



AEROSPACE STANDARD	AS5609™	REV. A
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	Superseding AS5609	
(R) Aircraft/Store Common Interface Control Document Format Standard		

RATIONALE

The Aircraft/Store Common Interface Control Document Format is a standard that defines a common document format for aircraft-store logical, mechanical, and environmental interfaces. Its purpose is to assist and harmonize aircraft-store interface standardization and to provide a common document format for the development and comparison of aircraft-store interface control documents (ICDs).

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1. SCOPE

This SAE Aerospace Standard (AS) defines the editorial format and policies necessary for the publication of Interface Control documents. The Common Interface Control Document Format Standard defines a common format for aircraft/store interface documents to foster increased interoperability. It is designed with the versatility to serve differing “ICD” philosophies and organizations.

This aerospace standard defines the common technical data sections for the Common Interface Control Document Format down to the third header level for the majority of sub-sections. The Common Interface Control Document Format Aerospace Standard provides a structured document format in appendixes supported by example paragraphs, drawings, etc.

1.1 Purpose

The Aircraft/Store Common Interface Control Document Format defines the document format to be utilized to define and document aircraft/store interfaces. A common document format is desired to foster increased interoperability of stores and aircraft across platforms.

1.2 Field of Application

This standard applies to new Aircraft/Store Interface Control Documents, and may be applied to existing ICDs when they are being revised.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AIR5532 Generic Aircraft Store Interface Framework (GASIF)

AS15531 Digital Time Division Command/Response Multiplex Data Bus

2.1.2 ANSI Publications

Copies of these documents are available online at <http://webstore.ansi.org>.

ASCII American Standard Code for Information Interchange

2.1.3 U.S. Government Publications

Copies of these documents are available online at <http://quicksearch.dla.mil>.

MIL-STD-1760-D Department of Defense Interface Military Standard for Aircraft/Store Electrical Interconnection System

MIL-STD-1553B Digital Time Division Command/Response Multiplex Data Bus

NOTE: Revision B Notice 4 is specifically required.

MIL-HDBK-1553

2.2 Applicable References

None

2.3 Definitions

AIRCRAFT: Any vehicle designed to be supported by air, being borne up either by the dynamic action of the air upon the surfaces of the vehicle, or by its own buoyancy. The term includes fixed and movable wing airplanes, helicopters, gliders, and airships, but excludes air-launched missiles, target drones, and flying bombs.

CARRIAGE STORE: Suspension and release equipment that is mounted on aircraft on a non-permanent basis as a store, and is intended to carry other store(s). Carriage store includes both single adapters and multiple store carriers. Pylons and primary racks (such as an MAU-12 and BRU-10) shall not be considered carriage stores.

DISPENSER: Equipment that is mounted on an aircraft on a non-permanent basis as a store and is intended to carry devices that are dispensed. Dispensers include, but are not limited to, chaff and flare dispensers, rocket pods, and small munitions dispensers.

STORE: Any device intended for internal or external carriage and mounted on aircraft suspension and release equipment, whether or not the item is intended to be separated in flight from the aircraft.

2.3.1 Terminology

SHALL: This term in the Aircraft/Store Common Interface Control Document Format is to be used wherever the criterion for conformance with the specific recommendation requires that there be no deviation.

SHOULD: This term in the Aircraft/Store Common Interface Control Document Format is to be used wherever the criterion for conformance with the specific recommendation is to meet a system objective. Failure to meet a "Should" statement shall be justified.

MUST: This term in the Aircraft/Store Common Interface Control Document Format is used for a legislative or regulatory requirement (e.g., health and safety) with which the customer, the aircraft company and the store company shall comply. It is not used to express a requirement of the specification.

WILL: This term in the Aircraft/Store Common Interface Control Document Format is used for the future tense. It does not express a requirement of the specification.

MAY: This term in the Aircraft/Store Common Interface Control Document Format expresses a permissible practice or action. It does not express a requirement of the specification.

3. AIRCRAFT/STORE COMMON INTERFACE CONTROL DOCUMENT FORMAT REQUIREMENTS

3.1 Background

Prior to the establishment of this standard, there were two major approaches to the definition of aircraft/store interface control documents. One approach was the "J-weapon" interface control document the United States store and airframe industry has developed. The second was several ICD structure proposals used in Europe on various aircraft programs with the most common being the European Industrial Group working on the Typhoon fighter.

In addition to the format differences between the two industry approaches, there is also a philosophical difference. Historically, the airframe industry in Europe writes an aircraft to store interface control document based on the inputs from the store contractor, i.e., manufacturing or qualification information or even a store interface control document. This was the case when an already developed store had to be integrated in an existing airframe. The interface control document itself may be a part of the contract documentation.

In the United States the store contractor writes the core interface control document with inputs from the airframe contractors through the interface control working group process. The core document defines the store mechanical, electrical, and environmental interfaces. The core document also defines the functional requirements for the store and aircraft to support integration of the interface. Each aircraft that integrates the store then writes an annex, to define aircraft peculiarities for specific requirements implementation. The aircraft annex is written to define aircraft dependent implementation of the mechanical, electrical, environmental and functional interfaces, and optional capabilities that are implemented from the core interface control document. If, for example, there is an optional capability, which the aircraft may use, it is described in the core as an "aircraft may" and introduced in the aircraft annex as an "aircraft shall".

Since neither industrial group (Europe and United States) is expected to adopt the other's approach to aircraft/store interface definition, the Aircraft/Store Common Interface Control Document Format is structured to serve both approaches. It can be used as a single form to describe the agreed interface or as the form to lay down store interface considerations and—as an annex—the aircraft side of the interface reflecting the same basic structure. Figure 1 and Figure 2 illustrate the dual uses of this document format.

The Aircraft/Store Common Interface Control Document Format is split into two volumes. The reason the document is defined in two volumes is to separate the hardware driven elements of the interface, which tend to change infrequently from the software elements of the interface which historically change very frequently during the development process.

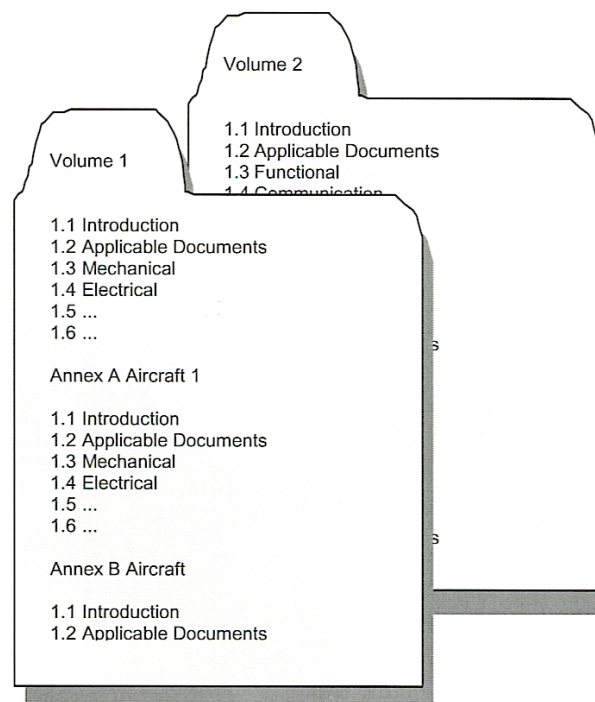


Figure 1 - CICD format for a "J-ICD" approach for one store with multiple aircraft annexes

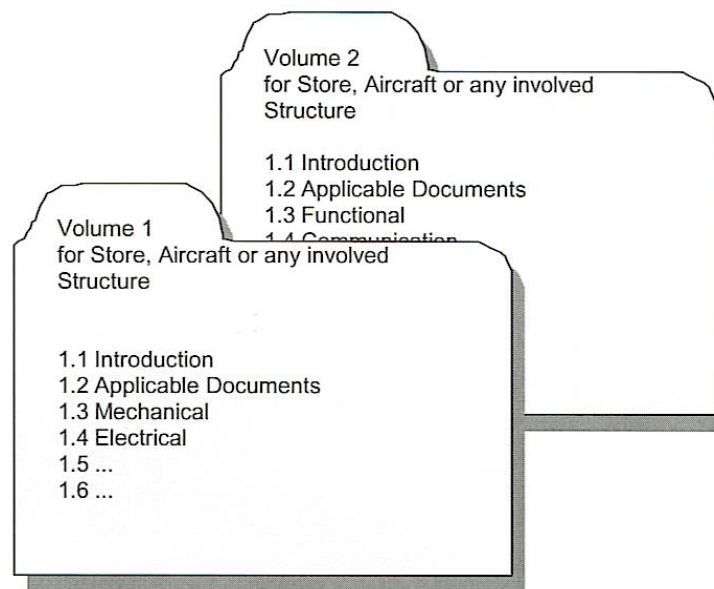


Figure 2 - CICD format for an "ICD" approach for a single store or aircraft or structure

3.2 Application Areas and Format Utilization

3.2.1 Application Areas

The Aircraft/Store Common Interface Control Document Format is intended for use in all areas and combinations of aircraft to store integration for all kinds of stores (including miniature stores, carriage stores, and dispensers) of any origin (legacy or new products).

3.2.2 Utilization and Basic Considerations

In principle, there exists just one interface, which shall be described within one Interface Control Document. That is the direct interface between the aircraft and the store mechanically and electrically directly connected (no intermediary system) together. However, depending on the interface control document approach (European versus United States) and on the stage of the development or the integration, there may be a single point of view, that is the interface can only be described from one side. For example, during European aircraft development with the requirement to integrate a specific set of stores, the store design authority will produce a document that provides baseline information describing the interface between the store and a non-specific or generic aircraft, sometimes referred to as a Generalized Aircraft Interface Specification (GAIS). The GAIS structure is identical to that of the ICD to be generated later, containing detailed information relevant to the store and generic information on what is expected of the aircraft. For a United States interface control document approach, the document will contain the functional requirements for both sides of the interface and the mechanical, electrical, and environmental requirements for the store (called the "Core Interface Control Document"), but the aircraft specific appendix, which describes the aircraft peculiar implementation of the functional, mechanical, electrical, and environmental interface, may not be available.

If a carriage store is connected between the aircraft and the weapon, things can become more complicated because the carriage store employs an interface to the aircraft and an interface to the store, but part of the carriage store interface to the aircraft may depend on which weapon is carried below the carriage store. For carriage stores with internal electronic boxes or signal adaptation units, several different interface control documents approaches could be utilized. Two Volume 1 documents could be written, one for the carriage store to the aircraft and one for the carriage store to the weapon since each has unique mechanical, electrical, and environmental criteria. As mentioned above, this will be related to the point of view and the approach to integration (European or United States). Alternatively, for the logical interface defined in the Volume 2 content, the carriage store may act like a black box and simply routes the appropriate signals directly from aircraft to the store and vice versa. Thus, only one Volume 2 could be written because the carriage store interface to the aircraft is a direct reflection of the weapon interface. The interface control author has the flexibility to choose the best approach for their program.

From the aircraft viewpoint, regarding the mechanical or electrical interface and other Volume 1 content, it is important to know the mechanical and electrical specifications of the overall structure, i.e., carriage store and store, despite the fact that the aircraft has only one interface with the carriage store. The same principles apply to dispenser or similar structures.

3.2.2.1 Concept for Interface Control Document Generation Involving a Carriage Store

To explain the concept further, consider two basic system configurations: the first involving an intelligent carriage store and the second involving a relatively simple or dumb carriage store. This simple distinction becomes a little blurred when considering the ownership of design authority for the three parts of the system. In discussions between the various design authorities, it is therefore essential that the subject interface is defined with total clarity at the front of the ICD, together with a description of how the related interfaces are being managed. However, regardless of who is responsible for what, there must be a definition of the interface between each part of the system.

3.2.2.1.1 Simple Carriage Store

For the situation where the carriage store is simple, the two main possibilities are:

- a. If the carriage store design authority is a third party, then there must be a complete ICD for each of the two interfaces (aircraft to carriage store, carriage store to store) so that the contractual arrangement is fully recognized. It should be noted that the carriage store design authority may well not be fully conversant with all of the nuances of the aircraft and store system operation and will need close supervision by the two other design authorities to ensure all systems operate as specified. In particular, there is an additional responsibility on the aircraft design authority to act as a 'coordinating integrator' to ensure correct definition/operation of the combined system.
- b. If the carriage store design authority is also the design authority for either the aircraft or the store, then there may be a single interface control document covering the interface between the areas of each design authority responsibility. However, the interface control document must clearly define the 'store present' situation and the 'store not present' situation. Note that it is not unusual to have two separate interface control documents here also, particularly if the store design authority is responsible for the carriage store and there are variations in the carriage store design where the same basic equipment may be used on more than one aircraft type.

3.2.2.1.2 Complex Carriage Store

For the situation where there is a complex carriage store that has an intelligent role within the overall system operation, there are alternatives as well depending on the overall system design. It is probable that there would need to be two Volume 1 interface control documents to identify the unique hardware aspects of the carriage-store-to-aircraft and carriage-store-to-store interfaces if that carriage store will be used to carry stores from multiple design authorities. If the carriage store will only be utilized to carry stores from the same design authority, then one Volume 1 document maybe sufficient. Similarly, there is flexibility in the utilization of Volume 2. If the carriage-store-to-aircraft interface is fully or partially a reflection of the carriage-store-to-store interface, a single Volume 2 document may suffice. If the carriage store is intended to be used to support stores from multiple design authorities, then it may be necessary to write two separate Volume 2 documents to reflect the carriage-store-to-aircraft and carriage-store-to-store functional interfaces. It may even be necessary to write a third Volume 2 document if part of the carriage-store-to-store interfaces is directly routed to the carriage-store-to-aircraft interface without any processing by the carriage store. Again, the aircraft design authority must operate as the system integrator to ensure overall system operation.

3.3 Basic Structure and Generation Rules

The Aircraft/Store Common Interface Control Document is split into two volumes. Volume 1 covers mostly hardware aspects such as the mechanical or electrical interface, while Volume 2 specifies the logical part and provides the Signal Format Sheets.

For simple interfaces, the two volume approach may be unnecessary. Dependent on the size and intent of the interface control document, the author may retain a single volume approach, but shall keep to the same section/paragraph sequence defined in the Aircraft/Store Common Interface Control Document Format for that document. For example, if the store has no logical interface requirements with the aircraft, the author may drop Volume 2 and only write a Volume 1 document, but the entire format must be utilized. Parts that are not applicable can be simply marked as "Not Applicable" but they must not be deleted.

However, all parts of the Aircraft/Store Common Interface Control Document Format may be tailored to the author's needs. This may be necessary to cope with special requirements or needs of a project such as stores integration, where test assets may be necessary during the development phase. This may require a separate ICD to cover separation rounds or environmental stores or specific flight test instrumentation connections and recording capability. For the purpose where a separate ICD is not regarded necessary, separate sections have been included in both volumes without further substructure.

3.3.1 Volume 1 Overview

Volume 1 covers mostly hardware aspects such as the mechanical or electrical interface. The heading level 1 structure for Volume 1 is shown in Figure 3. Examples for each paragraph of the Volume 1 template are provided in Appendix A.

1.	Introduction
2.	Applicable Documents
3.	Mechanical Interface
4.	Electrical Interface
5.	Aerodynamics Interface
6.	System Safety
7.	Environmental Considerations
8.	Store/ Aircraft Interface Specific
9.	Store/ Aircraft Post-Launch (Data-Link) Interfaces
10.	Support Interface

Figure 3 - CIGD format structure Volume 1, level 1

3.3.1.1 Volume 1, Section 1 Introduction

This section shall cover the introduction to the Volume 1 of the interface control document. An overview of the volume content and detailed information concerning updates shall be given. The use of terms within the interface control document shall be defined. In the installation subsection, the purpose of the store, aircraft, or the combination shall be identified, and the commonality for use of a store on different aircraft shall be defined (for store only interface control document). Figure 4 provides an outline of this section.

1.	Introduction
1.1	Scope
1.2	Updating
1.2.1	Information Accuracy
1.2.2	Definition of Terms
1.3	General Description
1.3.1	Installation
1.3.2	Commonality Considerations

Figure 4 - CIGD format structure for Volume 1, Section 1

3.3.1.2 Volume 1, Section 2 Applicable Documents

This section lists the referenced and considered documents relevant for Volume 1 of the interface control document and defines the order of precedence if any. All documents referenced elsewhere in Volume 1 of the interface control document and which are fundamental for the interface shall be listed in this section. The listing shall include the relevant document issue used during document generation to prevent invalidating the interface control document after an update of the referenced document. Figure 5 provides an outline of this section.

- 2. Applicable Documents
 - 2.1 General
 - 2.2 Specifications
 - 2.3 Standards
 - 2.3.1 Military Standards
 - 2.3.2 Civilian Standards
 - 2.4 Project Specific Documents
 - 2.5 Other Documents
 - 2.6 Precedence

Figure 5 - CICD format structure for Volume 1, Section 2

3.3.1.3 Volume 1, Section 3 Mechanical Interface

The mechanical interface shall be defined within this section. This section specifies physical characteristics such as moments of inertia or center of gravity, any physical clearance issues, hardware locations or alignment, as well as loads, stiffness, and loading considerations. A definition of units of measurement, scaling and scaling factors to facilitate interoperability and common understanding shall be included. Figure 6 provides an outline of this section.

- 3. Mechanical Interface
 - 3.1 General
 - 3.2 Physical Characteristics
 - 3.2.1 Dimensional Envelope
 - 3.2.2 Mass
 - 3.2.3 Centre of Gravity
 - 3.2.4 Moments of Inertia
 - 3.3 Suspension Interface
 - 3.3.1 Connector Interfaces
 - 3.3.2 Fuzing and Arming Connections
 - 3.3.3 Suspension Details
 - 3.3.4 Clearances
 - 3.3.5 S&RE Settings
 - 3.3.6 Carriage Store Unique Provisions
 - 3.4 Alignment
 - 3.5 Loads
 - 3.5.1 Separation Loads
 - 3.5.2 Captive Carriage Loads (Air to Ground)
 - 3.5.3 Store Unique Loads
 - 3.6 Store Stiffness
 - 3.7 Loading Considerations
 - 3.7.1 Loading to Aircraft
 - 3.7.2 Off-loading from Aircraft
 - 3.8 Additional Mechanical Interface Considerations

Figure 6 - CICD format structure for Volume 1, Section 3

3.3.1.4 Volume 1, Section 4 Electrical Interface

This section shall define all ICD relevant electrical, electromagnetic, and optical signals that are contained in the interface between the aircraft and the store. If possible, reference to existing standards and definitions shall be given to avoid multiple specifications. The layout of this section specifies the connection first (i.e., connector description including the umbilical, connector layout and contact assignment) and is followed by a general description of the signals separated between power signals, analogue signals, digital signals and signal lines. Further, the signal description comprises a section to specify the single pin. The employment of this structure is due to the fact that the signal type description is more common and may affect multiple connections (i.e., redundant signal lines such as multiples data bus connections). Deviations may be explained in the pin descriptive part. Figure 7 provides an outline of this section.

- | | |
|-------|--|
| 4. | Electrical Interface |
| 4.1 | General |
| 4.2 | Interface Connection |
| 4.2.1 | Connector Description |
| 4.2.2 | Contact Assignment and Contact Description |
| 4.3 | Contact Types |
| 4.3.1 | Power Lines |
| 4.3.2 | State Signals |
| 4.3.3 | Information Signals |

Figure 7 - CICD format structure for Volume 1, Section 4

3.3.1.5 Volume 1, Section 5 Aerodynamics Interface

This section shall define all aerodynamic aspects of captive carriage, release/jettison, and post launch maneuvers in the vicinity of the aircraft. Figure 8 provides an outline of this section.

- | | |
|-------|--------------------------------------|
| 5. | Aerodynamics Interface |
| 5.1 | Configuration |
| 5.2 | Drag Data |
| 5.2.1 | Drag Characteristics |
| 5.2.2 | Altitude Dependency |
| 5.2.3 | Incidence Angle Dependency |
| 5.3 | Flutter |
| 5.4 | Ballistic Data |
| 5.5 | Store Post Launch Separation Control |
| 5.6 | Engagement Envelopes |
| 5.6.1 | Carriage Envelope |
| 5.6.2 | Release Envelope |
| 5.6.3 | Jettison Envelope |

Figure 8 - CICD format structure for Volume 1, Section 5

3.3.1.6 Volume 1, Section 6 System Safety

This section shall specify all safety issues for ground operations of the store, captive carriage, release/jettison, and post launch. The section is split in subsections to deal with mission phases such as ground operation related safety, captive flight or safe separation safety. Figure 9 provides an outline of this section.

6.	System Safety
6.1	Ground Safety
6.1.1	Dangerous Components
6.1.2	Ammunition
6.1.3	Compressed Air
6.1.4	Chemical Substances
6.1.5	Anti-Corrosive Coatings
6.1.6	Batteries
6.1.7	Electrical Installations
6.1.8	Electromagnetic Radiation
6.1.9	Dangerous Areas
6.1.10	Fire Fighting
6.1.11	Hangfire
6.2	Captive Flight Safety
6.2.1	Hangfire during Captive Flight
6.3	Launch/ Release/ Jettison Safety
6.4	Hazards of Electro-Magnetic Radiation to Ordnance (HERO)
6.5	Personnel Safety

Figure 9 - CIGD format structure for Volume 1, Section 6

3.3.1.7 Volume 1, Section 7 Environmental Considerations

This section shall address interface relevant influences caused by environmental impact.

Environmental requirements evolve during the store development and integration with the host platforms. This section of the ICD will evolve during this process. It starts out defining the environmental conditions specified for the store and/or aircraft standalone and eventually evolves to the definition for the store/aircraft combination. At the conclusion of the integration program it shall define the environmental conditions the aircraft and store can withstand (either combined in one section or as the store design environments in the core and the specific aircraft/store combination in the aircraft annexes). In addition, the level of definition is predefined as follows to cope with the severity of the environmental influence for the aircraft/store combination:

- remain safe in a specific environment, means that the system will not endanger personnel, aircraft or store when exposed to the specified environment, or subsequently during any handling and disposal. The system is not required to operate either during or after exposure to the environment,
- operate means that the system will survive exposure to, and function correctly within its performance limits during exposure to the specified environment, and
- survive a specific environment means that the store/aircraft combination in addition to staying safe throughout and following exposure to the environment, will subsequently be capable of operating satisfactorily within its performance limits after exposure to the environment.

Figure 10 provides an outline of this section.

- 7. Environmental Interface
 - 7.1 Introduction
 - 7.2 Environmental Condition
 - 7.2.1 General
 - 7.2.2 Altitude and Ambient Pressure
 - 7.2.3 Dynamic Pressure Change
 - 7.2.4 Temperatures
 - 7.2.5 Humidity
 - 7.2.6 Solar Radiation
 - 7.2.7 Fungus Resistance
 - 7.2.8 Salt Fog
 - 7.2.9 Rain - Rain Erosion
 - 7.2.10 Hail
 - 7.2.11 Drip
 - 7.2.12 Sand and Dust
 - 7.2.13 Icing/ Freezing Rain
 - 7.2.14 Climatic Zones
 - 7.2.15 Vibration
 - 7.2.16 Gunfire Vibration
 - 7.2.17 Mechanical Shock
 - 7.2.18 Acoustic Noise
 - 7.2.19 Linear Acceleration
 - 7.2.20 Angular Motion, Acceleration and Angular Rates
 - 7.2.21 Radiation (nuclear)
 - 7.2.22 X-Ray Emissions
 - 7.2.23 Explosive Atmosphere
 - 7.2.24 Contamination
 - 7.2.25 Bio and Chemical Hardening
 - 7.2.26 TEMPEST
 - 7.2.27 NEMP
 - 7.3 Electromagnetic Environmental Effects (E³)
 - 7.3.1 Conducted Emissions, Power Lines
 - 7.3.2 Conducted Emissions, Control and Signal Lines
 - 7.3.3 Exported Spikes and Transients
 - 7.3.4 Radiated Emissions, Electric Field
 - 7.3.5 Conducted Susceptibilities, Power Leads
 - 7.3.6 Bulk Current Injection Test
 - 7.3.7 Imported Spikes and Transients
 - 7.3.8 Radiated Susceptibility, Magnetic Induction Field
 - 7.3.9 Radiated Susceptibility, Electric Field
 - 7.3.10 DC Magnetic Field Environment
 - 7.3.11 Compass Safe Distance
 - 7.3.12 EMP
 - 7.3.13 Conducted Emissions, Antenna Terminal
 - 7.3.14 Spurious and Harmonic Emissions
 - 7.3.15 Inter-Modulation
 - 7.3.16 Rejection of Unwanted Signals
 - 7.3.17 Cross-Modulation
 - 7.3.18 Electrostatic discharge
 - 7.3.19 Lightning Protection
 - 7.4 Store Life Constraints

Figure 10 - CICD format structure for Volume 1, Section 7

3.3.1.8 Volume 1, Section 8 Store/Aircraft Interface Specific

All interface relevant issues which have not been allocated to a specific section shall be defined within this section (e.g., cooling, signatures plume, etc). If due to security reasons all or part of the information is classified, a reference to where the classified information can be found shall be given. Figure 11 provides an outline of this section.

- 8. Store/ Aircraft Interface Specific
 - 8.1 Cooling
 - 8.1.1 Cooling line connection
 - 8.1.2 Cooling Medium and Constituents
 - 8.1.3 Pressure
 - 8.1.4 Flow Rate
 - 8.1.5 Duration of Supply
 - 8.2 Plume Data
 - 8.2.1 Propellant and Plume Composition
 - 8.3 Signatures and Emissions
 - 8.4 Air Fuel Transmissions

Figure 11 - CICD format structure for Volume 1, Section 8

3.3.1.9 Volume 1, Section 9 Store/Aircraft Post-Launch (Data-Link) Interfaces

This section specifies the post launch interface used to guide the store to its destination, update store information or simply to communicate with the store for data evaluation, sensor data retrieval, etc. While this section shall address the electrical part of the post launch communication, the logical description shall be part of the functional section of Volume 2 and the signal content structure shall be described in Volume 2, Section 5. Figure 12 provides an outline of this section.

- 9. Post-Launch Interface
 - 9.1 Overall System Architecture
 - 9.2 Interface Description
 - 9.3 Non-Radiating Post-Launch Communications
 - 9.3.1 Introduction
 - 9.3.2 Overall System Architecture

Figure 12 - CICD format structure for Volume 1, Section 9

3.3.1.10 Volume 1, Section 10 Support Interface

This section shall cover aspects with respect to the testing and ground handling of the store. For example, it would address flight test specific interfaces, such as precautions for handling of flight test instrumentation (specific connection, etc.) or ground operation issues such as ground equipment (STE) considerations. Figure 13 provides an outline of this section.

- 10. Support Interface
 - 10.1 Store and Aircraft Testing
 - 10.1.1 Store Pre-load Testing
 - 10.1.2 Aircraft Testing
 - 10.1.3 Store Testing on the Aircraft
 - 10.2 Loading and Handling
 - 10.2.1 Aircraft Store Loading Provisions
 - 10.2.2 Handling of the Store

Figure 13 - CICD format structure for Volume 1, Section 10

3.3.2 Volume 2 Overview

Volume 2 covers mostly software aspects of the interface such as the functional requirements, logical signal sheets, timelines and sequences. The heading level 1 structure for Volume 2 is shown in Figure 14. Examples for each paragraph of the Volume 2 templates are provided in Appendix B.

- | | |
|----|-------------------------------------|
| 1. | Introduction |
| 2. | Applicable Documents |
| 3. | Functional Interface |
| 4. | Communication Interface |
| 5. | Post Launch Communication Interface |
| 6. | Signal Format Sheets |
| 7. | Post-Launch Signal Format Sheets |

Figure 14 - CICD format structure Volume 2, level 1

3.3.2.1 Volume 2, Section 1 Introduction

This section shall cover the introduction to the Volume 2 of the ICD. An overview of the volume content and detailed information concerning updates shall be given. The use of terms within the ICD shall be defined. Figure 15 provides an outline of this section.

- | | |
|-------|----------------------|
| 1. | Introduction |
| 1.1 | Scope |
| 1.2 | Updating |
| 1.2.1 | Information Accuracy |
| 1.2.2 | Definition of Terms |
| 1.3 | General Description |

Figure 15 - CICD format structure for Volume 2, Section 1

3.3.2.2 Volume 2, Section 2 Applicable Documents

The section lists the used and considered documents relevant for Volume 2 of the ICD and defines the order of precedence if any. Figure 16 provides an outline of this section.

- | | |
|-------|----------------------------|
| 2. | Applicable Documents |
| 2.1 | General |
| 2.2 | Specifications |
| 2.3 | Standards |
| 2.3.1 | Military Standards |
| 2.3.2 | Civilian Standards |
| 2.4 | Project Specific Documents |
| 2.5 | Other Documents |
| 2.6 | Precedence |

Figure 16 - CICD format structure for Volume 2, Section 2

3.3.2.3 Volume 2, Section 3 Functional Interface

The functional interface is the core of Volume 2. The operation of a store as a system of systems shall be described in conjunction with the aircraft operation. Co-ordinate systems and parameter definition is included. Relevant system states and modes shall be specified and coarse and detailed timelines are defined. An example to represent timelines is provided. In principle the functional requirements for each bit specified in the signal format sheets, unless defined elsewhere, shall be described in the functional section. Figure 17 provides an outline of this section.

As in Volume 1, a specific section is defined for a flight test or integration phase provisions has been included.

A further detailed structure is proposed with examples in Appendix B, which highlights the different points of view—from aircraft and store—for a specific function.

- | | |
|-------|--|
| 3. | Functional Interface |
| 3.1 | General |
| 3.2 | Basic Mission Data and Definitions |
| 3.2.1 | Mission Data Overview |
| 3.2.2 | Axis Systems and Parameter Definitions |
| 3.3 | States and/or Modes of Operation |
| 3.4 | Sequence of Events |
| 3.5 | Event Description |

Figure 17 - CIGD format structure for Volume 2, Section 3

3.3.2.4 Volume 2, Section 4 Communication Interface

The communication interface section shall specify the implemented protocols, restrictions to standard protocols and optional capabilities of a protocol that are used. Important parts of standards shall be referenced and deviations shall be specified. Formal message representation, word and bit content and sequencing, etc., shall be defined.

The subsection “Operational Flight Programming” shall be used to address, for example, OFP programming issues of a store. Figure 18 provides an outline of this section.

- | | |
|-------|---|
| 4. | Communication Interface |
| 4.1 | Introduction |
| 4.2 | Protocol Options Implemented |
| 4.3 | Data Structure and Sequence |
| 4.4 | Operational Flight Program |
| 4.4.1 | Scope of Possible Store Program Changes |
| 4.4.2 | Interface Operation for Store Programming by the Platform |

Figure 18 - CIGD format structure for Volume 2, Section 4

3.3.2.5 Volume 2, Section 5 Post Launch Communication Interface

The post-launch communication interface section shall specify the implemented protocols and any restrictions or optional capabilities used. Important parts of standards shall be referenced, and any deviations shall be specified. Formal message representation, word and bit content and sequencing, etc., shall be defined. To get a more holistic view of all aspects of the post launch interface, Section 9 of Volume 1 and Sections 3 and 5 of Volume 2 have to be considered together. Figure 19 provides an outline of this section.

- | | |
|-----|-------------------------------------|
| 5. | Post Launch Communication Interface |
| 5.1 | Introduction |
| 5.2 | Post-Launch Link Interface |

Figure 19 - CIGD format structure for Volume 2, Section 5



3.3.2.6 Volume 2, Section 6 Information Format Sheets

This section contains the signal format sheets for the onboard interface. Figure 20 provides an outline of this section.

6. Information Format Sheets

Figure 20 - CICD format structure for Volume 2, Section 6

3.3.2.7 Volume 2, Section 7 Post-Launch Information Format Sheets

This section contains the signal format sheets for the post-launch interface. Figure 21 provides an outline of this section.

7. Post-Launch Information Format Sheets

Figure 21 - CICD format structure for Volume 2, Section 7

3.4 Rules for the Interface Control Document Generation Using this Format

3.4.1 Introduction

The Aircraft/Store Common Interface Control Document Format structure can be tailored to the project's needs. This means that for simple ICDs where a two-volume approach may not be necessary, the document could be covered with a single volume that maintains the defined section structure. The same applies for the decision whether a single two volume document should cover all store variants used during integration and test (including the operational stores) or whether separate documents will be required.

3.4.2 General

As of the release date of this Aerospace Standard, this Aircraft/Store Common Interface Control Document Format standard can be regarded as complete. To provide some growth, and to cover future developments, the writer of an Interface Control Document using this format shall establish all sections down to the third heading level (example: 2.1.2) as defined herein. It is anticipated that the top-level structure will rarely change. Although the standard format in Appendices A and B have sections below the third level, the structure below heading level 3 can be regarded as an example.

If explicitly outlined in the text of Appendix A or B or identified through a colored headline, even a higher-level structure (above heading level 4) may be regarded as an example. The higher-level example (above level 4) is required in areas, where this particular part of an Interface Control Document is still evolving or the structure is at the authors' discretion.

In contradiction to a higher-level example, a lower level structure (below heading level 3) may be required when the substructure is regarded mandatory for the Aircraft/Store Common Interface Control Document Format layout.

An interface control process (ICP) is established to define the rules for changing or updating the interface control document, including the maintenance of the correct relationship between the contents of Volume 1 and Volume 2. It is essential that each volume identify explicitly the related issue status of the other volume.

Commonly, the release of a new issue occurs more often in the early phases of an interface design when frequent changes require a new release. When the design is mature, interface changes can be distributed between new issues and a new release is only required after some major changes have been identified and when the project is close to completion.

3.4.3 Design and Layout Rules

Where the interface control document is used to define interface requirements, the requirements for the store or platform shall be uniquely identifiable throughout the ICD. Table 1 provides a suggested tracking identifier that should be followed by sequential numbering of the requirement type. To facilitate identification and to enable traceability, a table containing all requirements should be generated.

Table 1 - Tracking identifiers

First character – Interface Element Affected	Second character – Requirement Type
a – Aircraft	s – Shall
c – Carriage Store	m – May
s – Store	t – Must
l – Launcher	d – Should
Examples: {as-001} would be aircraft shall number 1, {lt-005} would be launcher must number 5.	

Figures and tables shall be numbered. The figure and table numbering shall be consecutive throughout the main document. Figure and table titles in each appendix shall include the corresponding appendix letter, and the consecutive numbering will restart at 1 in each appendix, e.g., "Figure 3 - Figure title" (Figure 3 of main document) or "Table A2 - Table title" (Table 2 of Appendix A). Only figures and tables in the main document shall be listed in the table of contents. Each table or figure shall be mentioned in the text. The position of a figure in the text is at the authors' discretion, i.e., either interspersed with the text or at the end of a section or subsection. The examples in Appendixes A and B cover both possibilities.

A table of contents shall be generated for each volume.

An abbreviations list shall be generated. A definition of symbols or a glossary is optional.

The applicable documents shall be listed by title and alphanumeric descriptor. References to these documents in the content of the ICD shall be by the descriptor rather than the document title

3.4.4 Use of the Formats in Appendix A and B

As required above, the interface control document author is required to keep the structure down to level 3. Exceptions are possible due to tailoring or a single volume approach. However, to comply with the Aircraft/Store Common Interface Control Document Format standard, the parts of the sections in the Appendixes A and B that are not marked as described below are required.

The beginning of an example in Appendixes A and B are marked and identified with the line: "----- Begin Example", and end with "----- End Example" in Arial 10pt in blue color. The example itself is also written in Arial 10pt in blue color.

Whenever possible, metric units shall be used.

3.4.5 Classified Information

An ICD may contain classified information. The author has three approaches, first classify the whole ICD, and second refer to the classified material in a reference document, and third place the classified material in a separate annex to the ICD. The approach selected will depend upon the proportion of classified material, level of classification and national security policies

4. NOTES

4.1 Revision Indicator

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.

4.2 Intended Use

The Aircraft/Store Common Interface Control Document Format standard is intended to be used for airborne military applications for aircraft to store integration. ICDs written in compliance with this standard may define requirements for aircraft, stores, carriage stores, or dispensers, in any combination of legacy and new products. The term “aircraft” includes both manned and autonomous systems.

4.2.1 Implementation

Implementation and application of the standard is the responsibility of each military service, with technical guidance and direction provided by appropriate service program offices.

4.3 Tailoring Guidance

This Aircraft/Store Common Interface Control Document Format standard defines a format for an Interface Control Document between stores and platforms/aircraft. This can be regarded as a first step towards a Common Interface for future plug and play weapons. To back this effort, tailoring of the Aircraft/Store Common Interface Control Document Format should be kept to a minimum. However, to facilitate the acceptance of the format, tailoring may be accepted in areas such as the incorporation of test assets and a single volume approach for simple interfaces.

PREPARED BY SAE SUBCOMMITTEE AS-1B, AIRCRAFT STORE INTEGRATION OF
COMMITTEE AS-1, AIRCRAFT SYSTEMS AND SYSTEMS INTEGRATION

APPENDIX A - VOLUME 1 - MECHANICAL/ELECTRICAL/PHYSICAL INTERFACE CONTROL DOCUMENT TEMPLATE

1. INTRODUCTION

The introduction of the CICD shall give an overview of the document. Scope, updating rules, used terms, and a general description. The whole ICD comprises 2 Volumes; Volume 1 contains the more stable parts of the integration process while this volume covers the logical and functional interface, which changes more often in the course of an integration. The introduction can be regarded as unique for both volumes, or, like in this example, for each volume separately. The introduction of the CICD Volume 1 shall clearly define the subject interface, with a description or illustration of how related interfaces are being managed.

----- Begin Example

This Interface Control Document (ICD) has been developed to support interface definition for host aircraft integration of weapon xyz. This includes the support of the definition of required hardware and software updates to the aircraft, as well as to support the requirements development process for the weapon xyz development.

----- End Example

1.1 Scope

The purpose of this volume shall be addressed with a short description of the affected interface. An overview of the content of the following sections shall be given.

----- Begin Example

Store X is installed on the aircraft by being fitted to launcher Z that is fitted to the wing pylon of aircraft Y. The interface controlled by this document is the interface between store X and launcher Z.

The interface between the aircraft and launcher Z is controlled by a separate ICD, document reference ABC.

Volume 1 contains the following sections:

Section 1 establishes the document scope and provides background information for the document user.

Section 2 identifies the applicable documents that are referred to in the ICD. It establishes the order of precedence of the applicable documents and identifies the version and requisite tailoring of the documents applicable to this ICD.

Section 3 addresses the mechanical interface between the weapon xyz and the host aircraft abc.

Section 4 addresses the electrical interface between the weapon xyz and the host aircraft abc.

Section 5 contains requirements for the aerodynamics interface like considered aircraft configurations, drag data, etc.

Section 6 addresses safety issues relevant to the interface.

Section 7 lists environmental conditions and marginal conditions to be considered. This section includes also Electromagnetic Environmental Effects requirements and store life constraints.

Section 8 specifies all other interface considerations, like required cooling aids, plume data, signatures, and air fuel transmissions if any.

Section 9 comprises the hardware relevant requirements for a post launch interface.

Section 10 applies to support measure like testing of the store on and off the aircraft and any handling issues not covered, e.g., in the mechanical section.

----- End Example

1.2 Updating

This section is used to document the update procedures of this volume, e.g., applied change procedures, or the section shall be used to establish the change process.

----- Begin Example

The ICD shall be updated on the design responsible authority's discretion. The information about and the reception of any updates are under the responsibility of the user. The update procedure shall be control by the established Interface Control Process (ICP) as defined in document xyz.

----- End Example

1.2.1 Information Accuracy

This section records information concerning handling of values during the generation process of the ICD, e.g., marking of currently unconfirmed values, uncertain statements or uncertain definitions.

----- Begin Example

Throughout this document and unless otherwise stated, when a value is quoted which is still unconfirmed, a 'TBC' rating follows the quoted value.

A star rating as follows grades this TBC rating system:

TBC* detailed calculations but not yet finalized
TBC** simple calculations and/or previous experience
TBC***best estimate

----- End Example

1.2.2 Definition of Terms

This section records the rules to specify use of wording in the document like "may", "shall", etc.

----- Begin Example

1.2.2.1 Utilization of Common Terms

The word "shall" in the text expresses a mandatory requirement of the specification. Departure from such a requirement is not permissible without formal agreement between customer and the aircraft company.

The word "should" in the text expresses a recommendation or advice on implementing a requirement of the specification. The customer expects such recommendation or advice to be followed unless good reasons are stated for not doing so.

The word "must" in the text is used for a legislative or regulatory requirement (e.g., health and safety) with which both the customer and the aircraft company shall comply. It is not used to express a requirement of the specification

The word "will" in the text is used for the future tense. It does not express a requirement of the specification.

The word "may" in the text expresses a permissible practice or action. It does not express a requirement of the specification.

Plain text (i.e., text not containing the above key words) is used to state facts and to describe existing capabilities or features. Such text does not express a requirement of the specification.

1.2.2.2 Non-Common Terms

Terms not specified in 1.2.2.1 are of informal nature and are not authoritative.

----- End Example

1.3 General Description

The system controlled by this interface shall be described. Subject to deletion if already covered by 1.1.

----- Begin Example

The weapon 'xyz' is an air-to-air missile comprising of the following sections:

- Seekerhead
- Warhead (replaced by a Telemetry Section for test purposes or a inert warhead for training purposes)
- Propulsion

The aircraft 'abc' is an agile all-weather supersonic strike fighter aircraft. Stores can be carried on external stations equipped with a MIL-STD-1760 interface:

- Center Pylon equipped with 2 heavy duty multi purpose ejection and release units
- Left and right hand shoulder pylons equipped with 2 light duty multi purpose ejection and release units or alternatively 1 heavy duty multi purpose ejection and release unit
- Left and right hand inboard wing pylons equipped with 2 light duty multi purpose ejection and release units or alternatively 1 heavy duty multi purpose ejection and release unit
- Left and right hand outboard wing pylons equipped with 2 light duty multi purpose ejection and release units
- Left and right hand wing tip pylons with specific air-to-air missile S & RE

----- End Example

1.3.1 Installation

This section describes the installation of the store on the aircraft. It details the available positions of the stations specified in 1.3.

----- Begin Example

1.3.1.1 Aircraft Installation

Depends on interface purpose here: aircraft side

1.3.1.2 Store Installation

Depends on interface purpose here: store side

----- End Example

1.3.2 Commonality Considerations

Store commonality means for use of store on different aircraft. Not relevant for aircraft related ICD.

----- Begin Example

The store is to be used on all fighter aircraft equipped with a MIL-STD-1760 interface and all related standards therein.

----- End Example

2. APPLICABLE DOCUMENTS

2.1 General

This section shall give an overview of the content of the applicable documents

----- Begin Example

The following documents, of the exact issue shown, form a part of this document to the extent specified herein. In the event of conflict between the document referenced herein and the contents of this document, see 2.6, Precedence.

----- End Example

2.2 Specifications

Aircraft or store related specifications relevant to the interface shall be listed in this section.

----- Begin Example

- Equipment Specification for launcher interface box xxx-yyy-zzz
- System Specification for integration of weapon xyz SS-123
- System Software Requirement Specification SSRS-123

----- End Example

2.3 Standards

2.3.1 Military Standards

Aircraft or store related military standards relevant to the interface shall be listed in this section.

----- Begin Example

- MIL-STD-1553: 'Aircraft Internal Time Division Command/Response Multiplex Data Bus'
- MIL-STD-1760D: 'Aircraft Store Electrical Interconnection System'
- STANAG 4586 (NATO Standardization Agreement) 'Leading the Way to NATO UAV Systems Interoperability'

----- End Example

2.3.2 Civilian Standards

Aircraft or store related civilian standards relevant to the interface shall be listed in this section.

----- Begin Example

- SAE Aerospace Information Report (AIR) 'AIR5532: Generic Aircraft-Store Interface Framework'
- SAE Aerospace Standard (AS) 'mnop'.

----- End Example

2.4 Project Specific Documents

Project handbooks, project specific and interface relevant technical notes shall be listed here.

----- Begin Example

- MIL-HDBK-1760
- MIL-HDBK-1553

----- End Example

2.5 Other Documents

Supplier Documents, Plans, Configuration Procedures, Drawings

----- Begin Example

- Drawing x
- Drawing y

----- End Example

2.6 Precedence

Defines the sequencing of documents including this ICD and which document controls the others, etc.

----- Begin Example

In the event of conflict between requirements specified in this and referenced documents, the following order of precedence applies:

- Document 1
- Document 2
- Document 3

----- End Example

3. MECHANICAL INTERFACE

3.1 General

Store mechanical interface aspects are dealt with in the following with the aim to standardize the kind of related information as well as the way the information is represented.

As far as is applicable, the aspects of interface are separately considered from Store and Aircraft perspective, in an attempt to differentiate those parameters which are different or commonly needed by the two communities (aircraft design authority and store design authority) to carry out the interface analysis task.

NOTE 1: Any required data has to be inserted in the ICD only if relevant to the store – station interface.

NOTE 2: If a drawing is translated from Imperial to metric or vice-versa, a precautionary note has to be inserted, warning that the drawing has been translated from a different system and this should be taken into proper consideration in any assembly, tolerance or installation analysis.

Conversion methods will be clearly stated.

3.2 Physical Characteristics

3.2.1 Dimensional Envelope

Dimensions will be expressed in mm.

Tolerances (and their applicable unit of measure) will be indicated.

Drawings and pictures should be presented in scales coherent with a representation on “A4” or “US letter” format pages.

Two recommended scales should be adopted: for drawings included in the text: one (i.e., 1/100) for large images, such as aircraft, and another one (i.e., 1/20 or 1/25) for smaller images, such as stores.

Full scale drawings or detailed graphical data can be dealt with as separate documents, which will be referred to in the applicable paragraphs together with suitable instruction in order to allow the exchange/download in electronic format (IGES or STEP formats to be preferred).

Ideally, dimensions provided here should allow:

- The aircraft design authority to create a simplified 3D model of the store itself
- The store design authority to gather the necessary information for a first fit trial analysis (station location, pylon geometry, etc).

Two kinds of dimensions will be provided:

a. Absolute dimensions

Overall dimensions that allows the physical volume containing the store to be drawn.

----- Begin Example

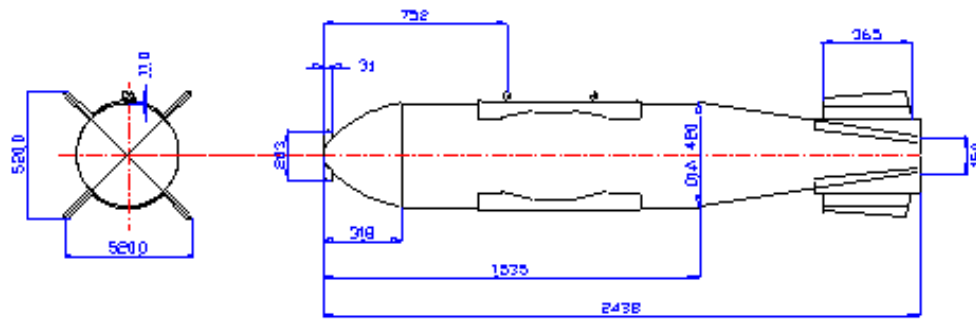


Figure A1 - Absolute store dimensions

----- End Example

b. Relative dimensions

Dimensions that allow the reciprocal positioning of the parts of the store, which are significant from the interface perspective (wings, fins, air intakes, wave guides, etc.) shall be specified.

----- Begin Example

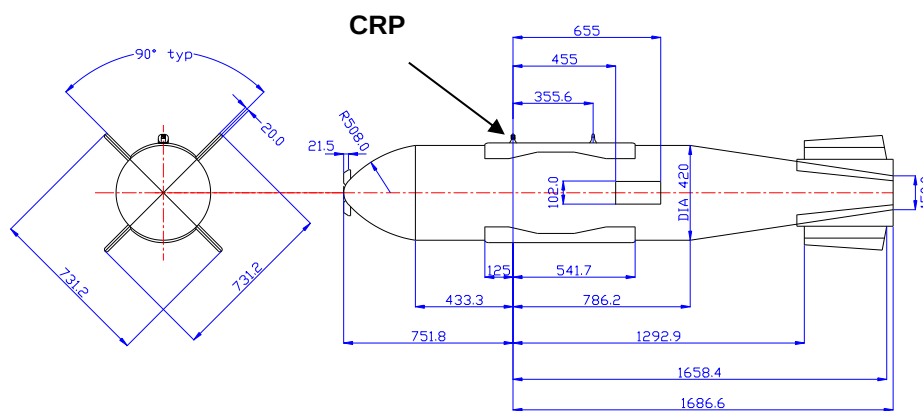


Figure A2 - Relative store dimensions

----- End Example

The *relevant dimensions* will be referred to a common reference point (CRP).

It is proposed to locate the CRP on the forward attachment.

Details of the forward attachment geometry and the relevant position of CRP will be referred to in the paragraph where geometry of attachment elements is given (14 inch lugs, 30 inch lugs, 30 inch bolts, 30 inch T-Lugs, T-Hangers, etc.).

The use of Store or Aircraft Stations (i.e., STA 1245) should be avoided whenever possible in order to avoid the need to perform equivalence computations necessary to translate Store dimensions to Aircraft dimensions and vice versa.

In those cases where the store configurations for installation, carriage, or release present different envelopes, these should be dealt with separately.

(Example: Access panels locally enlarge the installation envelope. Fins deploy or deflect during release. Rollers disengage during launch, etc.).

3.2.2 Mass

Mass unit of measure will be: kg.

Store Side:

Store mass will be provided for each store carriage configuration.

(Example: gun pods/dispensers/tanks empty, fully loaded, and, if deemed relevant, in intermediate loading conditions).

If necessary, variations of mass that could occur as a result of store functions (e.g., running of engines that consume fuel carried within the store), will be defined.

A store mass distribution graph will be provided in cases of significant unevenness in mass distribution.

----- Begin Example

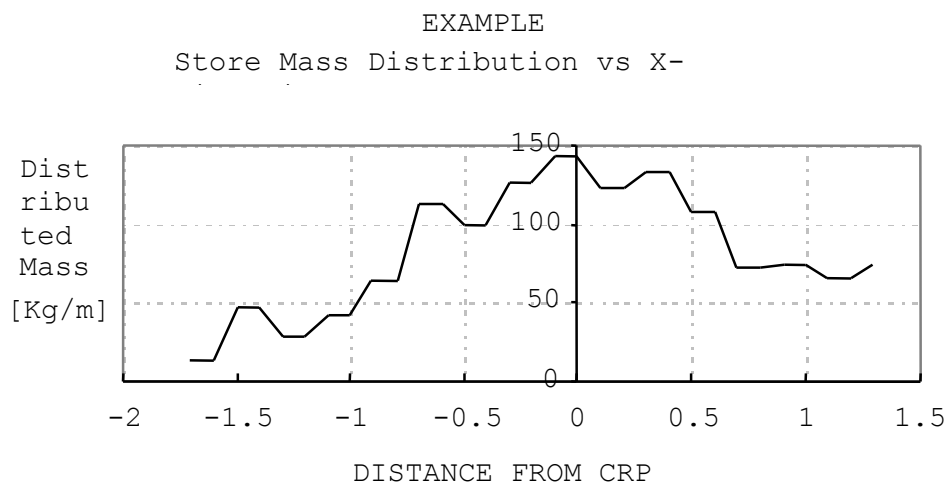


Figure A3 - Store mass distribution graph

----- End Example

Aircraft Side:

If applicable, the carriage mass limitation will be given for each candidate station.

3.2.3 Center of Gravity

It must be ensured that the variations that could occur simply as a measure of the tolerances associated with the agreed mass figures are addressed.

Store Side:

Position of center of gravity will be provided for each carriage configuration and referred to the CRP.

----- Begin Example

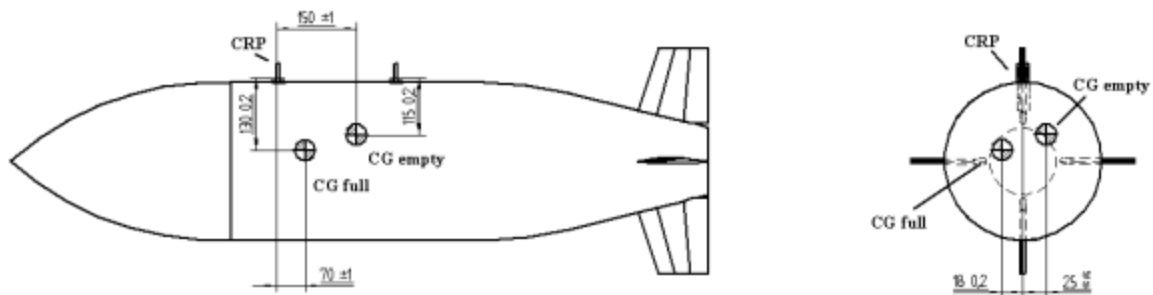


Figure A4 - Center of gravity location

----- End Example

Aircraft Side:

If applicable, the carried store center of gravity limitations will be given for each candidate station and referenced with respect to the CRP.

----- Begin Example

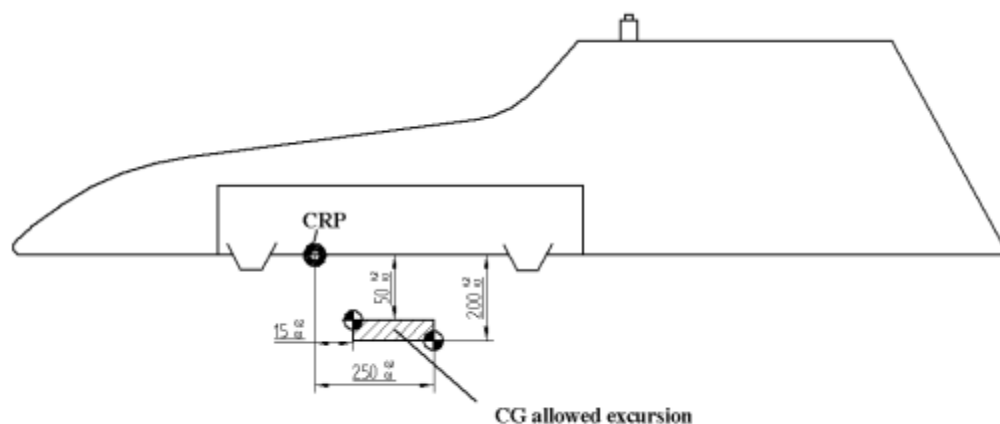


Figure A5 - Center of gravity location

----- End Example

3.2.4 Moments of Inertia

Moments of Inertia will be expressed in: kgm^2 .

It must be ensured that the variations that could occur simply as a measure of the tolerances associated with the agreed mass figures are addressed.

Store Side:

Moments of inertia in pitch, yaw and roll will be provided for each carriage configuration/status/combination.

Aircraft Side:

Either “Not Applicable” or eventual limitations to Moment of Inertia for defined stations will be highlighted.

3.2.5 Natural Frequencies

The natural harmonic frequencies of the system are defined here in.

Store Side:

Relevant store vibration modes shall be provided here.

Aircraft Side:

Relevant Aircraft Vibration modes shall be provided here (for example: number of rotor blades and rotation velocities).

3.3 Suspension Interface

3.3.1 Connector Interfaces

Connector Interface: Umbilical location(s) and clearance(s), e.g., primary and auxiliary interface connections, specific fuzing connectors. Orientation

Store Side:

Location, height above store surface, identification, and orientation of store connectors shall be specified.

Specific mating and de-mating requirements will be detailed (blind or bayonet mating, connection forces, torques, travel, shearing, or tearing forces, etc.)

Care will be given to ensure that all information leading to complete identification of the geometry of the connector and its mating condition are provided.

NOTE: Shielding properties and bonding features of electrical connectors will be covered in the proper paragraph of the electrical interface section.

----- Begin Example

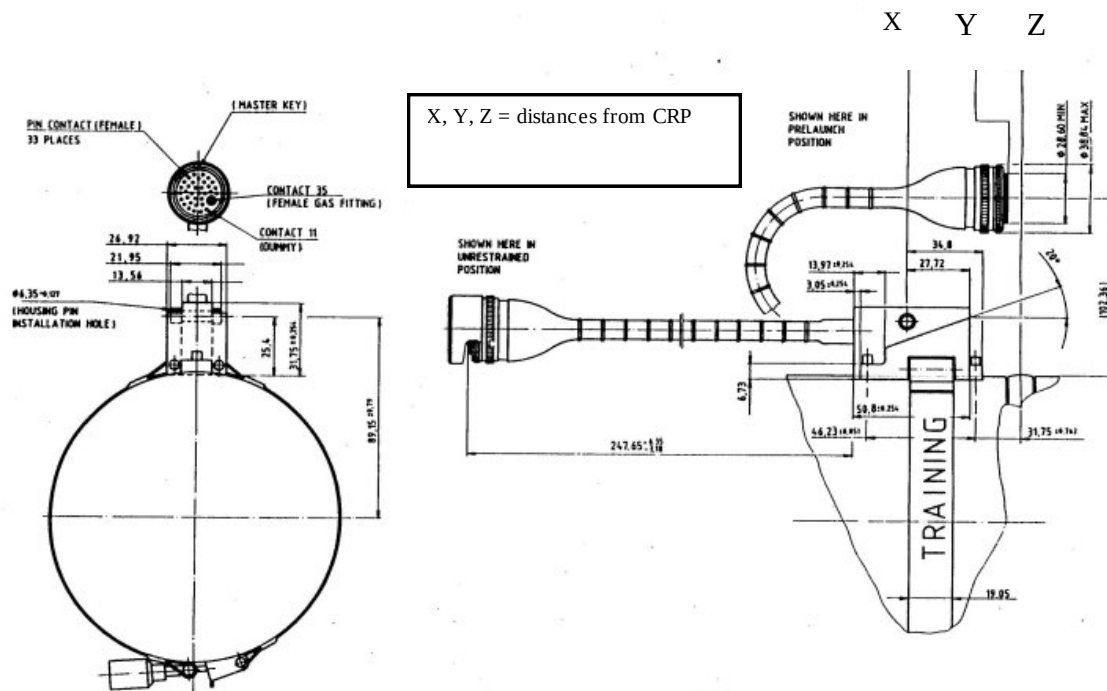


Figure A6 - Store connector interface (store side)

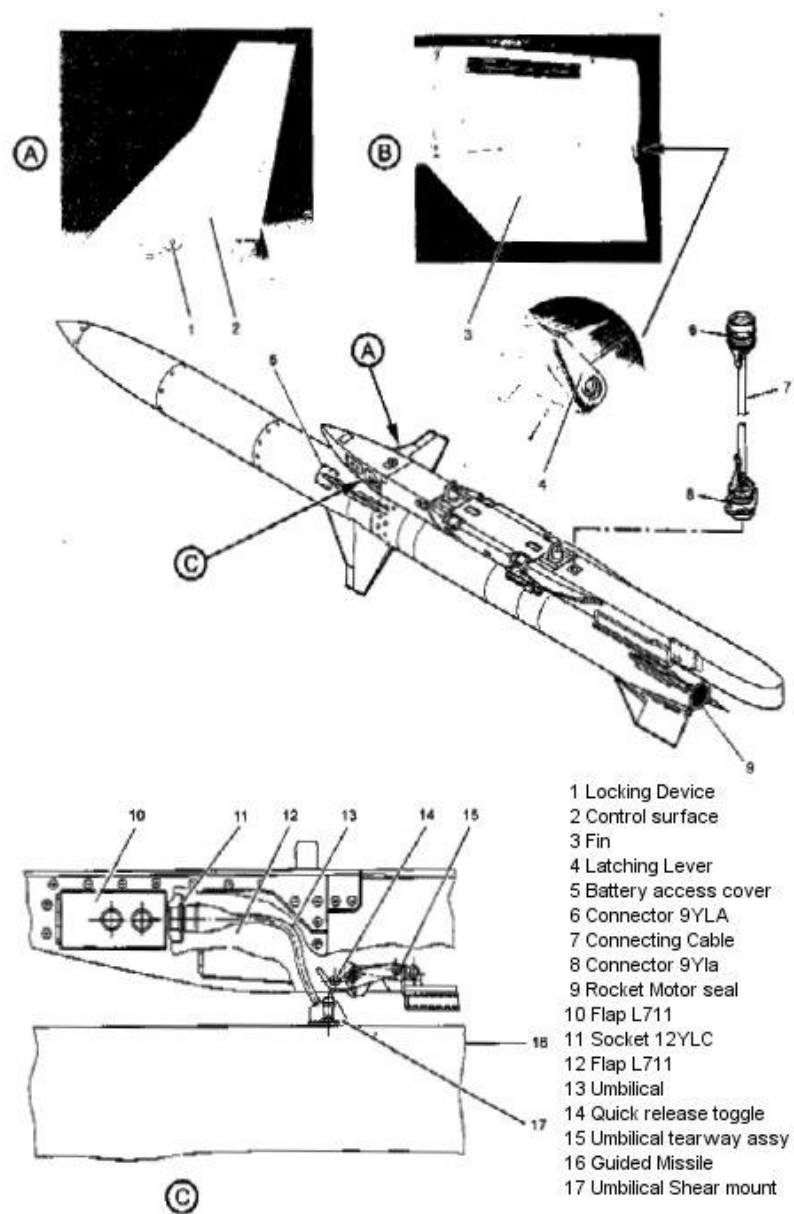


Figure A7 - Store connector interface (store side) (continued)

----- End Example

Aircraft Side:

Location, identification, and orientation of Pylons, stations and S&RRE connectors shall be specified.

Specific mating and de-mating requirements will be detailed (blind or bayonet mating, connection forces, torques, strokes, etc.).

Care will be given to ensure that all information leading to complete identification of the geometry of the connector and its mating condition are provided.

NOTE: Shielding properties and bonding features of electrical connectors will be covered in the proper paragraph of the electrical interface section.

----- Begin Example

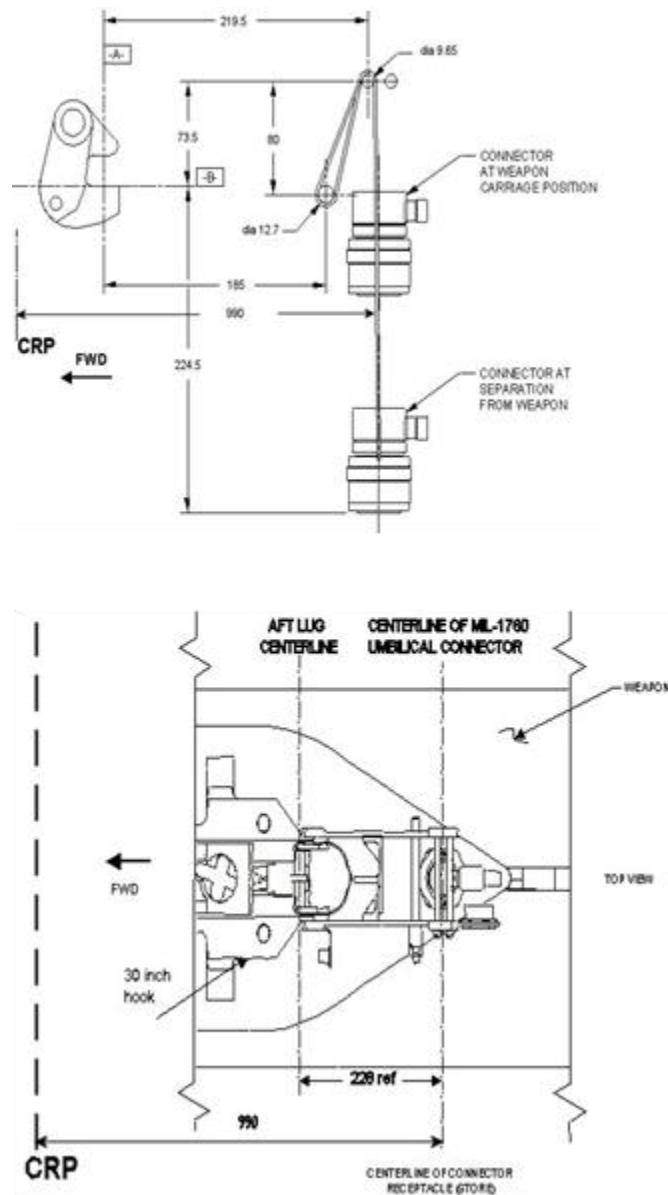


Figure A8 - Store connector interface (A/C side)

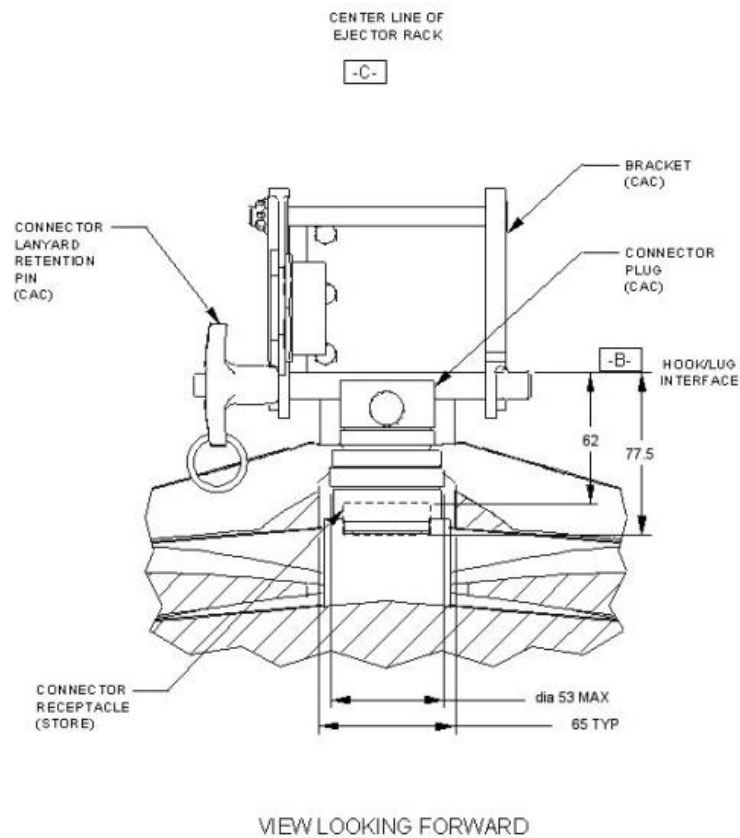


Figure A9 - Store connector interface (A/C side) (continued)

----- End Example

3.3.2 Fuzing and Arming Connections

Store Side:

Number, type, and location of fuzing and arming devices with their operating modes shall be specified.

Mechanical devices (to be connected to Strong Points or arming units)

The information to be provided for each lanyard is:

- Associated store function
- Connection intended for strong points or arming units
- Position (or ranges) of the lanyard (on store side and section view)
- Type of lanyard used
- Recommended (required) lanyard length
- Maximum force that can be exerted on the lanyard without actuation
- Minimum force required for actuation
- Eventual requirement for zero retention force
- Allowable pulling angle

Electrical devices (to be connected to fuzing units)

The information to be provided for each fuzing connector is:

- Associated store function
- Location
- Type of connector
- Recommended (required) cable length
- Allowable pulling angle
- Timing or sequencing requirement (if applicable)

----- Begin Example

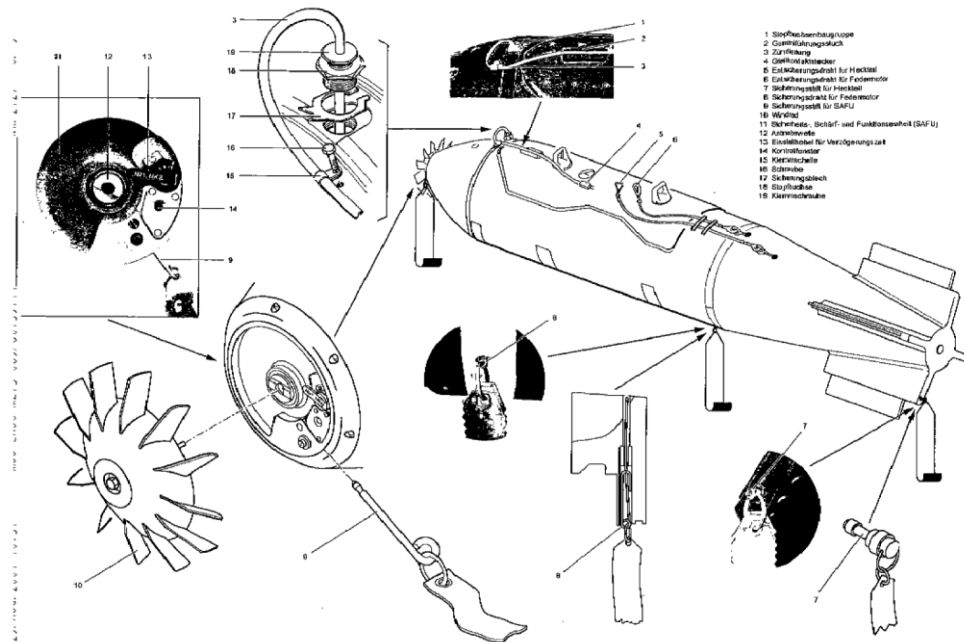


Figure A10 - Fuzing and arming connections (store side)

----- End Example

Aircraft Side:

The following details, addressing only the specific aircraft/store combination, will be provided:

Strong points (unconditional retention of arming lanyards at store release)

- Number and location
- Operating instructions and tools (if needed)
- Type of lanyard accepted
- Maximum retention force
- Eventual limits of operation

Arming Units (conditional retention/release of lanyards at store release)

- Number and location
- Operating instructions and tools (if needed)
- Type of lanyard accepted
- Maximum retaining force when “armed” (eventually zero retention)
- Minimum retaining force when “unarmed”
- Allowable pulling angle
- Eventual limits of operation

Fuzing Units (conditional arming electrical signal supplied after store release)

- Number
- Location
- Type of connector
- Allowable pulling angle
- Timing of disconnection from firing pulse

----- Begin Example

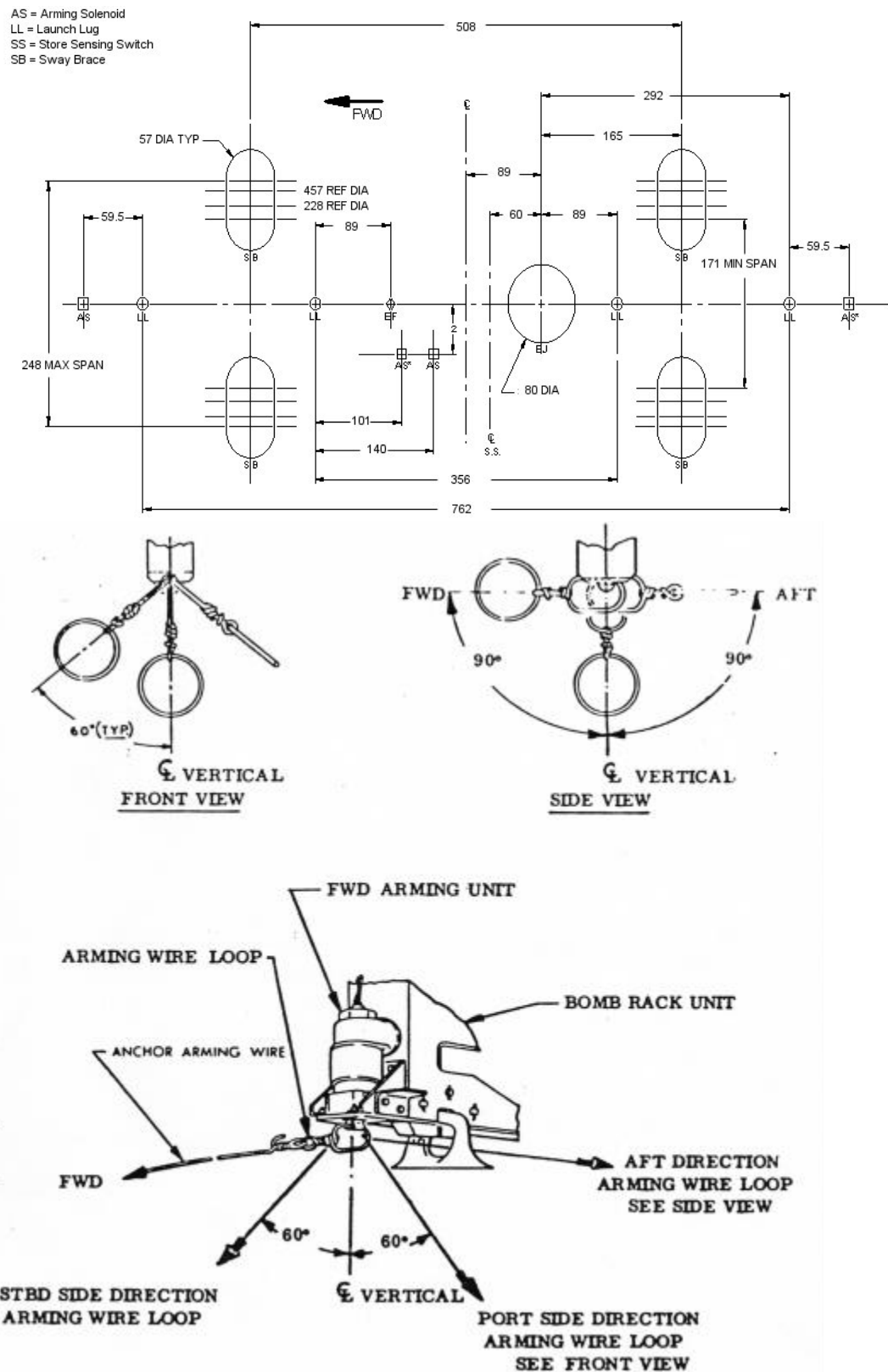


Figure A11 - Fuzing and arming connections (A/C side)

----- End Example

3.3.3 Suspension Details

Store Side:

The store suspension type will be identified and the detail geometry of the attachment points will be provided:

NOTE:

The maximum allowable loads on each attachment point will be provided (single limit loads?).

The maximum allowable and minimum required (where appropriate) crutching/sway bracing/snubbing loads and the associated reinforced allowable area will be provided.

Eventual limitations or precautions to be adopted will be provided.

----- Begin Example

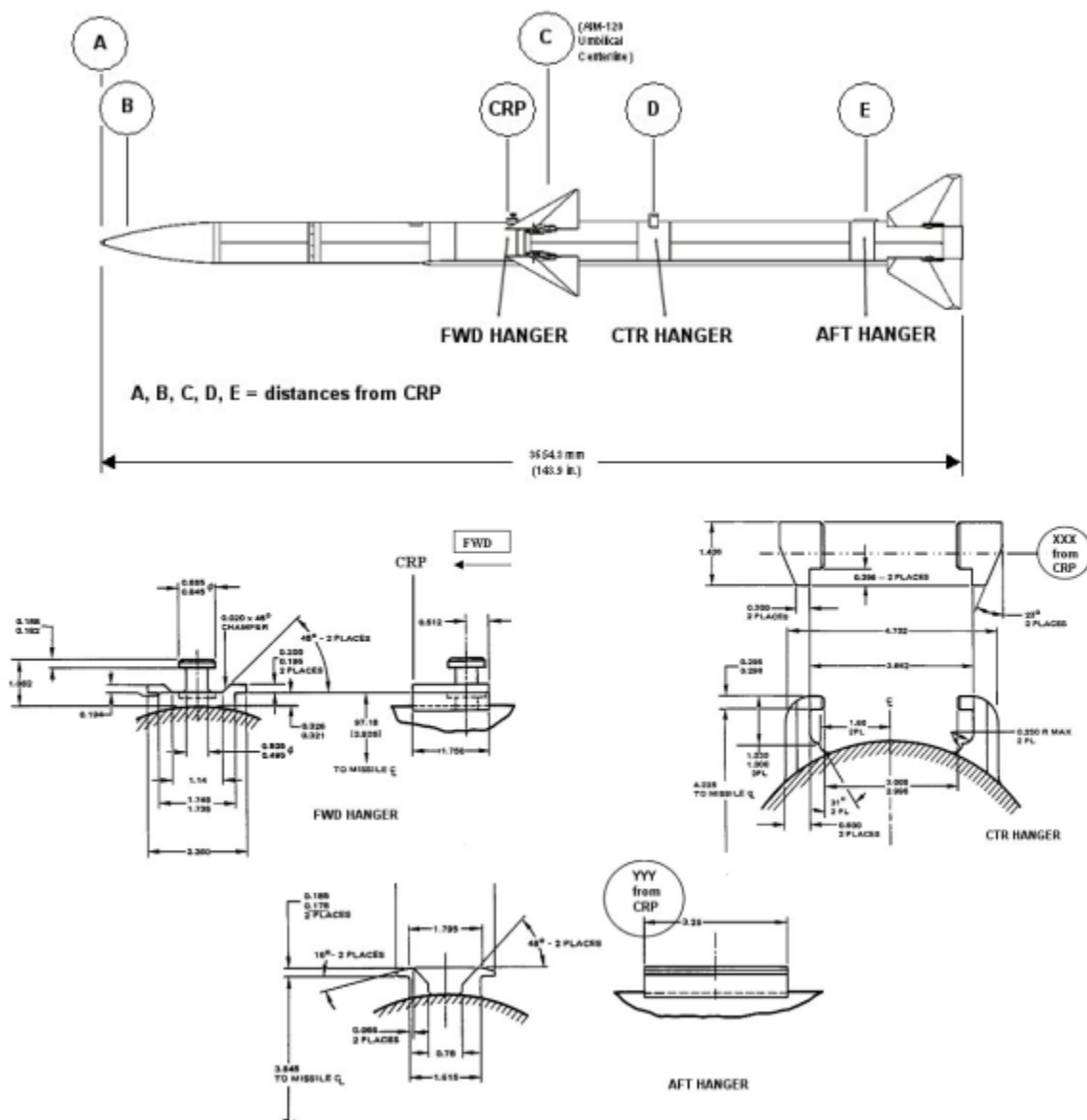


Figure A12 - Graphic detail of store attachment

----- End Example



Documents

Document Sharing Hub

Aircraft Side:

Interface data of the S&RRE installed in the candidate station will be provided.

Geometry of crutching/sway bracing/snubbing elements will be detailed.

----- Begin Example

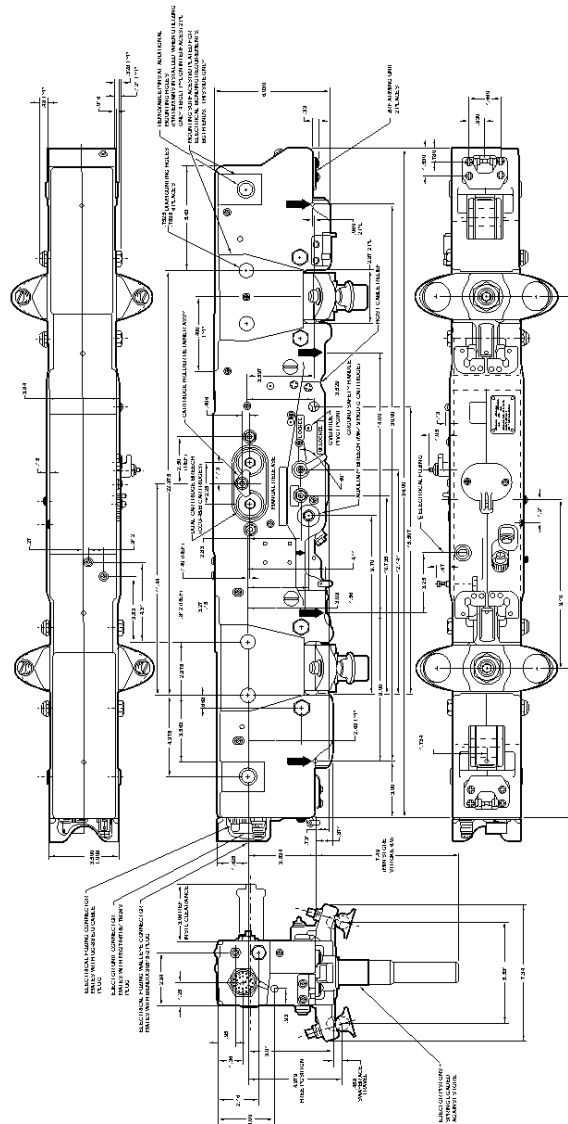


Figure A13 - S&RE interface

----- End Example

3.3.4 Clearances

This information is additional to that given with the store dimensional envelopes.

It is recommended that this data is provided in a separate set of pictures/drawings in order to reduce graphical clutter and to ease the addressing of eventual issues (for example a different loading procedure could be devised in case the standard procedure reveals incompatibilities or conflicts, i.e., rocket launchers to be installed only in loaded conditions as opposite to insert the rockets with the rocket launcher already installed).

Store Side:

The required clearances will be divided into the following sections (where applicable):

Clearances for Store loading

Clearance aspects of store loading devices and space envelopes to be respected during the store uploading will be addressed in this section.

Space needed to operate wrenches, special tools or to carry out mechanical and electrical connections will be specified.

----- Begin Example

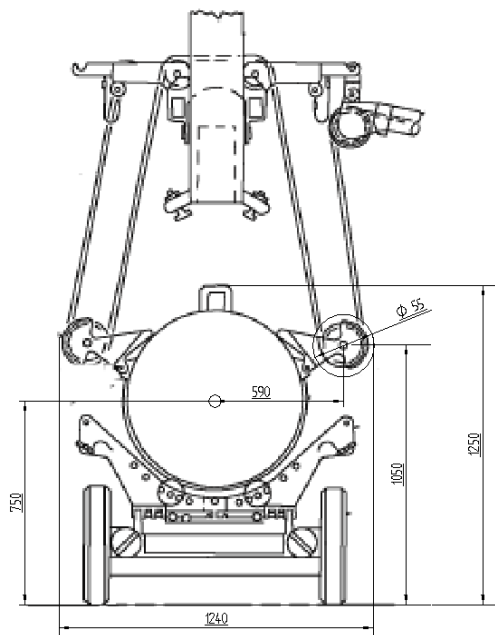


Figure A14 - Clearance envelope for store loading

----- End Example

Clearances for Store preparation/setting before flight

Space needed to operate first line functional check, setting or tuning operations, installation of checking devices, will be specified.

----- Begin Example

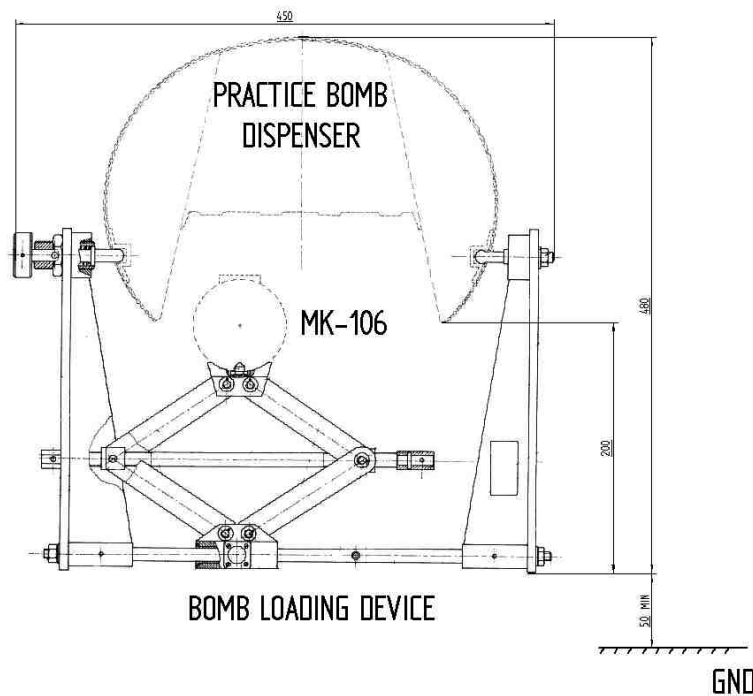


Figure A15 - Clearance envelope for store preparation/setting

----- End Example

Clearances for Store carriage

Space envelopes needed for the safe carriage of the store (if already dealt with in the dimensional envelope paragraph, make a reference).

Clearances for Store release

Space envelopes needed for the safe release of the store. If needed, clearances will be identified for each store condition/status.

----- Begin Example

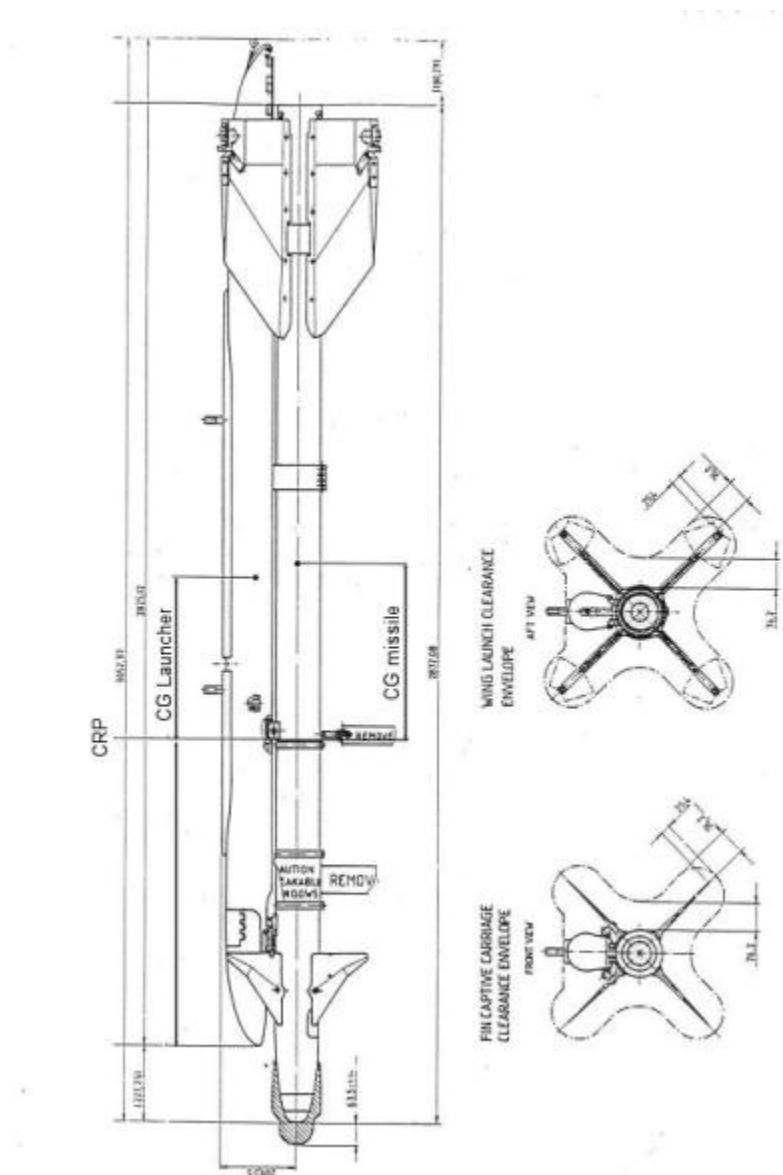


Figure A16 - Store clearances for carriage and release

----- End Example

Aircraft Side:

Minimum allowed clearances versus flaps, slats, ground (worst landing and take-off case) and near pylons, store stations, or aircraft structures in proximity of the installed store will be provided.

This information should allow the identification of the store loading profiles and combinations compatible with the candidate store.

----- Begin Example

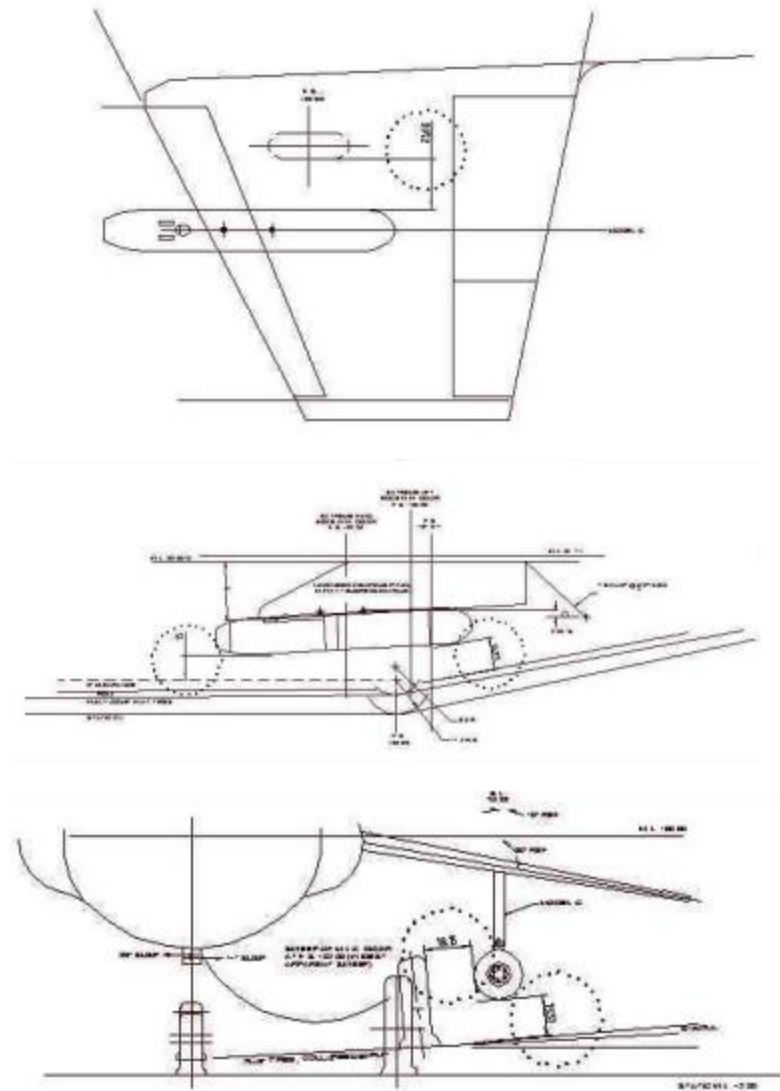


Figure A17 - Store station clearances

----- End Example

3.3.5 S & RE Settings

Store Side:

Not Applicable

Aircraft Side:

Unique items, tools, and operations driven by the specific store will be described in this section (i.e., throttle setting operation, preloading precautions, or specific to type observations as applicable).

3.3.6 Carriage Store Unique Provisions

Three categories of carriage store (CS) can be considered.

- CS which are unique to the aircraft (i.e., LAU-129 and F-16) are to be considered part of the Aircraft interface and dealt with in the relevant aircraft sections
- CS which are unique to the store (i.e., Maverick launcher) are to be considered part of the store interface and dealt with in the relevant store sections
- CS which are specific for a particular aircraft configuration (multiple store carriers) will be dealt with in this section replicating the contents of 3.3.1 to 3.3.5 as applicable.

3.4 Alignment

(Physical characteristics here, functional in Volume 2)

Only static alignment is dealt with in this paragraph.

Dynamic alignment during carriage can be gathered from Section 6 (Air carriage loads) and Store stiffness.

Store Side:

Store requirements for alignment repeatability will be provided (mrad ranges in yaw, pitch, and roll)

Store requirements for mechanical alignment - orientation (if applicable) will be declared.

Store internal alignment adjustment capability (i.e., gun pod) will be declared and the achievable adjustment range provided.

Aircraft Side:

For each station, the store Line (SL) nominal orientation (in degrees) with respect to a defined aircraft reference axis will be provided.

The alignment repeatability of the SL guaranteed by the candidate aircraft suspension will be provided (mrad ranges in yaw pitch and roll).

If available, the SL mechanical alignment adjustments achievable on the candidate station will be identified (ranges in yaw and pitch will be indicated).

If applicable (in case of interface impact) the associated procedure and tools will be described and listed.

3.5 Loads

3.5.1 Separation Loads

Store Side:**Ejected stores**

- Areas where ejection pistons can apply the ejection forces.
- Maximum total and single force that can be exerted by pistons.
- Maximum pressure allowed in the store/pistons contact area.
- Maximum allowable, minimum required store acceleration (if applicable).
- Minimum ejection stroke (if applicable).

Specify whether the store needs to be controlled (roll, pitch, yaw) during ejection.

Rail Launched Stores

- Maximum motor thrust and related time history will be provided.
- Maximum allowed and minimum required retention force before release will be provided (possibly with time history).
- Minimum and maximum detention time at launch (if applicable).
- Number and position of umbilical connectors, typology of the disconnection system (e.g., tear, shear bolts, etc.) and related forces (magnitude and direction) will be provided.
- Required disconnection operations, timing and sequence will be described together with eventual limitations or precautions to be respected.

Aircraft Side:**Ejection Stations**

Ejection pistons spacing, location, and store contact area will be provided.

Ejection stroke will be provided.

Store constraining capability during ejection to be declared.

Type and number of cartridges used (if applicable) and available set of throttle settings.

NOTE: It is proposed to adopt a common throttle setting definition (i.e., percentage of the total thrust available at each piston).

Maximum forces exerted by the pistons (at maximum temperature) and the minimum End Of Stroke (EOS) velocities (at minimum temperature).

Eventual angular EOS velocity to be declared.

Rail launch stations

- Number and position of snubbing devices.
- Number and position of forward and rearward locking systems.
- Minimum and maximum longitudinal force needed to open the latching system.
- Maximum restrain force in the rearward direction.
- Maximum force exerted by each snubbing unit.

For the candidate store, retention forces (and relevant duration) during launch as well as during lock shut firings will be provided.

Guidelines:

Minimum retention force is dictated by safe separation criteria, being associated with min end of rail relative speed.

Maximum retention force is related to lock shut firings and it is to be compared with the max motor thrust of the candidate missile.

Maximum retention time influences missile performance/endurance.

NOTE: In the case where the contribution to the overall retention force, due to elements other than the Detent Mechanism (snubbers, shear screws), is not negligible (more than 10 to 15%), the split of the overall force among the retention elements will be provided.

3.5.2 Captive Carriage Loads (Air and Ground)

Store Side:

This records the store information needed by the aircraft design authority to determine the loads induced by the store inertia and aerodynamic properties into the aircraft (candidate carriage station).

The aerodynamic coefficients (C_x , C_y , and C_z) of the store free stream shall be provided as a function of the angle of attack and sideslip.

NOTE: Store inertia data has already been provided in the relevant section.

Aircraft Side:

These records the aircraft (candidate carriage station) information needed by the store design authority to determine the loads induced on the store by the aircraft motion.

The candidate station inertial carriage loads envelope will be provided with a $n_z - n_y$ graphic and the range of rotational accelerations will be provided.

To allow evaluation of aerodynamic loads, a graphic of dynamic pressure versus angle of attack and dynamic pressure versus angle of sideslip will be provided.

Identification and location of the selected loads reference point (if different than CRP) will be provided.

Minimum and maximum preload forces exchanged between the suspension station and the store will be defined and provided.

Special load conditions (crash landing, aircraft carrier landing, barrier engagement, catapulting, etc) will be separately defined.

3.5.3 Store Unique Loads

Forces, which are transferred from store to aircraft as a result of the store specific function, and not associated with carriage or release (gun pods, rocket launchers, towed decoys, etc.) will be identified and detailed in this section.

3.6 Store Stiffness

Store stiffness data shall be provided in terms of distribution along the longitudinal (X) axis of EJ (the product of the modulus of elasticity by the moment of inertia of the section) for the two flexional bending modes and of GJ_{polar} (the product of the shear modulus by the polar moment of inertia of the section) for the torsional mode.

EI and GJ_{polar} will be expressed in Nm^2

----- Begin Example

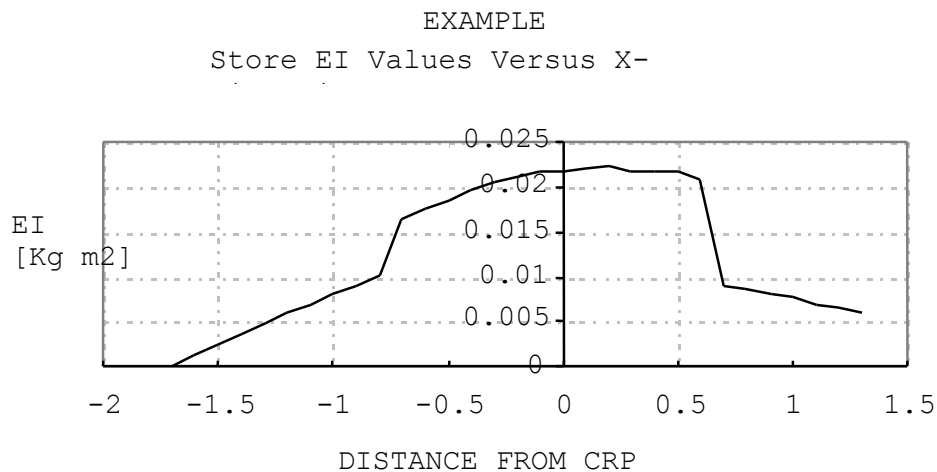


Figure A18 - Typical store EJ diagram

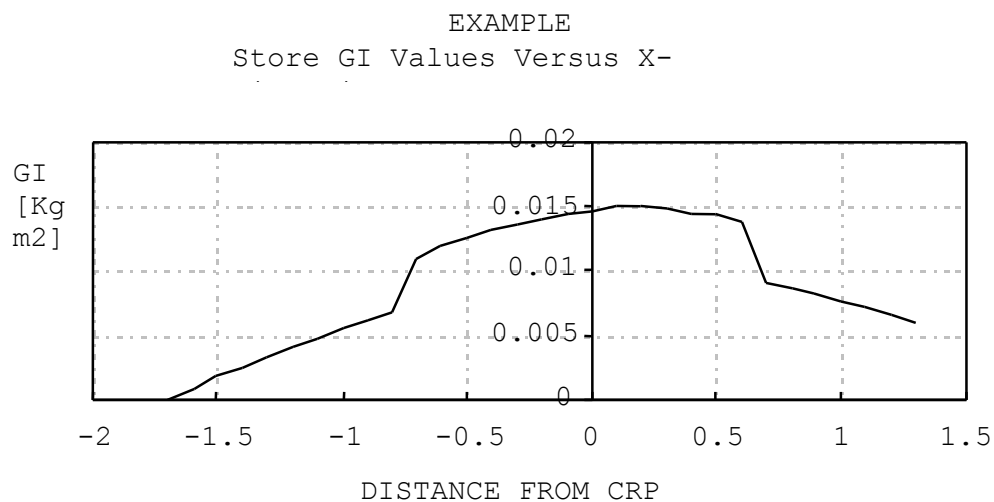


Figure A19 - Typical store GJ diagram

----- End Example

3.7 Loading Considerations

The topic of this paragraph is not the loading or unloading procedure but loading unloading considerations that can affect the interface.

3.7.1 Loading to Aircraft

Store Side:

Indication of store hard points and reinforced areas where loading forces can be applied and the eventual limitations or precautions shall be identified.

----- Begin Example

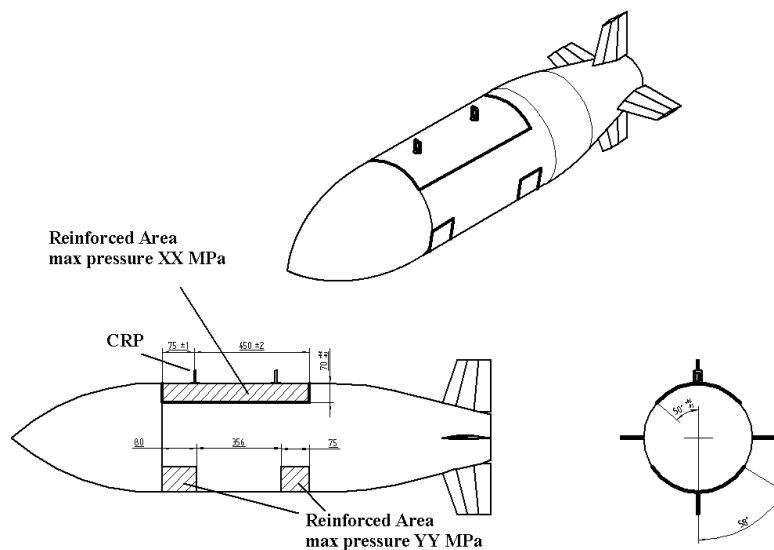


Figure A20 - Store reinforced areas identification

----- End Example

Description of loading procedure (and sequence(s) if any) elements or aspects that affect the interface shall be provided.

Identification of necessary associated devices/tools, list of aircraft where they are used, and list of stores that share the same devices/tools.

If applicable, store dressing (arming lanyard preparation) details to be provided.

Aircraft Side:

Indication of station hard points where loading forces can be applied and the eventual limitations or precautions.

----- Begin Example

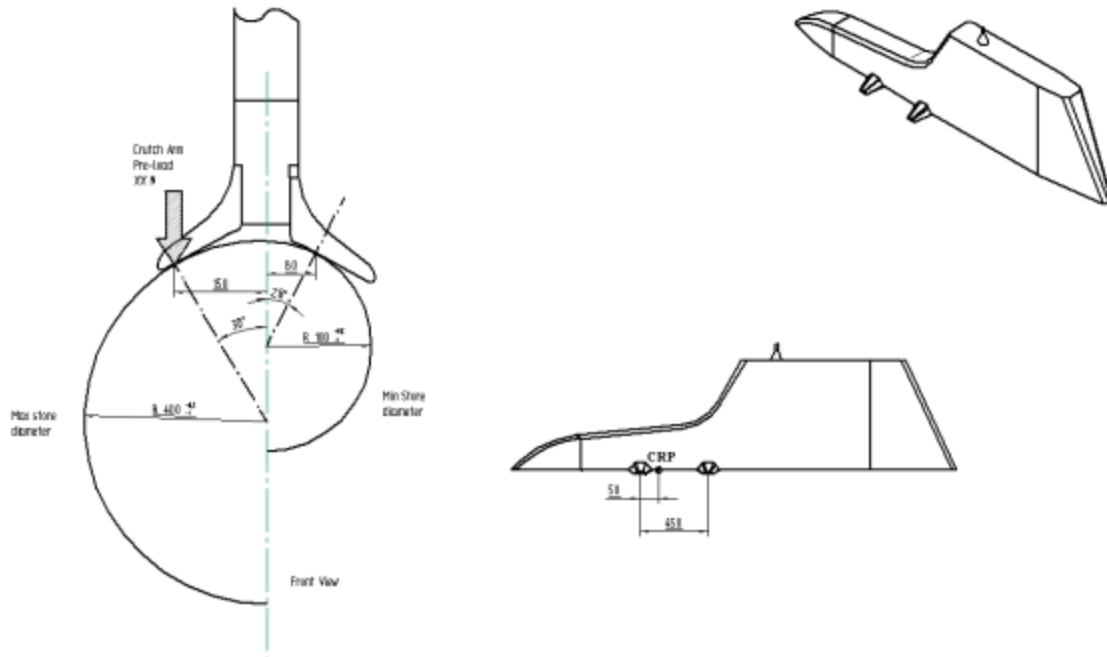


Figure A21 - Aircraft carriage station hard points identification

----- End Example

In case of impact on the aircraft/store interface, the relevant elements of the procedure for store loading at the candidate station will be provided, together (if necessary) with the list and description of the standard and special tools used.

Hoisting details, if applicable, will be detailed with indication of the allowable loads and eventual limitations or precautions to be observed.

If “common dressing” features are present they should be declared (i.e., 14 inch and 30 inch loading stations have the arming devices located in the same position).

----- Begin Example

- 1 L/R belly Pylon
- 2 Hoisting Device, guided missile launcher A
- 3 Guided missile launcher A
- 4 Winch cable
- 5 Safety Pin
- 6 Hoisting device guided missile B
- 7 Gripstock
- 8 Guided missile launcher B
- 9 Rope winch

CAUTION

Control surfaces and fins to be installed only after guided missiles A or B are mounted on the aircraft

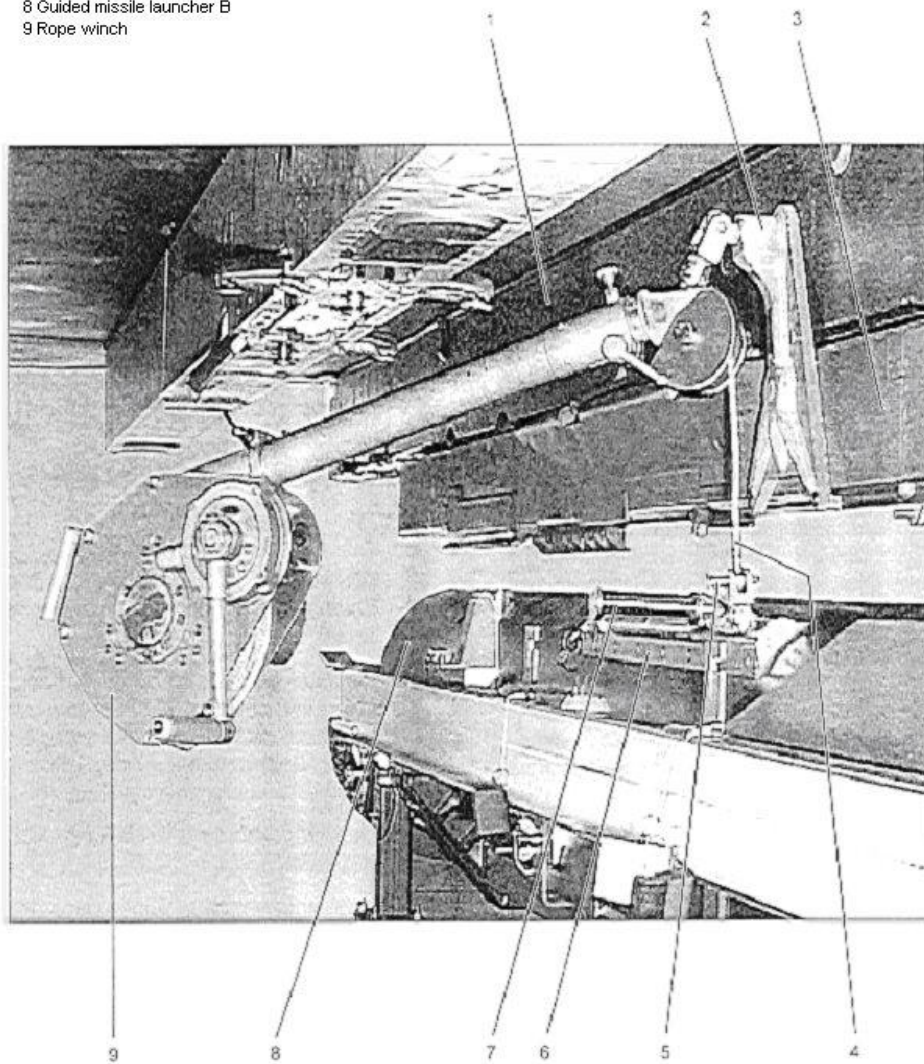


Figure A22 - Aircraft store loading consideration