

Fuze Well Mechanical Interface

RATIONALE

The SAE International (SAE) AS-1 Steering Group, Aircraft Systems and System Integration, formed SAE AS-1B7, Fuze Mechanical Task Group, to generate an Aerospace Standard (AS) to support interoperability and interchangeability of airborne weapons and their fuzes. This effort was initiated in response to a request made to the SAE AS-1 Steering Group by the North Atlantic Treaty Organization (NATO) Air Armament Panel for AS-1 to undertake a study or series of studies related to airborne weapons fuze standardization.

The specific charter of the Fuze Mechanical Task Group is to: "Study, define and develop standards and standards related documents for airborne mechanical fuze interfaces such as fuze wells, mechanical safety linkages and fuze associated components in order to achieve airborne fuzing systems interoperability."

This standard addresses the 3-Inch Fuze Well, as this is the most common size currently used by airborne weapons of NATO countries with field installable fuzes.

FOREWORD

This standard addresses the mechanical and physical characteristics of the interface between the weapon's fuze and the weapon fuze well to support interoperability of fuzes and weapon systems. The goal is to improve the effectiveness and readiness of NATO forces by reducing the logistics associated with supporting airborne weapon systems in the theater of operation.

This standard covers 3-Inch Fuze Wells which are common in current NATO weapon systems.

This document was prepared by the AS-1B7 Fuze Mechanical Task Group under the jurisdiction of the AS-1B Committee, Aircraft-Store Integration, of the SAE AS-1 Steering Group, Aircraft Systems and System Integration.

This effort has been closely coordinated with the AS-1B6 Fuze Systems Task Group which has been tasked by the AS-1 Steering Group to generate an AS standardizing the electrical, logical and functional characteristics of the interface between the weapon's fuze/fuzing system and the rest of the weapon to achieve airborne fuzing systems interoperability.

For information on the standardization of the electrical, logical and functional interface, reference should be made to document AS5716.

The objective of documents AS5680 and AS5716 is to jointly define the interface characteristics essential but not on their own sufficient at this time to ensure full interoperability.

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1. SCOPE

This interface standard applies to fuzes used in airborne weapons that use a 3-Inch Fuze Well. It defines:

- a. Physical envelope of the fuze well at the interface with the fuze.
- b. Load bearing surfaces of the fuze well.
- c. Physical envelope of the fuze and its connector.
- d. Mechanical features (e.g. clocking feature).
- e. Connector type, size, location and orientation.
- f. Retaining ring and its mechanical features (e.g. thread, tool interface).
- g. Physical envelope of the retaining ring at the interface with the fuze.
- h. Physical space available for installation tools.
- i. Torque that the installation tool shall be capable of providing.

This standard does not address:

- j. Materials used or their properties.
- k. Protective finish.
- l. Physical environment of the weapon.
- m. Explosive interface or features (e.g. insensitive munitions (IM) mitigation).
- n. Charging tube.
- o. Torque on the retaining ring or loads on the load bearing surfaces.

Each fuze and weapon combination should be evaluated to ensure that the weapon system will satisfy all safety, reliability, and performance requirements throughout its lifecycle.

2. REFERENCES

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AS5716 Standard Electrical and Logical Interface for Airborne Fuzing Systems.

2.2 Government Documents

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <http://assist.daps.dla.mil/quicksearch/>.

FED-STD-H28A Screw-Thread Standard for Federal Services.

MIL-DTL-38999L, Supplement 1 Detail Specification, Connectors, Electrical, Circular, Miniature, High Density, Quick Disconnect (Bayonet, Threaded, and Breech Coupling), Environment Resistant, Removable Crimp and Hermetic Solder Contacts, General Specification for.

MS27467L, Amendment 1

Military Specification Sheet, Connectors, Plug, Electrical, Straight, Crimp Type, Bayonet Coupling, Series I.

2.3 ASME Publications

Available from American Society of Mechanical Engineers, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, www.asme.org.

ASME Y14.5M-1994 Dimensioning and Tolerancing

3. DEFINITIONS

Note: The terms “store”, “weapon” and “munition” are largely used as synonyms.

AIRCRAFT MOUNTING DEVICE: A mechanical device used to suspend a weapon during captive carry and release.

ALIGNMENT FEATURE: A device or feature that allows mounting the fuze with a defined orientation in reference to the weapon (aka Clocking).

AIRBORNE WEAPON: A weapon which is tactically deployed from an aircraft.

CHARGING TUBE: A conduit, which runs from a sensor or power source, through the weapon to the inner end of the fuze well.

FIELD INSTALLABLE FUZE: A fuze which is installed in a weapon, in the theater of operation or forward operating base (e.g. airfield), immediately prior to deployment of such weapon.

FUZE: A physical system designed to sense a target or respond to one or more prescribed conditions, such as elapsed time, pressure, or command, and initiate a train of fire or detonation in a munition. Safety and arming are primary roles performed by a fuze to preclude ignition of the munition before the desired position or time. The term Fuze usually denotes a single device. (See also Fuzing System.)

FUZE RETAINING RING: A mechanical device used to securely fasten the fuze within the fuze well of a weapon.

FUZING SYSTEM: A physical system designed to sense a target or respond to one or more prescribed conditions, such as elapsed time, pressure, or command, and to initiate an explosive train in a munition. Safety and arming are primary roles performed by a fuze to preclude ignition of the munition before the desired position or time. A safety and arming device is a part of a fuzing system. (Note: For the purpose of this document the sum of all parts of a distributed Fuzing System is considered to be the Fuzing System even if some parts are installed permanently into the munition (e.g. external sensors).)

FUZE WELL: The location, typically a cavity, where the fuze is installed in a weapon.

INTERCHANGEABILITY: A condition which exists when two or more items, in a specified life cycle and environment, possess such functional and physical characteristics as to be equivalent in safety, performance and durability, and are capable of being exchanged one for the other without alteration of the items themselves, or of adjoining items, except for adjustment, and without selection for fit and performance.

INTEROPERABILITY: The ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together.

LANYARD: A device, typically a cable, which is used to activate a device (e.g. sensor or power source) after a predetermined event such as release of a weapon from an aircraft.

WEAPON: A device which is used against a target to achieve a specific objective whether it be destroy or neutralize such target.

4. ABBREVIATIONS

For the interpretation of this document the following specific abbreviations apply:

aka: Also known as.

i.e.: In other words.

e.g.: For example.

Ref: For reference.

5. MECHANICAL INTERFACE

The fuze well, fuze (including connector) after installation, fuze retaining ring, fuze retaining ring after installation and ring installation and removal tool shall meet the requirements as defined in the following sections. All dimensions are metric with the exception of the thread type identification. Appendix A of this document contains the Imperial unit equivalence for the dimensions for information only. Dimensioning and tolerancing shown on Figures 1 and 4 shall be interpreted in accordance with ASME Y14.5M-1994. Figure 1 and Figure 4 source document is under the control of the SAE courtesy of L-3 Fuzing & Ordnance Systems. (Version of source document is shown in figure for the purpose of maintaining configuration control.)

5.1 Fuze Well

The fuze well shall conform to the physical envelope and contain the mechanical features as defined in Figure 1. Figure 1 shows the dimensions for a charging tube as a reference since it may exist in some weapons. The fuze well shall be capable of mechanically supporting the fuze at the load bearing surfaces as defined in Figure 1.

5.1.1 Alignment Feature

The fuze well shall contain a feature as defined in Figure 1. (Note: Its purpose is to engage a corresponding feature on the fuze for aligning the fuze with respect to the weapon.) The feature shall be positioned with respect to the suspension lug or aircraft mounting device in accordance with Figure 1.

5.2 Fuze

The fuze, including the connector and any extraneous devices (e.g. lanyards, switches, protective caps or covers), when installed in the fuze well, shall not protrude outside the clearance zone as defined in Figure 1. (Note: The weapon must provide space for the mating connector and cable and any other devices connecting to the fuze.) The fuze shall only physically load the fuze well at the load bearing surfaces as defined in Figure 1. The fuze may contain a feature which mates with the alignment feature on the fuze well if orienting the fuze is desired.

5.2.1 Electrical Connector Interface

The fuze electrical connector (see Figure 2 for a picture of an example connector) shall be capable of mating with a MIL-DTL-38999L, Supplement 1, Series I connector that meets the following characteristics:

- a. MS27467L, Amendment 1 series
- b. 21 shell size
- c. 39 contact insert arrangement (Ref: 37 contacts size 20, 2 contacts size 16)
- d. Contact style "S" – Socket
- e. "Normal" positioning for the master keyway

Figure 3 shows the pin arrangement on the fuze. With the fuze installed in the fuze well (i.e. fuze retaining ring installed and properly tightened), the fuze electrical connector location shall be as defined in Figure 1. The angular orientation of the electrical connector keyway shall be within 5 degrees of the centerline of the alignment feature on the fuze, if an alignment feature is present on the fuze. When mounted in the fuze well and tightened, the electrical connector keyway shall be aligned to within 15 degrees of the centerline of the suspension lug or aircraft mounting device. The fuze connector shall not protrude beyond surface "A" shown in Figure 1. The mating end of the connector may be recessed inside this space, but not beyond surface "B" shown in Figure 1. Surface "B" represents the surface profile of the weapon in the area of the fuze. (A protective cap which is removed prior to mating of the two connectors may exceed the clearance zone as defined in Figure 1.)

5.3 Fuze Retaining Ring

The fuze retaining ring shall be provided with the fuze. It shall conform to the physical envelope and contain the mechanical features as defined in Figure 4. The inner diameter of the retaining ring shall accommodate the fuze electrical connector and other extraneous device(s) of the fuze; and shall allow sufficient space for attachment of the mating electrical connector and any other mating device(s). The retaining ring when installed in the fuze well shall not protrude past surface "B" shown in Figure 1. The retaining ring shall provide features, as defined in Figure 4, whose purpose is to interface with a tool for installation and removal of the ring. The maximum inner diameter of the ring and thickness of the ring (i.e. dimension "A") are not specified and will be design specific.

5.4 Mechanical Features

The fuze well and fuze retaining ring shall comply with the following requirements:

- a. FED-STD-H28A Screw-Thread Standard For Federal Services
- b. Unless otherwise specified, all inside radii shall be less than 0.25 mm
- c. Unless otherwise specified, all outside radii shall be less than 0.51 mm for the fuze well and less than 0.25 mm for the retaining ring
- d. Unless otherwise specified, surface roughness shall be equal to or better than 3.2 μm
- e. No burrs or sharp corners

5.5 Retaining Ring Installation and Removal Tool

The tool used to install and remove the retaining ring should interface with the features on the ring as defined in Figure 4. The tool shall be capable of properly installing and removing the ring without violating the clearance zone as defined in Figure 1. The tool shall be capable of tightening the ring to a torque of at least 1250 Newton-Meter (Nm).

6. NOTES

- 6.1 A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.



FIGURE 1. FUZE WELL PHYSICAL ENVELOPE AND MECHANICAL FEATURE INTERFACE
(DIMENSIONS IN MILLIMETERS EXCEPT FOR THREAD IN INCHES)



FIGURE 2 - EXAMPLE CONNECTOR: FRONT FACE OF FUZE CONNECTOR (LEFT) AND OF MATING WEAPON CABLE CONNECTOR (RIGHT)

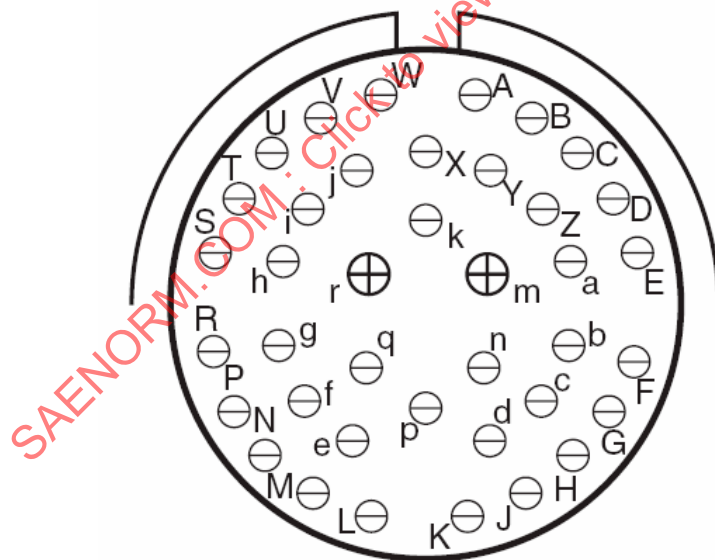


FIGURE 3 - PIN ARRANGEMENT OF THE CONNECTOR ON THE FUZE, FRONT FACE (SEE FIGURE 2)

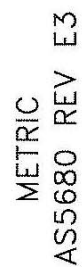


FIGURE 4. FUZE RETAINING RING PHYSICAL ENVELOPE AND MECHANICAL FEATURE INTERFACE
(DIMENSIONS IN MILLI-METERS EXCEPT FOR THREAD IN INCHES).