



AEROSPACE RECOMMENDED PRACTICE

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc.

485 Lexington Ave., New York, N. Y. 10017

ARP 956

Issued 2 - 15 - 68

Revised

SUMMARY OF TRANSPORTATION, HANDLING AND STORAGE REQUIREMENTS

FOR

STARTER CARTRIDGES, JET ENGINE, MXU-4/A AND MXU-129/A

1. PURPOSE

The objective of this ARP is to summarize current applicable requirements to provide a better understanding of the transportation, handling, and storage requirements of starter cartridges.

1.1 Historical and General - Until 1962, the Interstate Commerce Commission (I. C. C.) Regulations, T. C. George's Tariff for Transportation of Explosives, etc., classified starter cartridges, jet engine as a Class-B explosive. In July of 1960, a report from the Chemical Laboratory of the Bureau of Explosives classified one MXU-4/A Starter Cartridge as an "Explosive Power Device, Class C." This change in classification was based upon the results of a bonfire test and a modification to the tariff which deleted a maximum weight of 400 grams from the description of the Explosive Power Device, Class C. In April 1962, George's Tariff was revised to permit cartridges (containing a propellant classified as a flammable solid material) to be transported as a Class C explosive. Safe handling and storage procedures have evolved with continued innovations in design, test, and service experience.

1.2 Scope - This document is based upon current practices in the manufacture and use of the following cartridges:

- MXU-4/A (8 lb nominal net propellant)
- MXU-129/A (4 lb nominal net propellant)

NOTE: The newer MXU-4/A/A model is similar to the MXU-4/A as regards transportation, handling and storage criteria.

Because of varying local, state, or federal ordinances, these specific starter cartridges are included. It is pointed out that these rules govern interstate conditions and local or state laws may be more stringent.

2. APPLICABLE DOCUMENTS

The following documents shall form a part of this recommended practice to the extent specified herein. The applicable issue of each shall be that in effect on the date of this Aerospace Recommended Practice unless otherwise specified in the manufacturer's Model Specifications. Supplementary specifications, standards, or the

like, which by reference in any of the following publications are indicated to be part thereof, shall not be considered as effective except as specifically stated in the manufacturer's Model Specification or as may be otherwise mutually agreed upon between the vendor and the purchaser.

2.1 Military Specifications

- | | |
|---------------------|--|
| MIL-C-25641 (USAF) | Cartridge, Gas Generating, Solid Propellant Aircraft and Missile, Secondary Power Systems, General Specification for |
| Exhibit ASNPF 61-26 | Cartridge, Engine Starter, Type MXU-4/A |
| MIL-C-27505A | Cartridge, Engine Starter MXU-4/A/A |
| MIL-C-27658 | Cartridge, Engine Starter, MXU-129/A |

2.2 Transportation Regulations

- Agent T. C. George's Tariff No. 15
- Interstate Commerce Commission Regulations for Transportation of Explosives, etc.
- American Trucking Associations
- Motor Carriers' Explosives and Dangerous Articles Tariff 12
- Official Air Transport Restricted Articles Tariff No. 6-D

2.3 Handling and Storage Procedures

- | | |
|---------------------|---|
| AFM 71-4 | Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft |
| AFM 127-100 | Ground Safety, Explosives Safety Manual |
| AFT. O. 11A-1-47 | Explosive Hazard Classification Procedure |
| AFT. O. 11A-2-3-3-7 | Technical Manual, Storage, Handling and Inspection, Cartridge, Engine Starter MXU-4/A |

3. REQUIREMENTS FOR TRANSPORTATION, HANDLING, AND STORAGE

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."



3.1 Transportation Information (I. C. C. George's Tariff)

3.1.1 Explosive Classification for Shipment -

Starter cartridges may be classified as Class B per Section 73.88 or Class C per Section 73.100, depending upon whether the propellant charge is "... a block of propellant explosive ..." or "... a block of flammable solid ..." These raw material designations are provided by the Bureau of Explosives, I. C. C. from a design review analysis and actual sample tests of candidate material furnished by the contractor. Solid propellant of ammonium nitrate composite type, currently used in all cartridges, has generally been graded as a flammable solid allowing a Class C explosive classification of the cartridge for shipment in interstate commerce.

3.1.2 Preservation and Packaging - The cartridges are required by specification to contain integral weather seals to preclude damage from exposure to humidity, dust, and salt spray environments. They are also packaged in a metal can (reference Federal Specification PPP-C-96 Cans, Metal, 28 Gage and Lighter) with adequate dunnage. The outside shipping container with four MXU-4/A or six MXU-129/A units per carton in a fiber box meeting ICC 12H, 23F, or 23H (reference Federal Specification PPP-B-636 Boxes, Fiber). A recommended alternate sub-lot of sample shipping container is a sturdy wooden box with externally reinforced corners.

3.1.3 Marking - Packaged cartridges are marked per instructions of the procuring activity (reference MIL-STD-129 Marking for Shipment and Storage). Each outside container must be marked (George's Tariff Section 73.102), following verification of this classification by the Bureau of Explosives:

"STARTER CARTRIDGES, JET ENGINE, CLASS C"
"HANDLE CAREFULLY - KEEP FIRE AWAY"

3.1.4 Travel Modes - Starter cartridges may be shipped via motor, rail, water, and air by participating carriers listed in the American Trucking Associations' Dangerous Articles Tariff 11, I. C. C. George's Tariff No. 15, and Official Air Transport Restricted Articles Tariff 6-D. (This includes shipment on commercial passenger aircraft where individual packages do not exceed 50 lb net.)

3.2 Handling and Storage - Guides for minimum safety precautions in handling and storage of cartridges is difficult because of varying local or state ordinances, and final responsibility of the individual base commander of the user-agency to establish and monitor safe practices procedures. The discussions presented are primarily to inform the uninitiated or occasional user of minimizing hazards to personnel and equipment.

3.2.1 Explosive Classification - Propellants in starter cartridges are of a composite type ammonium

nitrate generally rated as Class 2 for handling and storage requirements. From Section 0528 of AFM 127-100; "Items assigned to this class burn with intense heat, but usually do not form dangerous fragments or generate dangerous pressure blasts."

3.2.2 Personnel - All handling of cartridges should be done by competent personnel trained in safe handling operations for explosives or hazardous materials. Minimizing of handling and segregation of these operations from other personnel is a cardinal rule.

3.2.3 Storage Location - Magazines or storage areas should be isolated from normally inhabited buildings according to Quantity-Distance Table 5-1 of AFM 127-100. (Example: 0-50 lb net propellant to be 25 ft away from inhabited building, and 1000-5000 lb to be 115 ft away). They require no special environmental conditioning but should be maintained intact in their approved shipping and storage containers whenever and as long as practicable.

3.2.4 Hazards

3.2.4.1 Fire - Cartridges are non-propulsive when consumed in ambient pressure combustion. They are best extinguished by soaking or immersion with water. Carbon dioxide (CO₂) extinguishers are largely ineffective since the propellant carries its own oxygen for combustion.

3.2.4.2 Autoignition - The cartridge may auto-ignite after one hour at a temperature of about 350 F. However, intermittent or long term exposure to temperatures above the normal service limit of 160 F can seriously degrade performance and impair proper functioning.

3.2.4.3 Electrical, Lightning, Electromagnetic Radiation - The cartridge is classified as an electro-explosive device (EED) because it is actuated by a current applied through a squib (electric match). Instrumentation used to determine electrical resistance or verify circuit continuity should not exceed 50 milliamperes current input to preclude damage to the squib or accidental ignition. The short-out clip or device attached to the cartridge as shipped should be left in place until insertion in the breech for maximum protection from static or stray circuits. In general, recommended distances of Chart 6-1 of AFM 127-100 should be observed from transmitter antennae of radio, FM mobile, and radar sites for safety from electromagnetic forces. Also, USAF Technical Manual, TO-11A2 - 3-3-7 specifies safe handling distances for cartridges when near electromagnetic generating systems (cartridges in the container maintain 6 ft from transmitting antenna of radio, radar or other electromagnetic generating systems, cartridges removed from container maintain one half the minimum distances shown in Chart 6-1 of AFM 127-100 but not less than 6 feet).

3.2.4.4 Exhaust Gases - The products of combustion include carbon monoxide and carbon dioxide, ingredients that may be toxic in closely confined or improperly