $\leq 70$ mm and/or pyrotechnic units, with $\leq 25\%$ perchlorate/metal pyrotechnic composition and $\leq 60\%$ pyrotechnic composition and designed to be projected from a mortar	$\leq 300$ mm	1.3G
combination/ batteries	barrage, bombardos, cakes, finale box, flowerbed, hybrid, multiple tubes, shellcakes	assembly including several elements either containing the same type or several types each corresponding to one of the types of fireworks listed in this table, with one or two points of ignition	the most hazardous firework type determines the classification	

Type	Includes: / Synonym:	Definition	Calibre /Weight	HD
[roman candles	exhibition candle, candle, bombettes	tube containing alternate propellant charge(s), pyrotechnic unit(s) and transmitting fuse(s)	≥ 50 mm containing flash composition	1.1G
			≥ 50 mm, containing no flash composition	1.2G
			≥ 30 mm and < 50 mm	1.3G
			< 30 mm	1.4G]
Rocket with stick(s)	avalanche rocket, signal rocket, whistling rocket, bottle rocket, sky rocket, missile type rocket, table rocket	tube containing pyrotechnic composition and/or pyrotechnic units, equipped with stick(s) for stabilisation of flight, and designed to be propelled into the air	≥ 40g flash composition effect	1.1G
			< 40g flash composition effect	1.3G
			[Coloured star effect	1.3G]
			[Coloured star effect	1.4G]
Rocket without stick(s)	avalanche rocket, signal rocket, whistling rocket, bottle rocket, sky rocket, missile type rocket, table rocket	tube containing pyrotechnic composition and/or pyrotechnic units, not equipped with stick(s) for stabilisation of flight	Containing flash composition effect	1.1G
			[Coloured star effect	1.3G]
			[Coloured star effect	1.4G]
mine	pot-a-feu, ground mine	tube containing propellant charge and pyrotechnic units and designed to be placed on the ground or to be fixed in the ground. The principal effect is ejection of all the pyrotechnic units in a single burst producing a widely dispersed visual and/or aural effect in the air	containing [> 3%] perchlorate/ metal composition as report effects	1.1G
			> 90 g pyrotechnic composition containing [≤ 3%] perchlorate/ metal composition as report effects	1.3G
			≤ 90 g pyrotechnic composition, containing ≤ 3% perchlorate/ metal composition as report effects	1.4G
	bag mine, cylinder mine	cloth or paper bag or cloth or paper cylinder containing propellant charge and pyrotechnic units, designed to be placed in a mortar and to function as a mine	containing report effects	1.1G
			[other, to be defined	1.3G]
			[other, to be defined	1.4G]

Type	Includes: / Synonym:	Definition	Calibre /Weight	HD
fountain	volcanos, gerbs, showers, lances, Bengal fire, flitter sparkle, cylindrical fountains, cone fountains, illuminating torch	non-metallic case containing pressed or consolidated sparks- and flame producing pyrotechnic composition	≥ 1 kg pyrotechnic composition	1.3G
			< 1 kg pyrotechnic composition	1.4G
sparklers	handheld sparklers, non-handheld sparklers, wire sparklers, dipped sticks	rigid wire or thin stick partially coated (along one end) with slow burning pyrotechnic composition with or without an ignition tip	pyrotechnic composition per item ≥ 10 g	1.3G
			pyrotechnic composition per item < 10 g	1.4G
low hazard fireworks and novelties	table bombs, throw downs, crackling granules, smokes, fog, chaser, snakes, glow worm, serpents	device designed to produce very limited visible and/ or audible effect which contains small amounts of pyrotechnic and/ or explosive composition.	articles may contain up to 1.6 mg of silver fulminate, or up to 16 mg potassium chlorate/ red phosphorous mixture	1.4G
spinners	aerial spinners, helicopters, ground spinners	non-metallic tube or tubes containing gas- or spark-producing pyrotechnic composition, with or without noise producing composition, with or without aerofoils attached	pyrotechnic composition per item > 20 g, containing ≤ 3% perchlorate/ metal composition as report effects	1.3G
			pyrotechnic composition per item ≤ 20 g, containing ≤ 3% perchlorate/ metal composition as report effects	1.4G
wheels	Catherine wheels, Saxon	assembly including drivers containing pyrotechnic composition and provided with a means of attaching it to a support so that it can rotate	no report effect, each whistle (if any) ≤ 5 g, ≥ 1 kg total pyrotechnic composition	1.3G
			no report effect, each whistle (if any) ≤ 5 g, < 1 kg total pyrotechnic composition	1.4G

Type	Includes: / Synonym:	Definition	Calibre /Weight	HD
aerial wheels	flying Saxon, UFO's, rising crown	tubes containing propellant charges and sparks- flame- and/ or noise producing pyrotechnic compositions, the tubes being fixed to a supporting ring	no report effect, each whistle (if any) $\leq 5$ g, $> 60$ g pyrotechnic composition per driver or $> 200$ g total pyrotechnic composition	1.3G
			no report effect, each whistle (if any) $\leq 5$ g, $\leq 60$ g pyrotechnic composition per driver and $\leq 200$ g total pyrotechnic composition	1.4G
Selection pack	display selection box, display selection pack, garden selection box, indoor selection box	A pack of 1.3G and/ or 1.4G fireworks of more than one type each corresponding to one of the types of fireworks listed in this table	the most hazardous firework type determines the classification	

References to percentages in the table, unless otherwise stated, are to the mass of the pyrotechnic composition.