Table of Standard Fireworks Chemicals

Chemical	Formula	Typical Use
Aluminum (> 149 microns) Use in break charge or effects	Al	Fuel / Not to exceed 10-percent by mass in break charge formulations.
Aluminum (> 53 microns to 149 microns) For use in compositions including report compositions, but not in break charges	Al	Fuel / Permitted in all effects except the break charge.
Aluminum (≤ 53 microns) Report composition only	Al	Fuel / Permitted only in reports.
Ammonium Dichromate (not to exceed 5% of formulation)	$(NH_4)_2Cr_2O_7$	Oxygen Donor/Colored Ash
Ammonium Perchlorate (Prohibited if mixed with a Chlorate)	NH_4ClO_4	Oxygen Donor
Antimony	Sb	Fuel
Antimony Sulfide: Antimonous Sulfide or Antimony Trisulfide	Sb_2S_3	Fuel
Antimony Trioxide	Sb_2O_3	Oxygen Donor
Barium Carbonate	$BaCO_3$	Neutralizer or Color Agent
Barium Chlorate (only as provided in Table 3.7-1 below)	$Ba(ClO_3)_2$	Oxygen Donor
Barium Nitrate	$Ba(NO_3)_2$	Oxygen Donor
Barium Oxalate	BaC_2O_4	Color Agent
Barium Phthalate	$Ba(C_8H_5O_4)_2$	Whistle / Color Agent / Report
Barium Sulfate	$BaSO_4$	Oxygen Donor or Color Agent
Bismuth Oxide or Bismuth Trioxide	Bi_2O_3	Oxygen Donor / Crackle
Boric Acid (Boracic Acid)	H_3BO_3	Neutralizer
Calcium Carbonate	$CaCO_3$	Neutralizer
Calcium Sulfate	$CaSO_4$	Oxygen Donor
Calcium Sulfate dihydrate (Gypsum)	$CaSO_4{\cdot}2H_2O$	Oxygen Donor
Carbon or Charcoal or Graphite	C	Fuel
Cationic Asphalt (< 10% Nitrogen)	Not required	Fuel
Chlorinated Paraffin or Wax	Not required	Color Intensifier/Chlorine Donor
Chlorinated Rubber	Not required	Color Intensifier/Chlorine Donor
Copper Metal **(Particle Size is not Required)**	Cu	Color Agent
Copper II Salts (Cupric Salts) **(**Prohibited if mixed with a Chlorate)		Color Agents
Copper (II) Acetate, Anhydrous (Verdigris) **(**Prohibited if mixed with a Chlorate)	Cu(OAc) or $Cu(CH_3COO)_2$	Color Agent
Copper (II) Acetate, Hydrated (Verdigris) **(**Prohibited if mixed with a Chlorate)	$Cu(OAc)_2{\cdot}(H_2O)_2$ or $Cu(CH_3COO)_2{\cdot}(H_2O)_2$	Color Agent
Copper (II) Carbonate (Basic Copper Carbonate) **(**Prohibited if mixed with a Chlorate)	$Cu_2(OH)_2CO_3$	Color Agent
Cuprous Chloride (Copper Chloride)	Cu_2Cl_2	Color Agent
Cupric Chloride (Copper Chloride) (Prohibited if used with a Chlorate)	$CuCl_2$	Color Agent
Cupric Oxide **(**Prohibited if mixed with a Chlorate)	CuO	Oxygen Donor/Color Agent
Cupric Oxychloride	$Cu_2Cl(OH)_3$ or $Cu_2(OH)_3Cl$	Color Agent
Cupric Sulfate (Prohibited if used with a Chlorate)	$CuSO_4$	Color Agent
Cryolite (Kryolite)	Na_3AlF_6	Color Agent
Cryolite: Sodium hexafluoroaluminate	Na_3AlF_6	Color Agent
Cryolite: Sodium fluoaluminate	Na_3AlF_6	Color Agent
Cryolite: Sodium aluminofluoaluminate	Na_3AlF_6	Color Agent
Cryolite: Sodium aluminofluoride	Na_3AlF_6	Color Agent
Cryolite: Aluminate (3-), hexafluoro-, trisodium, (OC-6-11)-	Na_3AlF_6	Color Agent
Cryolite: Koyoside	Na_3AlF_6	Color Agent
Cryolite: Kryocide	Na_3AlF_6	Color Agent
Cryolite: Kryolith (German)	Na_3AlF_6	Color Agent
Cryolite: Natriumaluminiumfluorid (German)	Na_3AlF_6	Color Agent

Cryolite: Natriumhexafluoroaluminate (German)	Na_3AlF_6	Color Agent
Cryolite: Potassium Cryolite	K_3AlF_6	Color Agent
Dextrin or Dextrine	$(C_6H_{10}O_5)_n \cdot xH_2O$ or $(C_6H_{10}O_5)_n$	Binder/Fuel
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	$SiO_2 \cdot nH_2O$	
Dyes for Smokes (See Smoke Dyes: Colored)		
Epoxy (Thermosetting polymer – two part – resin & hardener)	Not required	Binder
Flour (Wheat Flour, Rice Flour, Glutinous Rice Flour)	Not required	Binder
Glucose	$C_6H_{12}O_5$	Binder / Fuel
Hexachlorophene (Nabac)	$C_{13}H_6Cl_6O_2$	Fuel
Hexamethylenetetramine (Hexamine)	$C_6H_{12}N_4$	Fuel
Iron (Ferrum is Latin for Iron) **(Particle Size is not Required)**	Fe	Fuel
Iron/Titanium Alloy (Ferro/Titanium) **(Particle Size is not Required)**	Fe/Ti	Fuel
Iron/Titanium Alloy (Ferro/Titanium) **(Particle Size is not Required)**	Fe/Ti	Fuel
Iron Oxide	Fe_2O_3	Oxygen Donor
Lactose	$C_{12}H_{22}O_{11} \cdot H_2O$	Binder/Fuel
Lampblack	C	Fuel
Linseed Oil	Not required	Drying Agent/Fuel
Magnalium (> 149 microns) Use in break charge or effects	Mg/Al	Fuel / Not to exceed 10-percent by mass in break charge formulations.
Magnalium (> 53 microns to ≤ 149 microns) For use in compositions including report compositions, but not in break charges	Mg/Al	Fuel / Permitted in all effects except the break charge.
Magnalium (≤ 53 microns) Report composition only	Mg/Al	Fuel / Permitted only in reports.
Magnesium (> 149 microns) Use in break charge or effects **(Permitted in Fireworks, UN0335, 1.3G and Article Pyrotechnic, UN0431, 1.4G only)**	Mg	Fuel / Not to exceed 10-percent by mass in break charge formulations.
Magnesium (> 53 microns to ≤ 149 microns) For use in compositions including report compositions, but not in break charges **(Permitted in Fireworks, UN0335, 1.3G and Article Pyrotechnic, UN0431, 1.4G only)**	Mg	Fuel / Permitted in all effects except the break charge.
Magnesium (≤ 53 microns) Report Composition only **(Permitted in Fireworks, UN0335, 1.3G and Article Pyrotechnic, UN0431, 1.4G only)**	Mg	Fuel
Magnesium Carbonate	$MgCO_3$	Neutralizer
Magnesium Sulfate	$MgSO_4$	Oxygen Donor
Nitrated Asphalt (< 10% Nitrogen)	Not required	Fuel
Nitrated Asphaltum (< 10% Nitrogen)	Not required	Fuel
Nitrated Bitumen (< 10% Nitrogen)	Not required	Fuel
Nitrated Pitch (< 10% Nitrogen)	Not required	Fuel
Nitrated Tar (< 10% Nitrogen)	Not required	Fuel
Nitrocellulose (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.)	Not required	Binder
Nitrocellulose Based Lacquers (The amount of Nitrocellulose in a Nitrocellulose based lacquer must be less than 15 g per article (entire device). The Nitrocellulose in Nitrocellulose Based Lacquers may not contain more than 12.6% nitrogen by mass.)	Not required	Binder
Par Oil / Chlorowax (A Chlorinated paraffin or wax)	Not Required	Color intensifier/Chlorine Donor

Parlon: (A Chlorinated Rubber)	Not required or $(C_4H_6Cl_2)_n$	Color intensifier/Chlorine Donor
Phosphorus, Red (only as provided in table 3.7-1)	P	Fuel
Polyvinyl Butyral (PVB)	$(C_8H_{14}O_2)_n$	Binder
Polyvinyl Chloride (PVC)	$(C_2H_3Cl)_n$ or $(CH_2CHCl)_n$	Color Intensifier/Chlorine Donor
Polyvinylidine chloride (Saran Resin)	$(C_2H_2Cl_2)_n$ or $(CHClCHCl)_n$	Color Intensifier/Chlorine Donor
Potassium Benzoate	$KC_6H_5CO_2$ or $KC_7H_5O_2$	Whistle / Report
Potassium Dichromate or Potassium Bichromate (not to exceed 5% of formulation)	$K_2Cr_2O_7$	Oxygen Donor
Potassium Chlorate (only as provided in Table 3.7-1 below)	$KClO_3$	Oxygen Donor
Potassium Fluorosilicate	K_2SiF_6	
Potassium Hydrogen Phthalate (KHP)	$KC_8H_5O_4$	Whistle
Potassium Hydrogen Phthalate: hydrogen potassium phthalate	$KC_8H_5O_4$	Whistle
Potassium Hydrogen Phthalate: potassium acid phthalate	$KC_8H_5O_4$	Whistle
Potassium Hydrogen Phthalate: phthalic acid potassium salt	$KC_8H_5O_4$	Whistle
Potassium Hydrogen Phthalate: potassium biphthalate	$KC_8H_5O_4$	Whistle
Potassium Hydrogen Phthalate: 1,2-benzenedicarboxylic acid, mono-potassium salt	$KC_8H_5O_4$	Whistle
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	
Potassium Sulfate	K_2SO_4	Oxygen Donor
Red Gum	Not required	Binder
Resinox (Also considered a Phenolic Resin or a Phenol-formaldehyde Resin)	Not Required	Binder
Rice Hull (Non-impregnated)	Not Required	Density Control
Rice Hull Impregnated (Must specify any chemical compound(s) or chemical formulations involved in the impregnation)		
Rice Starch (Starch)	Not Required	Binder
Shellac	Not Required	Binder
Silicon	Si	Fuel
Silver **(Particle size not required)**	Ag	Fuel
Silver Fulminate	AgCNO	Explosive
Smoke Dyes (Colored)		
Smoke Dye (Blue): Lysine	$C_6H_{14}N_2O_2$	Blue smoke Dye
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)	$C_{32}H_{16}CuN_8$	Blue Smoke Dye
Smoke Dye (Green): 1,4-di-p-toluidino-anthraquinone (Solvent Green 3)	$C_{26}H_{20}O_2(NH)_2(CH3)_2$	Green Smoke Dye
Smoke Dye (Green): Lysine – 2, 6-diaminohexanoic acid	$C_6H_{14}N_2O_2$	Green smoke Dye
Smoke Dye (Orange): α-xylene-azo-β-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-anthraquione (Disperse Red 9)	$C_{15}H_{11}NO_2$	Red 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 (Red): 1-Naphthalenol, 4-[(4-ethoxyphenyl)azo] (Solvent Red 3)	$C_{18}H_{16}N_2O_2$	Red Smoke Dye CAS# 6535-42-8
Smoke Dye (Violet): 1,4-diamino-2,3-dihydroanthraquinone (Violet)	$C_{14}H_{12}N_2O_2$	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-quinolyl)-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	$C_{24}H_{12}O_2$	Yellow Smoke Dye

(Vat Yellow 4)		
Smoke Dye (Yellow): Dibenzo(a,h)pyrene-7,14-dione (Golden Yellow GK)	$C_{24}H_{12}O_2$	Yellow Smoke Dye
Smoke Dye (Yellow): Dibenzo(a,h)pyrene-7,14-dione (Tyrian Yellow I-GOK)	$C_{24}H_{12}O_2$	Yellow Smoke Dye
Smoke Dye (Yellow): Dibenzo(a,h)pyrene-7,14-dione (Dibenzochrysenedione)	$C_{24}H_{12}O_2$	Yellow Smoke Dye
Smoke Dye (Yellow): Dibenzo(a,h)pyrene-7,14-dione (Dibenzpyrenequinone)	$C_{24}H_{12}O_2$	Yellow Smoke Dye
Smoke Dye (Yellow): Methyl Yellow (Butter Yellow); Dimethyl Yellow; 4-Dimethylaminoazobenzene; N, N-Dimethyl-4-phenylazoaniline; Solvent Yellow 2; Oil Yellow	$C_{14}H_{15}N_3$	Yellow Smoke Dye CAS# 60-11-7
Smoke Dye (Yellow): Auramine (Basic Yellow 2)	$C_{17}H_{22}ClN_3$	Yellow Smoke Dye
Sodium Chlorate (Only as provided in Table 3.7-1)	$NaClO_3$	Oxygen Donor
Sodium Salts (except Sodium Chlorate)		Color Agent
Sodium Benzoate	$NaC_6H_5CO_2$ or $NaC_7H_5O_2$	Whistle / Report
Sodium Bicarbonate (Sodium Hydrogen Carbonate)	$NaHCO_3$	Neutralizer
Sodium Carbonate	Na_2CO_3	Neutralizer
Sodium Fluorosilicate	Na_2SiF_6	
Sodium Nitrate	$NaNO_3$	Oxygen Donor
Sodium Oxalate	$Na_2C_2O_4$	
Sodium Salicylate	$C_7H_5NaO_3$	Whistle
Sodium Silicofluoride	Na_2SiF_6	
Sodium Sulfate	Na_2SO_4	Oxygen Donor
Starch (Amylum) (includes Wheat, Corn and Rice)	Not required	Binder/Fuel
Stearic Acid (Octadecanoic Acid)	$C_{18}H_{36}O_2$ or $CH_3(CH_2)_{16}CO_2H$	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_2O_4	Color Agent
Strontium Phthalate	$Sr(C_8H_50_4)_2$	Whistle or Color Agent
Strontium Sulfate	$SrSO_4$	Oxygen Donor
Sulfur	S	Fuel
Titanium (> 149 microns) Use in a break charge and Effects	Ti	Fuel / Not to exceed 10-percent by mass in break charge formulations.
Ultramarine	$Na_2S_2{\cdot}3NaAlSiO_4$	Color Agent
Wood Powder (Cellulose)	$(C_6H_{10}O_5)_n$	

MISCELLANEOUS COMPOUNDS: Organic compounds may be a combination of carbon with hydrogen, oxygen, sulfur, nitrogen and/or chlorine. Nitrogen may be present in organic compounds if it accounts for less than 10-percent (by weight) of the compound. **(NOTE: Submit all compounds not on the above list to PHMSA for review prior to their use in manufacturing fireworks.)**

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 - Fireworks devices 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.

TABLE 3.7-1 Prohibited Chemicals

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 (Permitted in **Fireworks, UN0335, 1.3G** and **Article Pyrotechnic, UN0431, 1.4G** only)
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 all "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, should not be listed as part of a chemical composition.
3.) Benzene Hexachloride (C_6Cl_6) also known as Hexachlorobenzene or Phenyl Hexachloride or Perchlorobenzene – Prohibited in all fireworks devices.
4.) Hexachlorocyclohexane - ($C_6H_6Cl_6$) 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 ($Na_2CO_3 \cdot 1.5H_2O_2$) sometimes it is shown as ($Na_2CO_3 \bullet H_2O_2$).

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.