

# **Safety, Health, and Environmental Standard**

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**Title:** PYROPHORIC FUELS

**Standard No.:** E4

**Effective Date:** 3/10/2022

**Releasability:** There are no releasability restrictions on this publication.

The provisions and requirements of this standard are mandatory for use by all personnel engaged in work tasks necessary to fulfill the AEDC mission. Please contact your safety, industrial health and/or environmental representative for clarification or questions regarding this standard.

# Safety, Health, and Environmental Standard

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## PYROPHORIC FUELS

### 1.0 INTRODUCTION/SCOPE/APPLICATION

- 1.1 Introduction – This standard discusses basic hazards, storage, and transfer of pyrophoric fuels.
- 1.2 Scope – Explosive safety principles in this standard apply to pyrophorics only when they are mixed with Department of Transportation (DoT) Hazard Class (HC) 1 explosives; such as rocket propellants or munitions items and/or explosives. Otherwise DoT regulations and manufacturer's handling instructions apply. When there are any conflicts noted between this standard and industry or national codes, standards or regulatory requirements, the operating contractor shall notify the government.
- 1.3 Application – This standard applies to pyrophoric fuels (i.e., TEA (Triethylaluminum), TEB (Triethylboron), TMA (Trimethylaluminum) and Silane (SiH<sub>4</sub>).

### 2.0 BASIC HAZARDS/HUMAN FACTORS

The hazardous properties of TEB, TEA, TMA, and Silane are similar, but there are some minor differences.

The pyrophoric materials listed above are included in DoT HCs 2 and 4. Silane is designated as a HC 2 flammable gas; TEA, TEB, and TMA are designated as HC 4 spontaneously combustible materials. Pyrophoric fuels, by themselves, are not considered to be explosive products. When mixed with HC 1 explosive materials, they do not contribute to the net explosive weight of the HC 1 material. Quantity-Distance (QD) requirements only apply for pyrophorics when they are mixed with HC 1 explosives and then the predominant hazard takes precedence i.e. HC 1. Pyrophorics are given the compatibility group (CG) designation L similar to the CG-L given to some HC 1 materials. This CG-L designation allows pyrophorics to be stored with HC 1 materials which are also designated CG-L.

#### 2.1 Fire Hazards

- 2.1.1 Pyrophorics ignite immediately on contact with air or water. In case of spills, fire can be temporarily controlled by Dry Chemical, Carbon Dioxide (CO<sub>2</sub>), extinguishing agents or Dry Sand. Water or halogenated fire-extinguishing agents **MUST NOT** be used.
- 2.1.2 Persons fighting fires or entering spill areas must wear standard turnout suits with a self-contained breathing apparatus.

#### 2.2 Health Hazards

- 2.2.1 Acute poisoning by inhalation of pyrophorics is unlikely to occur since the vapor may ignite spontaneously at lower concentrations than those required to cause toxic reactions.
- 2.2.2 Exposure to pyrophorics may result in thermal burns. Even small amounts released or escaping into the air can produce skin, eye, and respiratory tract irritation and adverse effects to the central nervous system, such as dizziness, headaches, and drowsiness. Liquid pyrophorics cause severe burns on contact with the skin.
- 2.2.3 If fire results from a spill of large quantities of pyrophoric fuel in an enclosed area, oxygen deficiency of the atmosphere may occur, and harmful products of combustion will contaminate the air. Persons entering this area must wear air-supplied respirators equipped with escape bottles or self-contained breathing apparatus until the area is thoroughly ventilated. Use area oxygen meters to check for oxygen deficiencies. Industrial Hygiene should determine potential toxic problems.

### 3.0 DEFINITIONS/TERMS

Base Operating Contractor – A long-term contractor directly accountable to the Air Force for the AEDC mission.

Compatibility Group (CG) – Designations used to segregate ammunition and explosives (AE) on the basis of similarity of function, features, and accident effects potential. See AFMAN 91-201 for further details.

Compatibility Group L (CG-L) – A group containing AE that are not included in other CGs, such as those with characteristics that present a special risk that does not permit storage with other types of AE or with dissimilar AE of this group. Examples include water-activated devices, pyrophorics and phosphides and devices containing these

substances, prepackaged hypergolic liquid-fueled rocket engines, triethylaluminum (TEA), thickened TEA (TPA), and damaged or suspect AE of any group. See AFMAN 91-201 for further details.

Pyrophoric Materials – Gases that ignite spontaneously in air at temperatures of 130° F (54.4°C) or below, or solids or liquids that can ignite within five minutes after coming into contact with air without an ignition source.

Quantity-Distance (QD) – Separation requirements between potential explosive sites and exposed sites. See AFMAN 91-201 for further details.

Turnout Suit – An Ensemble which affords adequate protection to personnel engaged in firefighting operations.

## **4.0 REQUIREMENTS/RESPONSIBILITIES**

### **4.1 Requirements**

#### **4.1.1 First Aid**

- 4.1.1.1 If pyrophoric material is splashed on the skin, immediately remove all contaminated clothing including shoes while flushing the skin with large amounts of water. If pyrophorics are splashed in the eyes, begin immediate eye irrigation for at least 15 minutes. Call 911 for emergency or follow company injury protocols for non-emergency.
- 4.1.1.2 High volume safety showers and eye fountains must be conveniently located and visibly identified for operating personnel. See AEDC Safety, Health and Environmental (SHE) Standard B8 Safety Showers and Eye Fountains.
- 4.1.1.3 Safety information such as Safety Data Sheets [SDS] must be posted at sites where pyrophorics are used.

#### **4.1.2 Storage**

- 4.1.2.1 Pyrophorics may be stored in the same locations as HC 1 explosive materials designated CG-L. CG- L materials **MUST NOT** be stored with any other HC 1 compatibility group explosives.
- 4.1.2.2 Pyrophoric Materials must be stored in the shipping container in which they are received and must be kept under an inert atmosphere such as dry nitrogen or argon. Carbon dioxide must not be used as a blanket or purge gas because of its electrostatic properties.
- 4.1.2.3 Pyrophoric fuels and oxidizers shall be separated from incompatible materials as follows:
  - 4.1.2.3.1 Except as noted in 4.1.2.3.2, liquids in containers having capacities greater than 5 lb. or 1/2 gal shall be separated from incompatible materials by:
    - 4.1.2.3.1.1 A distance of at least 20 feet.
    - 4.1.2.3.1.2 A noncombustible partition that extends at least 18 inches above and to the sides of the stored materials.
    - 4.1.2.3.1.3 Storage in approved flammable liquids storage cabinets
  - 4.1.2.3.2 In all instances, flammable and combustible liquids shall be separated from oxidizers by a distance of at least 25 feet.
  - 4.1.2.3.3 Water-reactive materials shall not be stored in the same control area as aqueous liquids.
- 4.1.2.4 Storage buildings must be of noncombustible construction, be well ventilated, and be kept dry.

#### **4.1.3 Handling and Transfer**

- 4.1.3.1 Persons transferring pyrophorics and who manually operate valves, etc., or perform work on systems containing small quantities of pyrophorics must wear fire retardant coveralls, fire retardant apron, gloves, safety glasses, face shield, and a hard hat. Leather shoes or rubber boots may be worn if the tops are high enough to be covered by trouser legs.
- 4.1.3.2 For transferring larger quantities of pyrophorics, full-coverage fuel handler's suits must be worn. Suits must be designed to permit quick removal.
- 4.1.3.3 Explosion-proof equipment and adequate natural or explosion-proof ventilation must be used to ensure concentrations are kept below exposure limits.
- 4.1.3.4 An eye wash station suitable for the materials being handled must be readily available and visibly marked for identification from a distance. All employees who work with pyrophorics must know the location of and how to operate eye wash stations.

4.1.3.5 All metal parts must be grounded during handling and transfer operations to avoid ignition by static electricity.

#### **4.2 Responsibilities**

**4.2.1 Functional Manager and/or Project Engineer** - Ensures operations involving pyrophorics comply with manufacturer's requirements for storage, handling, transport and disposition. In addition, ensures SDS is available and that all employees involved in pyrophorics operations understand the hazards.

**4.2.2 Supervisor** - Ensures personnel are trained and briefed on the hazards and operations involving pyrophoric material. In addition, ensures operations involving pyrophoric material comply with manufacturer's instructions and requirements.

**4.2.3 Base Operating Contractor Safety, Health and Environmental** - Provides assistance in the development and implementation of projects/operations involving pyrophoric materials.

#### **5.0 TRAINING**

Personnel working with pyrophoric material must be trained in the safe use and handling of pyrophoric materials.

#### **6.0 INSPECTION/AUDITS**

Contractor Safety will conduct periodic required inspections of test facilities involved in pyrophoric testing

#### **7.0 REFERENCES**

**7.1 AEDC Safety, Health and Environmental Standards**

B8 Safety Showers and Eye Fountains

E15 Explosives Safety

**7.2 AFMAN 91-201, Explosives Safety Standard**

**7.3 NFPA 30 (2021), Flammable and Combustible Liquids Code**

#### **8.0 SUPPLEMENT**

NFAC A321-0801-XSP E4 Pyrophoric Fluids

## A321-0801-XSP E4 Pyrophoric Fluids

As there are no Pyrophoric Fluids at the NFAC site this supplement is being reserved in the event that if Pyrophoric Fluids are introduced, this supplement will need to be revised.

**Review:** Non-Applicable at this time.

**References:**

**Scope:**

**NFAC Worksite Application:**