



CLASS D FIRE FIGHTING AGENTS

Understanding Class D Fires, Fire Extinguishers and the Fire Fighting Agents Used to Protect Those Hazards

Combustible metals have never been more prevalent in our lives. Metals like Aluminum, titanium, and magnesium are frequently used in the automotive and aerospace industries due to their high strength to weight ratio. The energy density of Lithium has created an entirely new battery industry replacing internal combustion engines in many products. While these products may contain lithium in one form or another, they **ARE NOT** the intended hazard normally protected with Amerex Class D Fire Extinguishers and Class D Fire Fighting Agents.



Amerex Class D Extinguishing agents and fire extinguishers are designed to be used to **extinguish incipient stage fires in raw combustible metal powders, flakes, shavings, chips or liquids.** All NFPA's Combustible Dust Standards including NFPA 484, Standard for Combustible Metals, 2022 edition have been combined into NFPA 660, Standard for Combustible Dusts and Particulate Solids which sets the standard for Combustible Metals in Chapter 22. Chapter 3 defines an incipient stage fire.

NFPA 660 – Standard for Combustible Dusts and Particulate Solids – 3.3.64 Incipient-Stage Fire – A fire that is in the initial or beginning stage and that can be controlled or extinguished by portable extinguishers or small amounts of dry extinguishing agents, without the need for protective clothing or breathing apparatus. (CMD-FUN)

Below are 3 examples of common hazards involving Lithium or combustible metals. The first 2 present significant thermal and electrical shock hazards to the user of a fire extinguisher, while the 3rd is best suited to the use of an Amerex Class D fire extinguisher or class D firefighting agents.

EXAMPLE 1



Most automobiles have some sort of combustible metal in them, but we don't protect every car with a class D fire extinguisher because those metal parts, as they are being used, are not in a combustible form. A fully involved vehicle fire may provide a large enough heat source to melt these larger, finished chunks of metal. At that point we do not have an incipient stage fire, but rather a fully involved fire with melting metal and Class A, B, C and D hazards. This fully involved fire will radiate too much heat and may produce toxic gases requiring a breathing apparatus. **This is NOT an incipient stage fire.**

EXAMPLE 2



While lithium-ion battery powered products contain lithium the lithium in these batteries is not a combustible metal and usually represents lithium compounds such as lithium cobalt oxide, or similar products. Even though these batteries contain combustible products and are charged with electricity, **they do not involve or present a combustible metal fire hazard.** Additionally, Class D fire extinguishers DO NOT have a class C rating because the agents inside them conduct electricity. **WARNING - Batteries utilizing class D combustible metals (such as Lithium Metal Batteries) can discharge electrical energy creating an electrical shock hazard for the fire extinguisher user. Only fire extinguishers UL Listed and rated for class C fires are safe to use on battery fires. Reference Amerex's Lithium battery position paper here.**

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EXAMPLE 3



Before combustible metal components or batteries are used to build a product, they are first processed from raw minerals to finished products. **Mining, refining, processing, storage and manufacturing facilities where raw combustible metal powders, flakes, shavings, chips or liquids are used is where Amerex class D fire extinguishing agents and fire extinguishers are best suited for protection.**

WHY ARE CLASS D FIRES SO HAZARDOUS AND SO HARD TO EXTINGUISH?

Combustible metals present extreme hazards that typical Class A, B, & C fires do not. Class D metals involved in a fire can react violently with normal firefighting agents like water, foam and halogens resulting in the release of explosive hydrogen gas and toxic byproducts. Additionally, these fires burn at extreme temperatures that can produce additional hazards if not properly handled.

▶ WARNING!

Before protecting combustible metal hazards, the SDS for that material shall be consulted. Combustible metals may react violently with water or halogens and may spontaneously combust or explode. The SDS will describe the correct firefighting measures to be used with each combustible metal.

CLASS D FIRE FIGHTING AGENTS

Class D fires involve combustible metals or metallic alloy elements with combustible metal components. Some of the better-known combustible metals with a record of fire involvement include magnesium, titanium, zirconium, sodium, potassium, lithium and zinc. To be effective on any type of Class D fire, the extinguishing agent must suppress the fire without reacting physically or chemically with combustible materials.

The most familiar dry powder extinguishing agents for controlling combustible metal fires are sodium chloride (salt), copper (US Navy developed for lithium fires) and graphite. It should be noted that the term "Dry Powder" should not be confused with "Dry Chemical" which is normally associated with extinguishing agents suitable for use on Class A, B & C fires. In fact, some "Dry Chemicals" may create an explosive reaction when applied to combustible metal fires.

Amerex Super D Dry Powder is an off-white non-abrasive and non-combustible formulation of Sodium Chloride blended with additives to improve its flowing and non-caking characteristics. This allows Super D Dry Powder to be applied with a smooth, even discharge from either the Amerex model B570 30 lb. stored Pressure hand portable or model 680 125 lb. argon cylinder operated wheeled class D extinguisher. The four foot discharge hose plus extension wand on the model B570 permits the operator an extra margin of safety when applying the powder with a minimum disturbance to the burning material via the specially designed baffled nozzle. The extension wand can be quickly disconnected so that the powder can be lobbed through a straight nozzle where greater range is desired. The model 680 may be discharged through the wand for large volume close-up firefighting.

Normally, the Super D powder is applied by making a ring around the fire, gradually reducing the circle until the surface of the combustible metal has been completely covered to a depth sufficient to smother the fire. The application of Super D powder forms a sealing crust on the combustible metal fire. This crust excludes air and also assists in dissipating the heat from the burning metal.



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Amerex Copper Dry Powder is a non-abrasive, non-combustible pure copper powder. This unique Class D agent was developed by and for the US Navy specifically for the very difficult extinguishment of lithium and lithium alloy fires. It is an excellent heat sink providing a quick cooling effect on the fire. **It is two to three times more effective than graphite on lithium fires. It will cling to vertical surfaces and is heavier and denser which makes it the preferred agent on three dimensional and flowing fires.** The model B571 30 lb. hand portable and model 681 250 lb. Class D wheeled units use argon as the pressurizing gas since lithium reacts with nitrogen to form other combustible metal alloys. An extension wand with straight nozzle capability is optional with the model B571 and for the model 681.

Amerex G-Plus Dry Powder is a black, non-toxic material consisting of finely graded, granular graphite (carbon). **It is normally applied to a metal fire using a spark proof scoop or shovel.** The powder should be applied with a minimum disturbance, adequately covering the fire area to a depth of approximately two inches. If the burning material is on a combustible surface, the fire should be covered with dry powder as previously mentioned. A one- or two-inch layer of powder should then be spread on a nearby area (preferably a non-combustible surface) and the burning material shoveled onto this layer with more powder added as needed.

Graphite is an excellent conductor of heat (heat sink). When applied to a combustible metal fire, the temperature is reduced below the metal's ignition temperature. The finely ground particles of the powder also act as a smothering agent by packing and effectively sealing the hazard from air.

Training - Practice drills should be conducted to train possible users on any of the three types of dry powder extinguishing agents. Fires in some combustible metals and combustible metal alloys generate by-products which constitute a health hazard. It is very important that you consult the SDS provided by the material supplier for recommended breathing and clothing protection.



You and your customers should be aware of the following OSHA Requirements:

- ▶ **29CFR 1910.157 (d) Selection and distribution. (6)** “the employer shall distribute portable fire extinguishers or other containers of Class D extinguishing agent for use by employees so that the travel distance from the combustible metal working area to any extinguishing agent is 75 feet (22.9 m) or less. Portable fire extinguishers for Class D hazards are required in those combustible metal working areas where combustible metal powders, flakes, shavings, or similarly sized products are generated at least once every two weeks.”
- ▶ **29CFR1910.157 (g) Training and education. (1)** “Where the employer has provided portable fire extinguishers for employee use in the workplace, the employer shall also provide an educational program to familiarize employees with the general principles of fire extinguisher use and the hazards involved with incipient stage firefighting. (2) The employer shall provide the education required in paragraph (g)(1) of this section upon initial employment and at least annually thereafter.”

Primary reference materials for Class D agent specifications are listed below:

NFPA 10, Standard for Portable Fire Extinguishers – Chapters 5 & 6

NFPA 660, Standard for Combustible Dusts and Particulate Solids – Chapter 22

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