

Approved and Prohibited Fireworks Chemicals

(NOTE: Restriction Column is added to group restrictions together)

Chemical	Formula	Typical Use	Restrictions
Alloprene (Chlorinated Rubber)	Not Required	Color Intensifier	
Aluminum (> 53 microns)	Al	Fuel	Ok for use in a break charge and other compositions including report compositions
Aluminum (≤ 53 microns)	Al	Fuel	Report composition only
Ammonium Dichromate	(NH ₄) ₂ Cr ₂ O ₇	Oxygen Donor / Colored Ash	Not to exceed 5% of formulation Prohibited if mixed with a Chlorate
Ammonium Perchlorate	NH ₄ ClO ₄	Oxygen Donor	Prohibited if mixed with a Chlorate
Anthracene	C ₁₄ H ₁₀	Fuel	
Antimony	Sb	Fuel	
Antimony Sulfide: Antimonous Sulfide or Antimony Trisulfide	Sb ₂ S ₃	Fuel	
Antimony Trioxide	Sb ₂ O ₃	Oxygen Donor	
Barium Carbonate	BaCO ₃	Color Agent	
Barium Chlorate	Ba(ClO ₃) ₂	Oxygen Donor / Color Agent	1) In smoke formulations an equal or greater weight of bicarbonates or carbonates is required; 2) In all other devices the total chemical composition cannot exceed 4 grams of which no more than 15 percent can be chlorate salts; 3) Permitted in firecrackers, party poppers and booby traps.
Barium Nitrate	Ba(NO ₃) ₂	Oxygen Donor / Color Agent	
Barium Oxalate	BaC ₂ O ₄	Color Agent	
Barium Phthalate	Ba(C ₈ H ₅ O ₄) ₂	Whistle / Color Agent	
Barium Sulfate	BaSO ₄	Oxygen Donor / Color Agent	
Benzoic Acid Potassium Salt (Potassium Benzoate)	KC ₆ H ₅ CO ₂ or KC ₇ H ₅ O ₂	Whistle / Fuel	
Benzoic Acid Sodium Salt (Sodium Benzoate)	NaC ₆ H ₅ CO ₂ or NaC ₇ H ₅ O ₂	Whistle / Fuel	
Bismuth Oxide or Bismuth Trioxide	Bi ₂ O ₃	Oxygen Donor	
Boric Acid (Boracic Acid)	H ₃ BO ₃	Neutralizer	
Calcium Carbonate	CaCO ₃	Neutralizer	
Calcium Sulfate	CaSO ₄	Oxygen Donor	
Calcium Sulfate dihydrate (Gypsum)	CaSO ₄ · 2H ₂ O	Oxygen Donor	
Carbon or Charcoal	C	Fuel	
Carbon Black or Lamp Black	C	Fuel	
Cationic Asphalt	Not required	Fuel	< 10% Nitrogen by mass
Chlorinated Paraffin or Chlorinated Wax	Not required	Color Intensifier	
Chlorinated Rubber	Not required	Color Intensifier	
Copper Metal	Cu	Color Agent	Particle size not required
Copper Salts (except Copper Chlorate)			
Copper (II) Acetate, Anhydrous (Verdigris)	Cu(OAc) or Cu(CH ₃ COO) ₂	Color Agent	Prohibited if mixed with a chlorate
Copper (II) Acetate, Hydrated (Verdigris)	Cu(OAc) ₂ · (H ₂ O) ₂ or Cu(CH ₃ COO) ₂ · (H ₂ O) ₂	Color Agent	Prohibited if mixed with a chlorate
Copper Carbonate	CuCO ₃	Color Agent	Prohibited if mixed with a chlorate
Copper Oxide (Cupric Oxide)	CuO	Oxygen Donor / Color Agent	Prohibited if mixed with a chlorate
Copper Oxide (Cuprous Oxide)	Cu ₂ O	Oxygen Donor / Color Agent	
Copper Sulfate (Cupric Sulfate)	CuSO ₄	Color Agent	Prohibited if mixed with a chlorate
Copper Chloride (Cuprous Chloride)	Cu ₂ Cl ₂	Color Agent	
Copper Chloride (Cupric Chloride)	CuCl ₂	Color Agent	Prohibited if mixed with a chlorate
Cork	Not Required	Fuel	
Cotton (Fiber / Powder) (Cellulose)	Not Required	Fuel	
Cryolite (Kryolite)	Na ₃ AlF ₆	Color Agent	
Cryolite: Sodium hexafluoroaluminate	Na ₃ AlF ₆	Color Agent	
Cryolite: Sodium fluoaluminate	Na ₃ AlF ₆	Color Agent	
Cryolite: Sodium aluminofluoaluminate	Na ₃ AlF ₆	Color Agent	
Cryolite: Sodium aluminofluoride	Na ₃ AlF ₆	Color Agent	
Cryolite: Aluminate (3-), hexafluoro-, trisodium, (OC-6-11)-	Na ₃ AlF ₆	Color Agent	
Cryolite: Kryoside	Na ₃ AlF ₆	Color Agent	
Cryolite: Kryocide	Na ₃ AlF ₆	Color Agent	
Cryolite: Kryolith (German)	Na ₃ AlF ₆	Color Agent	
Cryolite: Natriumaluminiumfluorid (German)	Na ₃ AlF ₆	Color Agent	
Cryolite: Natriumhexafluoroaluminate (German)	Na ₃ AlF ₆	Color Agent	
Cryolite: Potassium Cryolite	K ₃ AlF ₆	Color Agent	
Cryolite: Potassium hexafluoroaluminate	K ₃ AlF ₆	Color Agent	

Dextrin or Dextrine	$(C_6H_{10}O_5)_n \cdot xH_2O$ or $(C_6H_{10}O_5)_n$	Binder/Fuel	
Dicopper chloride trihydroxide	$Cu_2(OH)_3Cl$	Color Agent	Prohibited if mixed with a chlorate
Diatomaceous Earth	$SiO_2 \cdot nH_2O$		
Diatomaceous Earth: Silica	$SiO_2 \cdot nH_2O$		
Diatomaceous Earth: Hydrated Silica	$SiO_2 \cdot nH_2O$		
Diatomaceous Earth: hydrated Silicon Dioxide	$SiO_2 \cdot nH_2O$		
Diatomaceous Earth: Diatomite	$SiO_2 \cdot nH_2O$		
Diatomaceous Earth: Kieselgur	$SiO_2 \cdot nH_2O$		
Diphenylamine	$(C_6H_5)_2NH$	Stabilizer	
Dyes for Smokes (See Smoke Dyes: Colored)			
Epoxy (Thermosetting polymer – two part – resin & hardener)	Not required	Binder	
Flour (Wheat Flour, Rice Flour)	Not required or $(C_6H_{10}O_5)_n \cdot xH_2O$	Binder	
Glucose	$C_6H_{12}O_5$	Binder	
Hexachlorophene (Nabac)	$C_{12}H_6Cl_6O_2$	Fuel	
Hexamethylenetetramine (Hexamine)	$C_6H_{12}N_4$	Fuel	
Iron (Ferrum is Latin for Iron) (> 53 microns)	Fe	Fuel / Sparks	
Iron (Ferrum is Latin for Iron) (\leq 53 microns)	Fe	Fuel / Sparks	
Iron Alloy (Ferro/Titanium) (> 53 microns)	Fe/Ti	Fuel / Sparks	
Iron Alloy (Ferro/Titanium) (\leq 53 microns)	Fe/Ti	Fuel / Sparks	
Iron (II, III) Oxide (Black)	Fe_2O_4 or FeO or Fe_2O_3	Oxygen Donor	
Lactose	$C_{12}H_{22}O_{11} \cdot H_2O$	Binder/Fuel	
Linoleic acid	Not required or $C_{18}H_{32}O_2$	Drying Agent/Fuel	
Linseed Oil	Not required	Drying Agent/Fuel	
Lysine	$C_6H_{14}N_2O_2$	Smoke Dye (Blue)	
Magnalium (Magnesium/Aluminum) (> 53 microns)	Mg/Al	Fuel	Ok for use in a break charge and other compositions including report composition
Magnalium (Magnesium/Aluminum) (\leq 53 microns)	Mg/Al	Fuel	Report Composition only
Magnesium (> 53 microns)	Mg	Fuel	Ok for use in a break charge and other compositions including report composition (Permitted in Fireworks, UN0335, 1.3G and Article Pyrotechnic, UN0431, 1.4G only)
Magnesium (\leq 53 microns)	Mg	Fuel	Report Composition only (Permitted in Fireworks, UN0335, 1.3G and Article Pyrotechnic, UN0431, 1.4G only)
Magnesium Carbonate	$MgCO_3$	Neutralizer	
Magnesium Stearate	Not Required	Binder	
Magnesium Sulfate	$MgSO_4$	Oxygen Donor	
Nitrated Asphalt	Not required	Fuel	< 10% Nitrogen by mass
Nitrated Asphaltum	Not required	Fuel	< 10% Nitrogen by mass
Nitrated Bitumen	Not required	Fuel	< 10% Nitrogen by mass
Nitrated Pitch	Not required	Fuel	< 10% Nitrogen by mass
Nitrated Tar	Not required	Fuel	< 10% Nitrogen by mass
Naphthol Pitch	Not required	Fuel	< 10% Nitrogen by mass
Nitrocellulose	Not required	Fuel / Binder	(The amount of Nitrocellulose must be less than 15 g per article (entire device). Nitrocellulose may not contain more than 12.6% nitrogen by mass.)
Nitrocellulose Based Lacquers	Not required	Fuel / Binder	(The amount of Nitrocellulose in a Nitrocellulose based lacquer must be less than 15 g per article (entire device). Nitrocellulose in Nitrocellulose Based Lacquers may not contain more than 12.6% nitrogen by mass.)
Parlon: (A Chlorinated rubber)	Not required or $(C_4H_6Cl_2)_n$	Color intensifier	
Par Oil (Chlorinated Wax)	Not Required	Color intensifier	
Phosphorus, Red (only as provided in table 3.7-1)	P	Fuel	
Polyvinyl Alcohol (PVA)	$[CH_2CH(OH)]_n$	Binder	
Polyvinyl Butyral (PVB)	$(C_8H_{14}O_2)_n$	Binder	
Polyvinyl Chloride (PVC)	$(C_2H_3Cl)_n$ or $(CH_2CHCl)_n$	Color Intensifier	
Potassium Benzoate	$KC_6H_5CO_2$ or $KC_7H_5O_2$	Whistle/Fuel	
Potassium Bichromate (Potassium Dichromate)	$K_2Cr_2O_7$	Oxygen Donor	Not to exceed 5% of formulation
Potassium Chlorate	$KClO_3$	Oxygen Donor	1) In smoke formulations an equal or greater weight of bicarbonates or carbonates is required; 2) In all other devices the total chemical composition cannot exceed 4 grams of which no more than 15 percent can be chlorate salts; 3) Permitted in firecrackers, party poppers and booby traps.
Potassium Fluorosilicate	K_2SiF_6		

Potassium Hydrogen Phthalate (KHP)	$KC_8H_5O_4$	Whistle / Fuel	
Potassium Hydrogen Phthalate: hydrogen potassium phthalate	$KC_8H_5O_4$	Whistle / Fuel	
Potassium Hydrogen Phthalate: potassium acid phthalate	$KC_8H_5O_4$	Whistle / Fuel	
Potassium Hydrogen Phthalate: phthalic acid potassium salt	$KC_8H_5O_4$	Whistle / Fuel	
Potassium Hydrogen Phthalate: potassium biphthalate	$KC_8H_5O_4$	Whistle / Fuel	
Potassium Hydrogen Phthalate: 1,2-benzenedicarboxylic acid, mono-potassium salt	$KC_8H_5O_4$	Whistle / Fuel	
Potassium Nitrate	KNO_3	Oxygen Donor	
Potassium Oxalate	$K_2C_2O_4$	Color Agent	
Potassium Perchlorate	$KClO_4$	Oxygen Donor	
Potassium Silicofluoride	K_2SiF_6	Color Intensifier	
Potassium Sulfate	K_2SO_4	Oxygen Donor	
Red Gum	Not required	Binder	
Resinox (Also considered a Phenolic Resin or a Pheno l- formaldehyde Resin)	Not Required	Binder	
Rice Hull (Non-impregnated)	Not Required	Density Control	
Rice Hull Impregnated		Density Control	Specify chemical formulation of the coating
Rice Starch (Rice Flour / Glutinous Rice Flour / Starch)	$(C_6H_{10}O_5)_n \cdot xH_2O$	Binder	
Saran Resin / Powder Saran Wrap / Polyvinylidene chloride	$(C_2H_2Cl_2)_n$	Binder	
Shellac	Not Required	Binder	
Silica	$SiO_2 \cdot nH_2O$	Moisture Absorber	
Silicon	Si	Fuel	
Silver (> 53 microns)	Ag	Fuel	
Silver (\leq 53 microns)	Ag	Fuel	
Silver Fulminate	$AgCNO$	Explosive	
Silver Oxide	Ag_2O	Oxygen Donor	
Smoke Dyes (Colored)			
Smoke Dye (Blue): Methylene Blue	$C_{16}H_{18}ClN_3S \cdot 3H_2O$	Blue Smoke Dye CAS# 61-73-4	
Smoke Dye (Blue): Phthalocyanine (Blue)	$C_{24}H_{16}CuN_8$	Blue Smoke Dye	
Smoke Dye (Blue): Lysine	$C_6H_{14}N_2O_2$	Blue Smoke Dye	
Smoke Dye (Blue) Ultramarine	$Na_8S_2 \cdot 8NaAlSiO_4$	Smoke Dye	
Smoke Dye (Green): 1,4-di-p-toluidino-anthraquinone (Solvent Green 3)	$C_{26}H_{20}O_2(NH)_2(CH_3)_2$	Green Smoke Dye	
Smoke Dye (Green): Lysine - 2, 6-diaminohexanoic acid	$C_6H_{14}N_2O_2$	Green smoke Dye	
Smoke Dye (Orange): □-xylene-azo-□-naphthol (Orange 7) or Sodium 4-[(2-Hydroxy-1-naphthyl)azo]benzenesulphonate	$C_{16}H_{11}N_2NaO_4S$	Orange Smoke Dye CAS# 633-96-5	
Smoke Dye (Orange) Oil Orange Pigment	$C_{26}H_{28}N_2O_2$	Orange Smoke Dye CAS# 84632-59-7	
Smoke Dye (Red): 1-methylamino-anthraquinone (Disperse Red 9)	$C_{12}H_{11}NO_2$	Red Smoke Dye	
Smoke Dye (Red) 1-Naphthalenol, 4-[(4-ethoxyphenyl)azo] (Solvent Red 3)	$C_{18}H_{16}N_2O_2$	Smoke Dye	
Smoke Dye (Red): Para Red (Pigment Red1 or p-nitroaniline red)	$C_{16}H_{11}N_3O_3$	Red Smoke Dye CAS# 6410-10-2	
Smoke Dye (Violet): 1,4-diamino-2,3-dihydroanthraquinone	$C_{14}H_{12}N_2O_2$	Violet Smoke Dye	
Smoke Dye (Violet): Rhodamine B (Basic Violet 10)	$C_{28}H_{31}N_2O_3 \cdot Cl$	Violet Smoke Dye	
Smoke Dye (Yellow): 2-(2-quinoly)-1, 3-indandione (Chinoline Yellow or Solvent Yellow 33)	$C_{18}H_{11}O_2N$	Yellow Smoke Dye	
Smoke Dye (Yellow): Dibenzo(a,h)pyrene-7,14-dione (Vat Yellow 4 / Golden Yellow GK / Tyrian Yellow I-GOK / Dibenzochrysenedione / Dibenzpyrenequinone)	$C_{24}H_{12}O_2$	Yellow Smoke Dye	
Smoke Dye (Yellow): 4-Dimethylaminoazobenzene / N, N-Dimethyl-4-phenylazoaniline / Yellow (Butter Yellow) / Dimethyl Yellow / Solvent Yellow 2 / Oil Yellow	Methyl $C_{14}H_{15}N_3$	Yellow Smoke Dye CAS# 60-11-7	
Smoke Dye (Yellow): Auramine (Basic Yellow 2)	$C_{17}H_{22}ClN_3$	Yellow Smoke Dye	

Sodium Salts (except Sodium Chlorate)		Color Agent	
Sodium Benzoate	NaC ₆ H ₅ CO ₂ or NaC ₇ H ₅ O ₂	Whistle/Fuel	
Sodium Bicarbonate (Sodium Hydrogen Carbonate)	NaHCO ₃	Neutralizer	
Sodium Carbonate	Na ₂ CO ₃	Neutralizer	
Sodium Chlorate (Only as provided in Table 3.7-1)	NaClO ₃	Oxygen Donor	1) In smoke formulations an equal or greater weight of bicarbonates or carbonates is required; 2) In all other devices the total chemical composition cannot exceed 4 grams of which no more than 15 percent can be chlorate salts; 3) Permitted in firecrackers, party poppers and booby traps.
Sodium chloride	NaCl	Color Agent	
Sodium Fluorosilicate (Sodium Silicofluoride)	Na ₂ SiF ₆	Color Agent	
Sodium Nitrate	NaNO ₃	Oxygen Donor	
Sodium Oxalate	Na ₂ C ₂ O ₄	Color Agent	
Sodium Salicylate	C ₇ H ₅ NaO ₃	Whistle/Fuel	
Sodium Sulfate	Na ₂ SO ₄	Oxygen Donor	
Starch (Amylum) (includes Wheat, Corn and Rice)	Nor Required	Binder/Fuel	
Stearic Acid (Octadecanoic Acid)	Not Required or C ₁₈ H ₃₆ O ₂	Fuel	
Strontium Salts (except Strontium Chlorate)		Color Agent	
Strontium Carbonate	SrCO ₃	Color Agent	
Strontium Chloride	SrCl ₂	Color Agent	
Strontium Nitrate	Sr(NO ₃) ₂	Oxygen Donor	
Strontium Oxalate	SrC ₂ O ₄	Color Agent	
Strontium Phthalate	Sr(C ₈ H ₅ O ₄) ₂	Whistle/Fuel/Color Agent	
Strontium Sulfate	SrSO ₄	Oxygen Donor	
Sucrose	C ₁₂ H ₂₂ O ₁₁	Fuel	
Sulfur	S	Fuel	
Titanium (>149 microns) Ok for use in a break charge and other compositions	Ti	Fuel	
Ultramarine	Na ₂ S ₂ · 3NaAlSiO ₄	Color Agent	
Wood Powder (Cellulose) or Cotton (Cellulose)	(C ₆ H ₁₀ O ₅) _n		

MISCELLANEOUS COMPOUNDS: Organic compounds may be a combination of carbon with hydrogen, oxygen and/or chlorine. Nitrogen may be present in organic compounds if it accounts for less than 10-percent (by weight) of the compound.

RESTRICTION NOTICE: Fireworks UN0336, 1.4G and Fireworks UN0335, 1.3G - Nitrocellulose may not contain more than 12.6% nitrogen by mass, that meets the criteria for classification as a 4.1 flammable solid, is permitted as a propelling or expelling charge provided there is less than 15 g of nitrocellulose per article (entire device). Nitrocellulose as a binder or the Nitrocellulose component of a Nitrocellulose based lacquer must be less than 15 g per article (entire device). These restrictions are not additive.

Prohibited Chemicals and Components

Prohibited Chemicals - Consumer fireworks devices offered or intended for sale to the public may not contain a chemical enumerated in Table 3.7-1, except for small amounts (less than 0.25% by weight) as impurities, and except as specified therein.

Note: Display fireworks and theatrical pyrotechnics are not subject to the provisions of this section (Table 3.7-1).

TABLE 3.7-1 Prohibited Chemicals for Consumer Fireworks

1. Arsenic sulfide, arsenates, or arsenites
2. Boron
3. Chlorates, except:
 - a. In colored smoke mixtures in which an equal or greater weight of sodium bicarbonate is included
 - b. In party poppers
 - c. In those small items (such as ground spinners) wherein the total powder content does not exceed 4 g of which not greater than 15% (or 600 mg) is potassium, sodium, or barium chlorate
 - d. In firecrackers
 - e. In toy caps
4. Gallates or gallic acid
5. Magnesium (magnesium/aluminum alloys, called magnalium, are permitted)
6. Mercury salts
7. Phosphorus (Yellow or white are prohibited; red phosphorus is permissible in caps and party poppers)
8. Picrates or picric acid
9. Thiocyanates
10. Titanium, except in particle size that does not pass through a 100-mesh sieve or greater than 149 microns
11. Zirconium
12. Lead tetroxide (red lead oxide) **and other lead compounds**

Note: For transportation purposes the term, forbidden devices, may also include mixtures or devices that contain a chlorate and an ammonium salt, or an acidic metal salt, or devices that contain yellow or white phosphorus, devices that combine an explosive and a detonator or blasting cap, and any device that has not been approved by DOT.

NOTE: For All Fireworks UN0336, 1.4G; Fireworks UN0335, 1.3G; and Articles, Pyrotechnic UN0431, 1.4G - Nitrocellulose with not more than 12.6% nitrogen by mass, that meets the criteria for classification as a 4.1 flammable solid, is permitted as a propelling or expelling charge provided there is less than 15 g of nitrocellulose per article (entire device). Additionally, Nitrocellulose as a binder or Nitrocellulose based lacquers may not 15 g of nitrocellulose per article (entire device). These restrictions are not additive.

PROHIBITED CHEMICALS IN ALL FIREWORKS:

- 1.) All liquids are prohibited in "Fireworks" and "Articles, Pyrotechnic."
- 2.) Methylene Chloride, Ethylene Chloride and Xylene are liquids. If this chemical is used in the manufacturing process, but is removed during the drying process, it should not be listed as part of a chemical composition.
- 3.) Benzene Hexachloride (C₆Cl₆) also known as Hexachlorobenzene or Phenyl Hexachloride or Perchlorobenzene – Prohibited in all fireworks devices.
- 4.) Hexachlorocyclohexane - (C₆H₆Cl₆) also known as Lindane - Prohibited in all fireworks devices.
- 5.) Nitric Acid is a liquid and is prohibited in all fireworks devices.
- 6.) Sodium Percarbonate (Na₂CO₃·1.5H₂O₂) sometimes it is shown as (Na₂CO₃·H₂O₂).
- 7.) Acacia – The plant's sap and leaves contain large amounts of tannins, which contains Gallic Acid. Gallic Acid and Gallates are forbidden chemicals.
- 8.) Sodium Complex - Name is too vague. Specify what the "Complex" is.
- 9.) Rice – Name is too vague. Specify what "Rice" means (Rice flour, Rice Starch, Rice Hull, etc.). NOTE: Rice Hulls may or may not be impregnated with a chemical composition, which is permitted, but applicant must specify any chemical compound(s) or chemical formulations involved in the impregnation.
- 10.) Resin – Name is too vague. Specify the chemical name for the "Resin".
- 11.) Lac – Name is too vague. Need to specify what the chemical component is, such as, shellac or lactose.
- 12.) Olefin Chloride – Chemical name is too vague. Provide actual chemical name.