NATO STANDARD

AOP-4526

SHAPED CHARGE JET IMPACT TEST PROCEDURES FOR MUNITIONS

Edition A, Version 2

MARCH 2022

NORTH ATLANTIC TREATY ORGANIZATION

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NATO LETTER OF PROMULGATION

4 March 2022

1. The enclosed Allied Ordnance Publication AOP-4526, Edition A, Version 2, SHAPED CHARGE JET IMPACT TEST PROCEDURES FOR MUNITIONS, which has been approved by the nations in the CNAD AMMUNITION SAFETY GROUP (CASG – AC/326), is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 4526.

2. AOP-4526, Edition A, Version 2, is effective upon receipt and supersedes AOP-4256, Edition A, Version 1, which shall be destroyed in accordance with the local procedure for the destruction of documents.

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4. This publication shall be handled in accordance with C-M(2002)60.

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Major General, GR (A)
Director, NATO Standardization Office

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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RECORD OF SPECIFIC RESERVATIONS

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Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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CHAPTER 1 INTRODUCTION

When reviewing requirements for this test, **SRD AOP-39.1** should first be read for guidance in the organization, responsibilities and conduct of full-scale testing.

1.1 ANNEXES

A. Best Practices

B. Historical Overview

1.2 RELATED DOCUMENTS

STANAG 4439	Policy for Introduction and Assessment of Insensitive Munitions (IM)
AOP-39	Policy for Introduction and Assessment of Insensitive Munitions (IM)
SRD AOP-39.1	Guidance on the Organization, Conduct and Reporting of Full-scale Tests
STANAG 4526	Shaped Charge Jet Impact Test Procedures for Munitions

1.3 AIM

The aim of this AOP is to specify the test requirements and procedures to provide evidence of the response of munitions and weapon systems to the threats represented from being impacted by a shaped charge jet.

1.4 AGREEMENT

1. Participating nations agree that the requirements and methods incorporated in this AOP will be used for determining the response of munitions and weapon systems to a shaped charge jet impact represented by the most prevalent threat (currently the RPG) or more appropriate threat.

2. Participating nations further agree that national standards, orders, manuals and instructions implementing this AOP will include a reference to the STANAG 4526 for purposes of identification.

3. No departure may be made from this agreement without consultation with the NATO Tasking Authority. Nations may propose changes at any time to the NATO Tasking Authority where they will be processed in the same manner as the original agreement.

1.5 DEFINITIONS

For the purpose of this document, definitions of terms to be used to describe test details and events are given in the NATO Terminology Database (NATOTerm) that is available by reference for all Allied Publications.[1]

1.6 GENERAL

1. Effort to minimize the violence of the reaction of munitions impacted by a shaped charge jet is a continuing commitment of weapons designers in order that the safety of personnel and materiel will not be unduly jeopardized.

2. This AOP addresses the situation where munitions and weapon systems are impacted by a shaped charge jet. This can occur in peacetime as the result of an accident, dissident/saboteur activity, or on operations as a consequence of enemy action, which can result in a significant compromise of safety.

3. The objective of the Shaped Charge Jet Impact Test is to determine the response of the munition(s) when subjected to a defined shaped charge jet.

1.7 TEST LIMITATIONS

1. The Shaped Charge Jet Impact Test is only designed to simulate the most violent response that a viable shaped charge jet impact threat would produce.

2. This test only represents a particular set of conditions as it is not possible to cater to the wide range of shaped charge weapons, impact velocities or angles of attack in the real world.

[1] https://nso.nato.int/natoterm/

CHAPTER 2 TEST SPECIFICATIONS

2.1 TEST ITEM CONFIGURATION

1. The test item configuration shall be the final production standard and in accordance with the condition as appropriate to the life cycle phase represented by the test, or representative as approved by the National Authority.

2. Guidance on variations to the production standard and condition (e.g. live vs inert, pre-conditioning, packaged vs unpackaged, single vs multiple test items, All-Up-Round vs component-level) as given in SRD AOP-39.1 Annex B shall be considered.

2.2 TEST DETAILS

2.2.1 Test Methods

There are two methods for performing the Shaped Charge Jet Impact Test for Munitions:

a. Method 1 (Standard): Using the general guidance specified herein, subject the Test Item to the jet from a shaped charge representing the rocket propelled grenades, as described in Section 2.2.2.2 Paragraph 1 of this document. The complete characterization of the jet used for the test shall be conducted to meet the requirements of this AOP, and shall be provided or referenced. Examples of tests fulfilling these requirements can be found in Annex A.

b. Method 2 (Alternative): Using the general guidance specified herein, subject the Test Item to a well characterized shaped charge jet as documented in a Threat Hazard Assessment (THA). The jet should be fully characterized and reported, as documented in Section 2.2.2.2 Paragraph 2 of this document.

2.2.2 Test Requirements

2.2.2.1 Generic

1. Shaped Charge Jet Requirements

a. The shaped charge shall be designed such that the output after a conditioning plate, represents the performance of a shoulder launched rocket propelled grenade (RPG). The performance parameters considered shall include the diameter and velocity both at the tip and along the jet. The characterization shall include information as to the placement that replicates the standoff of the RPG threat (for Method 1).

b. The shaped charge will be produced in a precise manner ensuring that all components are properly located, and that the charge is axially symmetric. Dimensional tolerances shall be selected such that a consistent straight jet is achieved. The explosive charge diameter shall be between 61 mm and 95 mm, with an explosive fill performance, detonation velocity and Gurney energy, between COMP B and Pure HMX at TMD. The charge liner shall be made from a high quality oxygen free copper and described. Initiation methods will be specified to assure consistent and strong symmetric initiation. The method for positioning the shaped charge shall not destabilize the jet formation (e.g. avoid using high density materials placed asymmetrically on the perimeter of the charge).

2. Jet Characteristic Requirements

a. Shaped charge jets that comply entirely with examples found in the Annexes of this AOP, are fully characterized and do not require additional documentation. Characterization of the shaped charge jet shall be documented in a technical report available to National Authority.

b. Jet diameters shall be measured as shown in Figure 1. The larger sections are due to phenomenon such as the slow moving jet at the tip from real geometric liner designs, being impacted by faster following sections of the jet (reverse velocity gradient). These sections will be reduced or stripped by the conditioning plate. Efforts should be made to reduce or eliminate spall from conditioning plates impacting the test item.

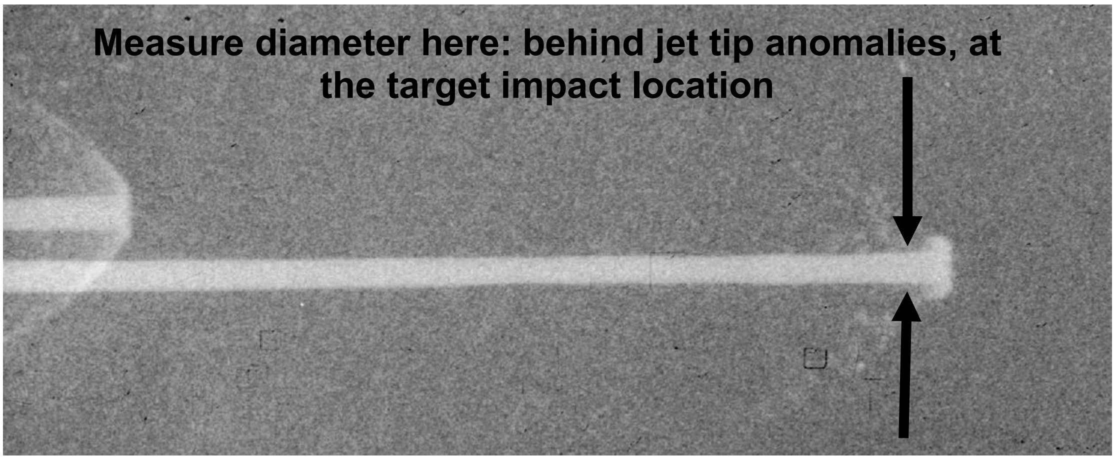


Figure 1: Jet Diameters

c. Primary Jet parameters should be measured by using appropriate test instrumentation such as flash radiography. Calibration rods can be used to assist in accurate measurement. Computer modelling can be used for supporting data.

d. Aim-Point Selection: Methods shall be established to assure the jet is aimed at the selected aim-point and that the jet follows the desired path through the munition. Base the shot-line on the THA, and in general, select it to produce the worst case reaction while remaining consistent with the THA. Subjected to this constraint, the likelihood of getting a violent response, will normally be maximized by choosing a shot line, which provides the longest possible path length through the energetic material. However, unlikely shot-lines should be avoided, which are aimed at components that are quite small when compared to the bulk of the explosive, propellant or aimed at unlikely angles. Prior to testing, shot-lines should be agreed to by the appropriate authorities.

In this regard, the following considerations may apply: if the energetic material contains a cavity of significant size (such as the bore of a rocket motor), aim the jet to pass perpendicularly through the cavity. (It has been observed that such cavities can promote the occurrence of violent reactions).

2.2.2.2 Specific

1. For Method 1, the following requirements shall be met:

   a. Distances between the shaped charge, the conditioning plate, and the test object shall be documented.

   b. A conditioning plate of suitable uniform thickness to remove the first part of the jet, must be used. Parts of the munition's normal configuration, such as armour and packaging, shall not be used as conditioning plates.

   c. Jet diameter at the target (2.5 - 3.5 mm).

   d. V^2d at the target (between 120 and 140 $mm^3/\mu s^2$).

   e. A jet straightness exhibiting less than ½ of a jet diameter deviation at a 20 charge diameter standoff is desired.

   f. Breakup characterization of the SCJ shall be documented.

2. For Method 2, the following data shall be reported as a minimum:

   a. Distances between the shaped charge, the conditioning plate, and the test object.

   b. Conditioning plate materials and thickness, if used. Parts of the munition's normal configuration, such as armour and packaging, shall not be used as conditioning plates.

   c. Jet diameter at the target.

d. V^2d at the target.

e. Jet straightness and diameter deviation at an appropriate distance.

f. Breakup characterization of the SCJ.

2.2.3 Test Set-Up

1. The test item condition and orientation shall be applied in coherence with the life cycle phase represented by the test, or representative as approved by the National Authority.

2. Additional guidance on variations to the test conditions (positioning / orientation, aim-point/shot-line, restraints, conditioning, marking, reuse, etc.) as given in SRD AOP-39.1 Annex B shall be considered.

2.2.4 Number of Tests

Any of the selected methods shall be carried out as directed by National Authorities to provide appropriate information contributing to the munition's IM Signature required by AOP-39. Multiple tests (different test item configurations, multiple components, etc.) may be required to fully assess the munition.

2.3 DOCUMENTATION AND COMPLIANCE

1. A test directive, test plan and test report shall be produced and shall be agreed by the National Authority. Guidance on completion of documentation, responsibilities for completion and review are discussed in detail in SRD AOP-39.1.

2. It is essential that the test is conducted in accordance with the test directive; one of the responsibilities of the Project Team is to confirm compliance.

3. Where deviations from the agreed test directive and test plan, or the procedure agreed upon at the Trial Readiness Review prove necessary, these must be approved on behalf of the review body by the appropriate Project Team representative, taking advice as necessary from the safety advisor and technical specialists.

2.4 OBSERVATIONS AND RECORDS

Guidance on specific aspects of the conduct of testing, observations and data recording is discussed in more detail in SRD AOP-39.1. Unless noted as "optional", for IM purposes, the following minimum observations shall be made and records kept.

a. Test item identification and configuration (model, serial numbers, number of test items, etc.); Type of energetic material and weight; Listing of environmental preconditioning tests performed; Spatial orientation of the test item.

b. Test setup/configuration: Type of procedure; Details of shaped charge used; Distance between weapon(s) and test item; Method of mounting and/or restraint; Distances between the shaped charge, the conditioning plate, and the test item; Method of mounting and/or restraint; Distances from the test item to any protective wall or enclosure; Identification and location of any other instrumentation if used.

c. Record of events versus time, from the order to fire to the end of the test.

d. Record of aim point(s) selected.

e. Details of shaped charge jet characteristics and conditioning plate.

f. Nature of any reactions by the Test Item.

g. Photo Imagery of the Test Item and the Test Setup before and after performing the test.

h. Nature and distribution of remains/residue and debris including: range, position, photographs, identification (as possible), and mass of each piece.

i. Meteorological data (wind speed, direction) during the test.

j. Indication of propulsion (video or other suitable means).

k. Audio and video records: A recording device shall be placed near the trial site to record all audio and enable correlation between visible events and indicated time.

l. Suitable Blast or overpressure gauges should be positioned around the test item to record pressure-time history with a record of gauge location and height.

m. Witness plates and screens as a measure of projection severity (optional); Photographs of witness plates and screens (if used); Number and depth of penetrations in fragment recovery panels (if used).

n. A complete data record shall be compiled to include pressure, sound, imagery, fragmentation, debris and propulsion information.

2.5 EVALUATION OF TEST RESULTS

Policy and procedures for evaluation of test results are given in:

a. AOP-39, Policy for Introduction and Assessment of Insensitive Munitions (IM);

ANNEX A BEST PRACTICES

A.1 SHAPED CHARGE 81 MM, LX-14 (USA)

A.1.1 Introduction

The U.S. DoD has developed a standardized shaped charge jet attack configuration to represent standard rocket propelled grenade (RPG) attacks based on the RPG-7 rocket launcher. Figure A-1 presents the U.S. developed RPG IM threat test configuration and 81 mm LX-14 shaped charge warhead used to represent RPG attacks.

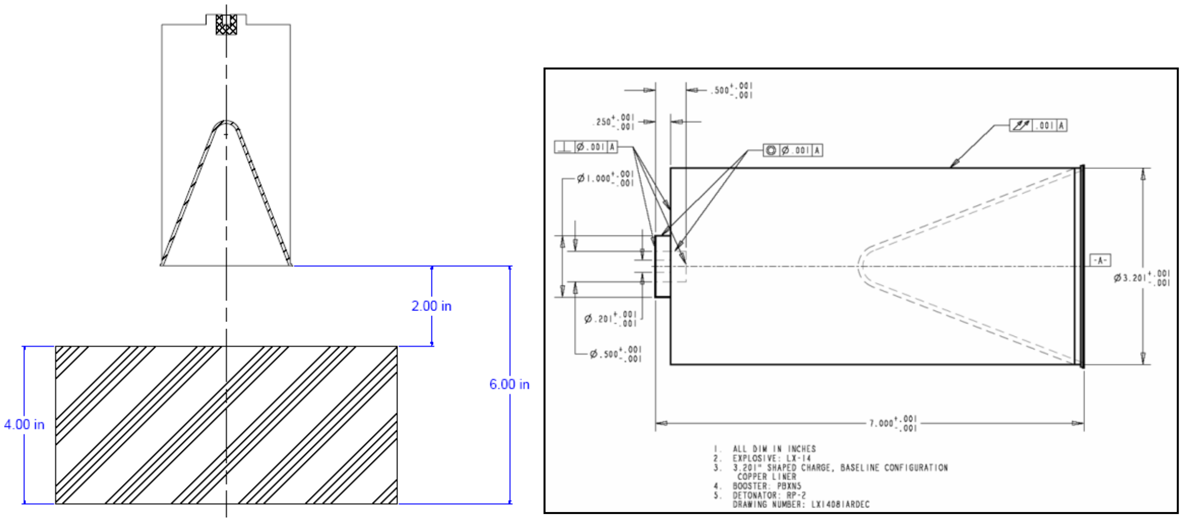


Figure A-1: IM RPG threat test configuration (left) and warhead (right).

A.1.2 Shaped Charge

1. The 81 mm shaped charge is comprised of a high precision forged and machined liner made from C101 Oxygen Free Copper (OFE, UNS C10100) and a bare billet LX-14 configuration that has been pressed to a minimum density of 1.815 g/cm3 and is machined to final dimensions. Figure A-2 presents a drawing of the 81 mm shaped charge copper liner.

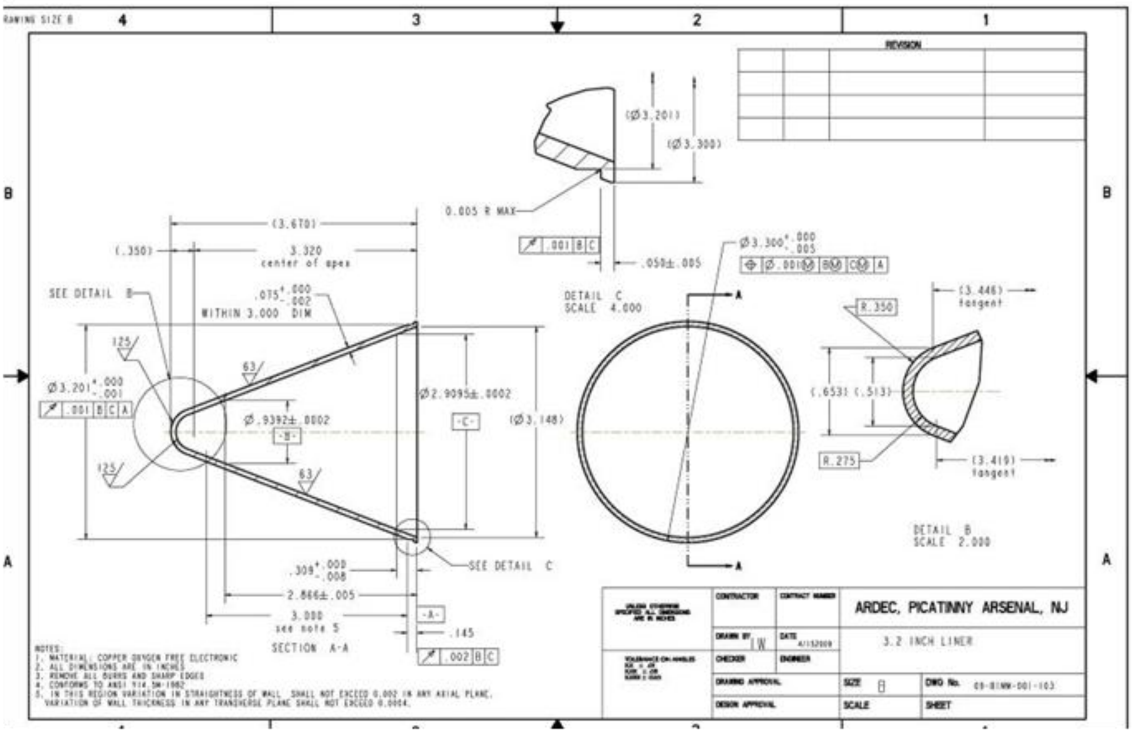


Figure A-2: Liner drawing.

2. Experimental characterization of the LX-14 81 mm shaped charge included jet characterization using long standoff x-rays. The x-rays were taken up to a 24-charge diameter standoff to assure jet characterization for the fully particulated jet. Figure A-3 presents CALE high-rate continuum modelling of the accumulated jet mass characteristics for RPG IM threat test. Figure A-4 presents the resulting shaped charge jet x-rays. A jet tip velocity of 6.2 km/s was measured, which agrees with CALE hydrocode modelling results. The jet characteristics were reduced using a digitizing light table and ARDEC-developed software. Figure A-5 presents the shaped charge characterization jet length vs. jet velocity for the fully particulated jet.

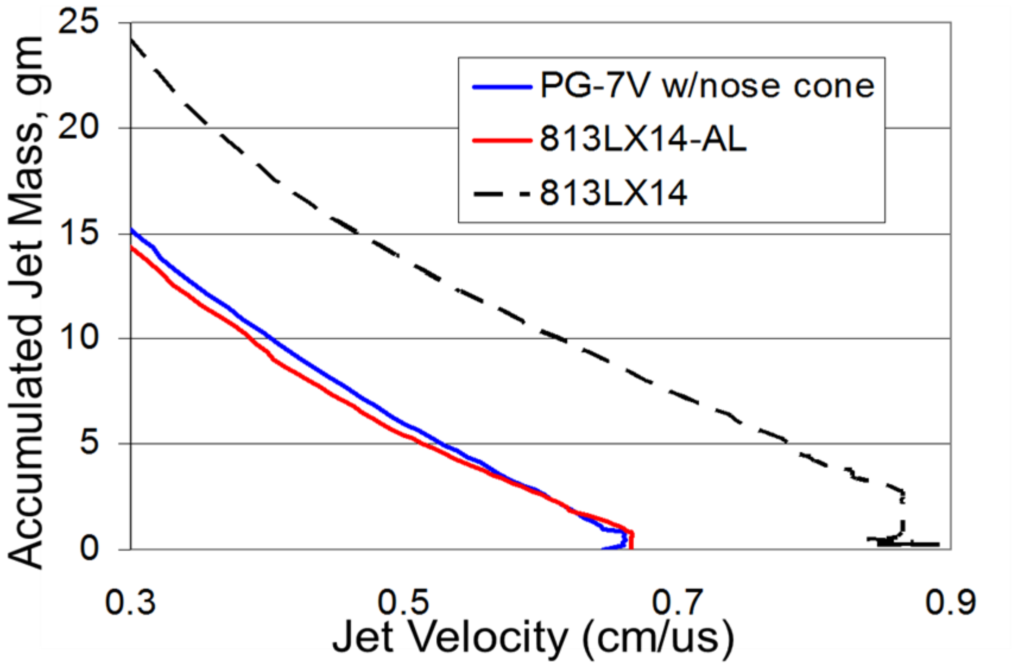


Figure A-3: CALE modeling used for RPG IM threat test development based on a standard LX-14 loaded 81 mm shaped charge.

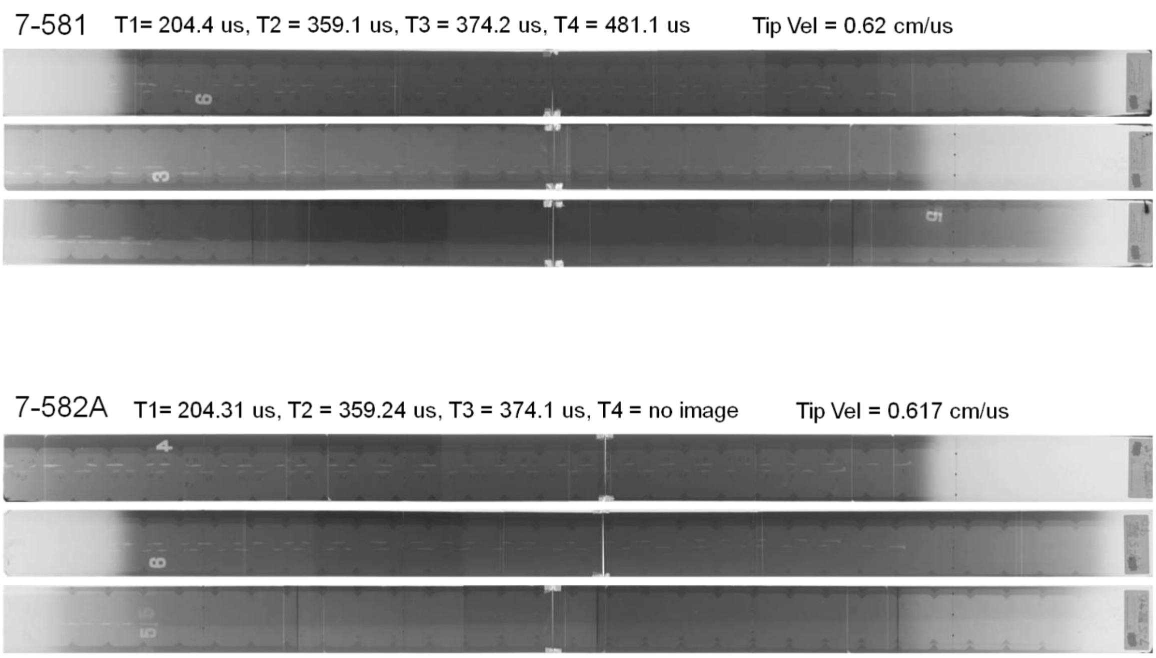


Figure A-4: Shaped charge jet characterization long standoff x-rays.

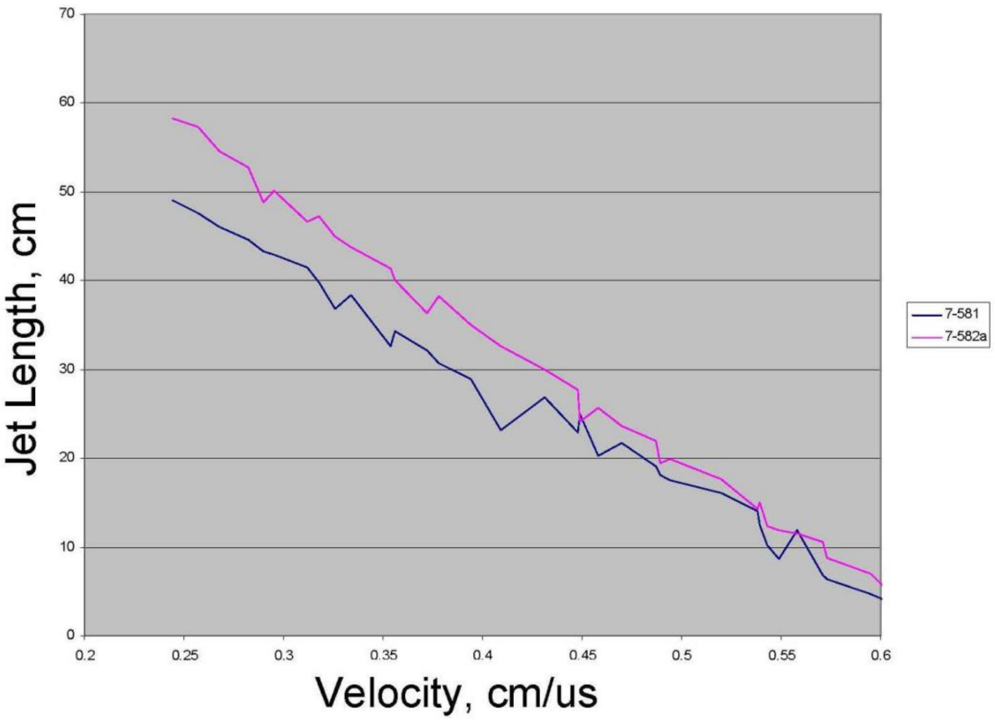


Figure A-5: Shaped charge characterization jet length vs. jet velocity.

3. Figure A-6 presents the shaped charge characterization jet diameter vs. jet velocity for the fully particulated jet. The presented jet diameter is measured as the largest diameter of each jet particle. Figure A-7 presents the shaped charge jet characterization jet break-up time vs. jet velocity.

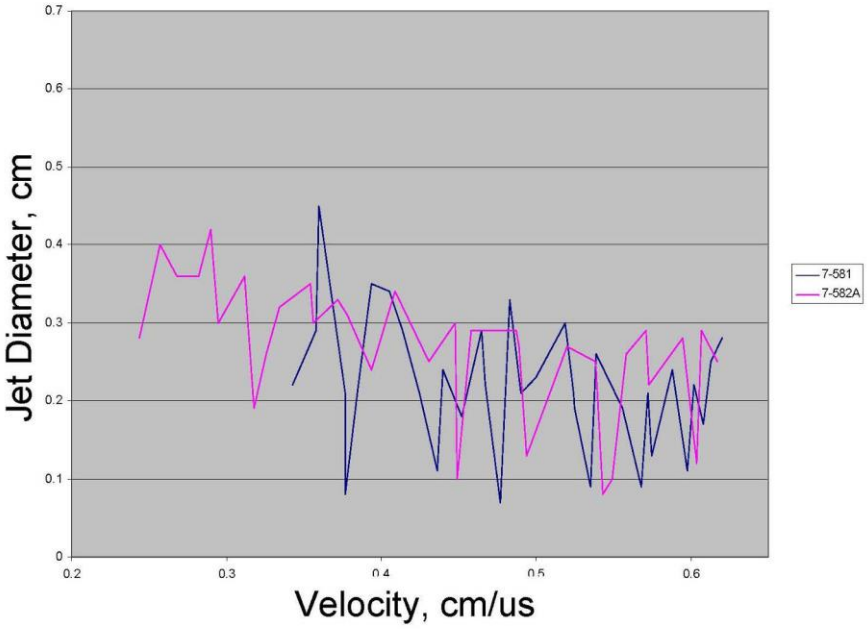


Figure A-6: Shaped charge characterization jet diameter vs. jet velocity.

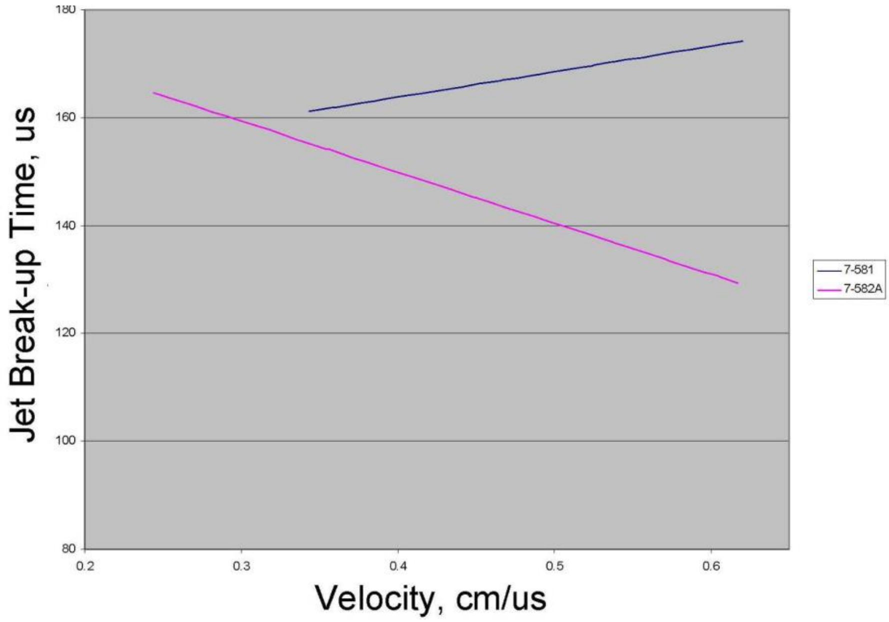


Figure A-7: Shaped charge jet characterization jet break-up time vs. jet velocity.

4. The break-up time is calculated using the particulated jet length velocity profile and the known standoff from the original warhead position. The results are relatively consistent empirical data and indicative of a high precision shaped charge built using a high-quality liner made from relatively pure copper.

A.1.3 Conditioning Plate

1. The RPG IM threat test is configured such that the back of the aluminum conditioning plate represents the probe nose position of the RPG. As shown in Figure A-8, the back of the Al conditioning plate is placed in the geometric position to represent the RPG attack probe nose position. Figure A-9 presents a drawing of the aluminum conditioning plate.

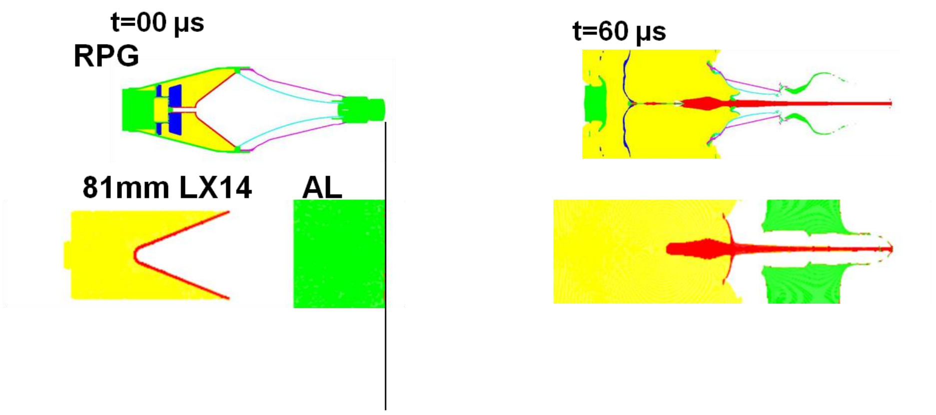


Figure A-8: The back of the Al conditioning plate represents probe nose position of the RPG.

2. For IM threat testing, place the back of the Al conditioning plate in the geometric position to represent RPG attack probe nose position.

A.1.4 Setup

1. To facilitate testing, a set of standardized test configuration hardware has been developed as shown in Figure A-9 through Figure A-14. Although this hardware is not required to achieve the standardized RPG threat testing configuration, it can greatly facilitate the testing.

2. Figure A-9 provides photographs of the LX-14 loaded 81 mm shaped charge and the shaped charge in the test assembly configuration. As shown in Figure A-10, Figure A-11 and Figure A-12, the standardized configuration hardware is based around an acrylic holder. The acrylic holder that is made by clamping two acrylic triangles together. The corners of the acrylic triangles are drilled and tapped in order to provide threaded holes for clamping using threaded rods. The space between the triangles is adjusted to allow for the 4-inch aluminum cylinder and 2-inch air gap positioning, as well as to ensure that components are level and aligned.

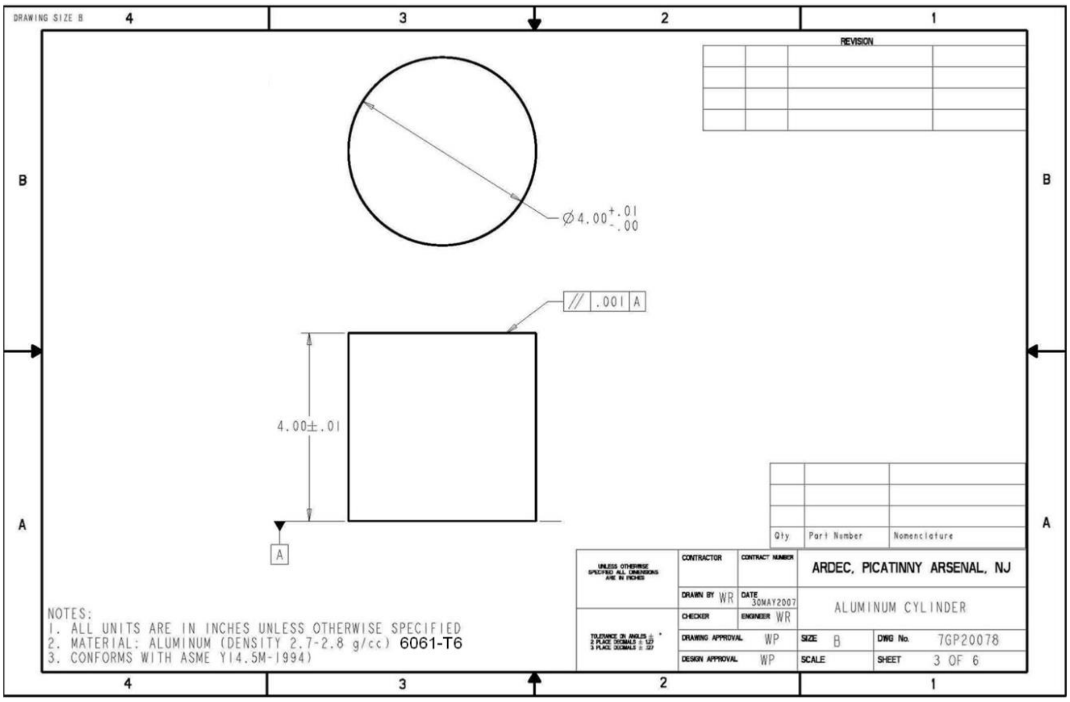


Figure A-9: Aluminum conditioning plate drawing.

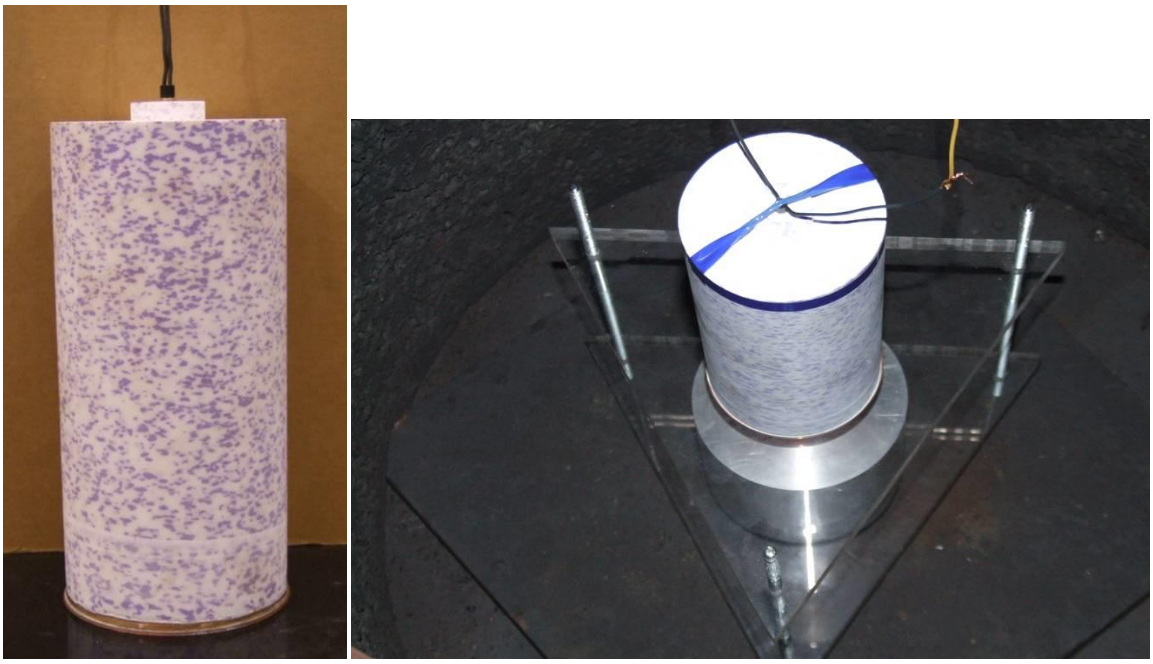


Figure A-10: Shaped charge (left) is typically assembled into a test configuration using a set of standardized hardware.

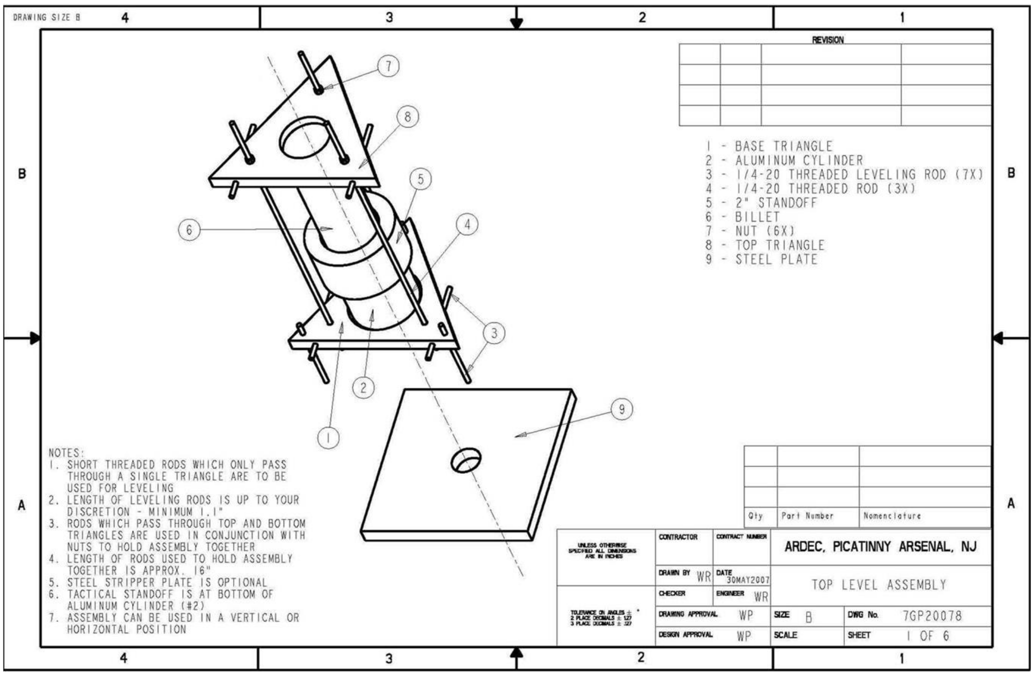


Figure A-11: Standardized test assembly and hardware.

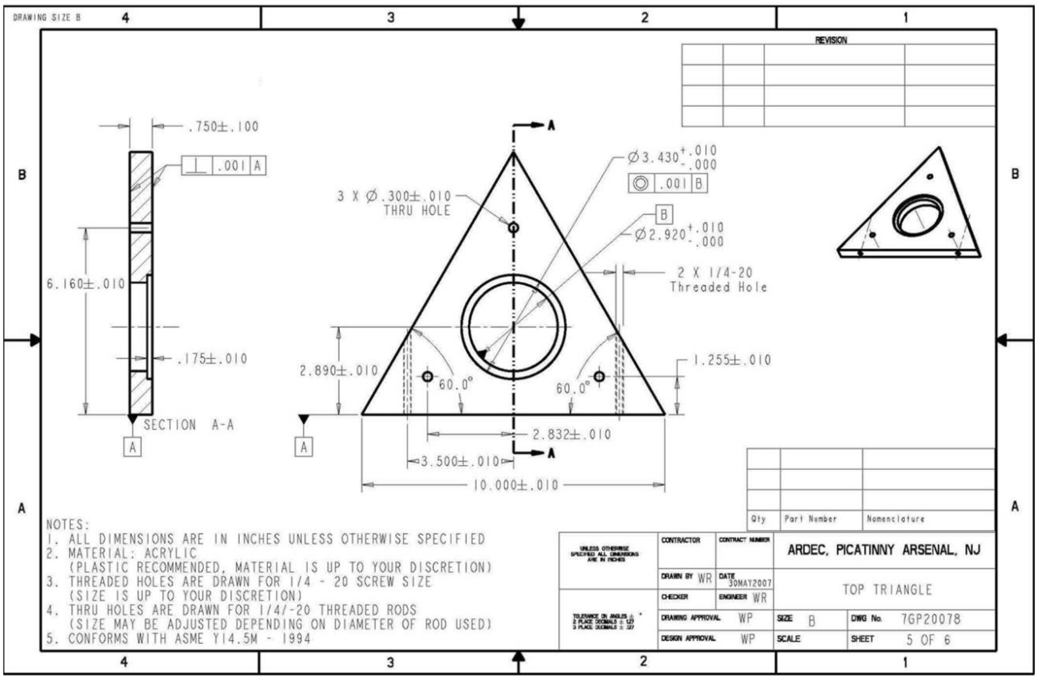


Figure A-12: Assembly hardware drawing.

3. For testing, an approximate 0.5-inch of standoff clearance is left between the aluminum cylinder face and the target test article. If the standardized test configuration hardware is being used in the vertical position, then the threaded leveling rods (3) from Figure A-10 are used to ensure proper alignment.

4. If the standardized test configuration hardware is being used in the horizontal position, then the threaded leveling rods (4) from Figure A-10 are used to ensure proper alignment.

5. If the aluminum spall produced by the shaped charge jet aluminum conditioning plate perforation is of concern, a stripper plate can be used to prevent the aluminum spall from impacting the test article, as well as to achieve the 0.5-inch gap between the aluminum conditioning plate and the target test article.

6. A stripper plate design and assembly configuration is shown in Figure A-10 and Figure A-15 shows a jet diameter measurement used to calculate the Held's parameter, at the test item impact position. The resulting calculated V^2d is 119.8 $mm^3/\mu s^2$, based on an averaged measured jet diameter of 3.04 mm and a measured jet tip velocity of 6.28 mm/µs.

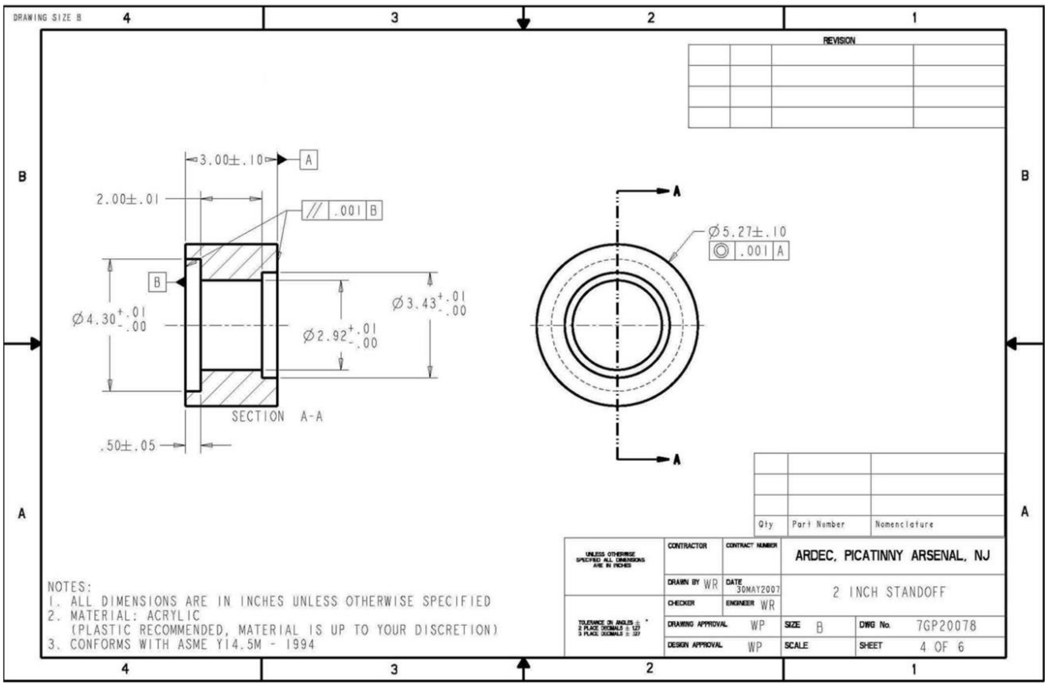


Figure A-13: Assembly hardware drawing.

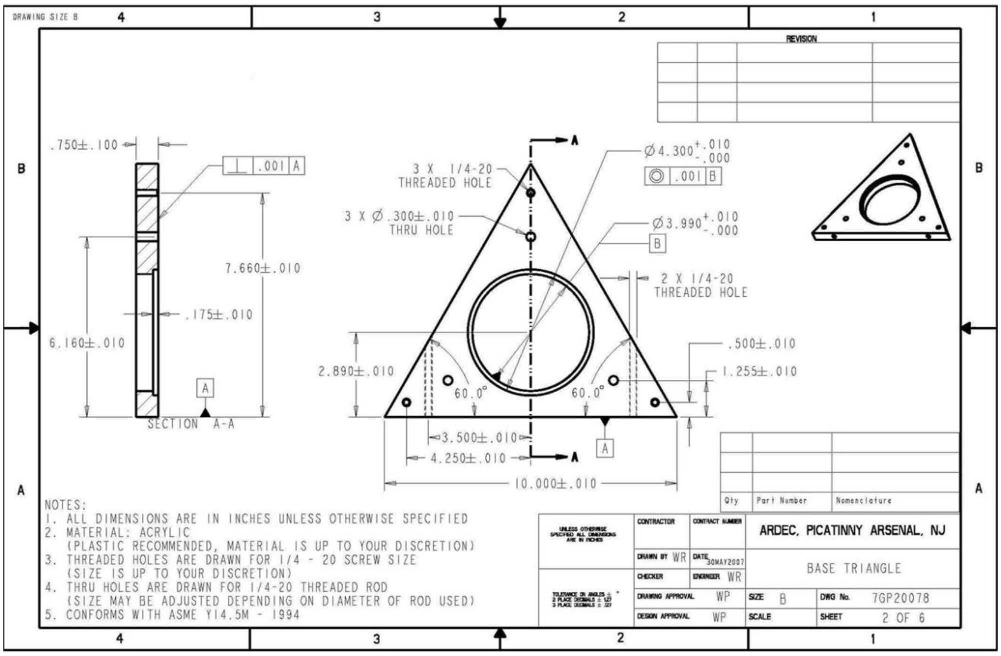


Figure A-14: Assembly hardware drawing.

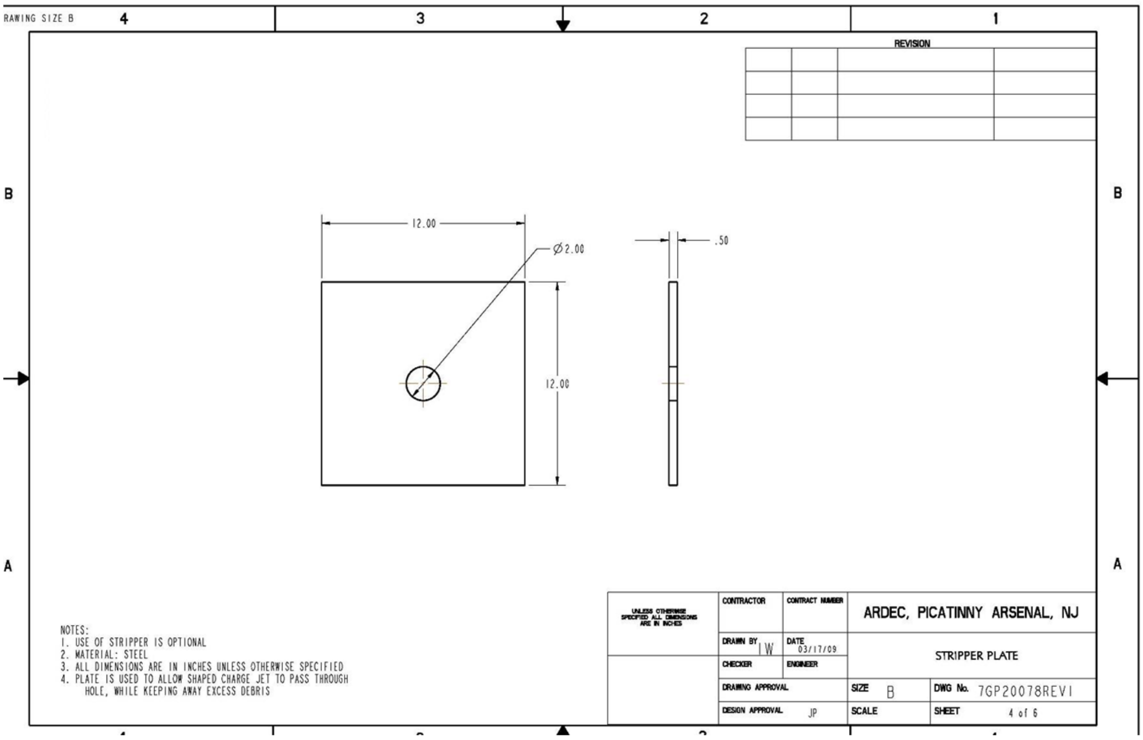


Figure A-15: Stripper plate hardware drawing.

A.2 SHAPED CHARGE CCEB 62

A.2.1 Introduction

1. CCEB 62 is the French standardized shaped charge for Insensitive Munitions signature assessment in agreement with MoD Instruction N°211893/DEF/DGA/INSP/IPE issued on 21 July 2011. It is initiated with a Nexter M720 Explosive Bridgewire Detonator.

2. This charge was selected for two reasons: (1) CCEB 62 is representative of the standard rocket propelled grenades threat; and (2) this charge has been used for many years mainly in the field of armour studies (CCEB 62 is a French acronym for “shaped charge for armour studies of 62 mm”). This charge has thus been designed to be highly reproducible as shown on Figure A-16 by the jet straightness at long stand-off.

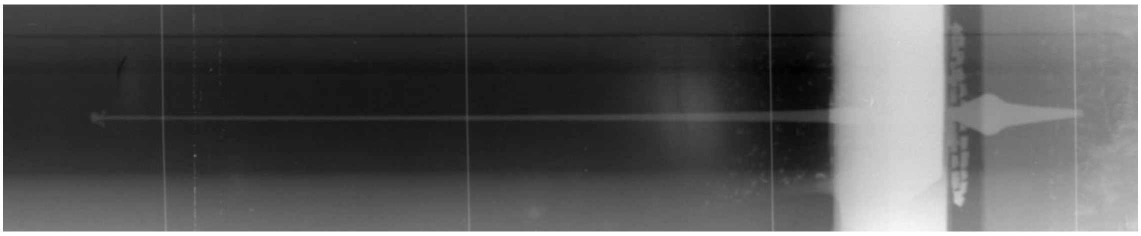
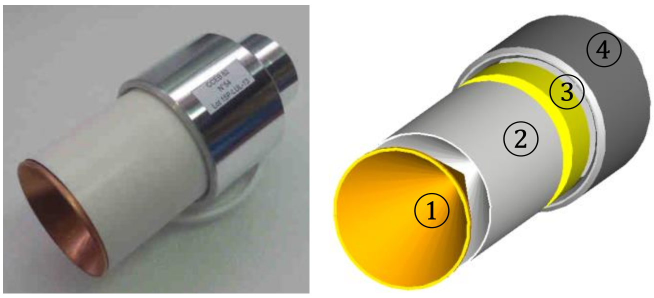


Figure A-16: CCEB62 Jet Characterization at Long Stand-off X-ray (around 7 Calibers)

A.2.2 Shaped Charge

1. The CCEB 62 shaped charge consists of an oxygen-free, high thermal conductivity (OFHC) copper liner and an explosive charge as presented in Figure A-17. The main explosive charge and booster are manufactured through an isostatic process and an accurate machining step is needed to ensure the required final dimensions. A drawing of the charge is shown in Figure A-18.



① Liner: OFHC copper

② Main explosive: HMX-based composition

③Booster: RDX-based composition

④ Fixing device: 7000 series aluminum alloy

Figure A-17: French Reference Shaped Charge CCEB 62 for IM Tests

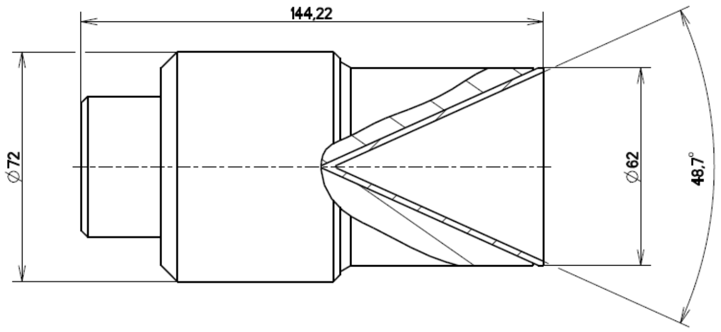


Figure A-18: French Reference Shaped Charge CCEB 62 Drawing

2. The charge manufacturer reference is:

a. **Code:** F0531

b. **Reference:** 82108633000

c. **Index:** A

3. A jet characterization has been performed and consisted in the full jet particulation observation, the V^2d determination and the penetration reproducibility validation. Figure A-19 presents the shaped charge characterization - jet length vs. jet velocity (when fully particulated). Jet particles having a velocity lower than 3000 m/s are not presented here.

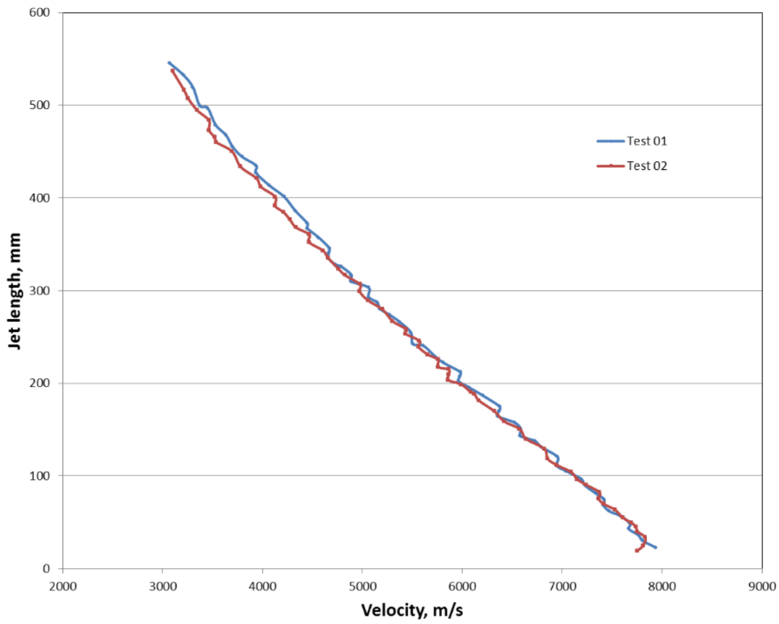


Figure A-19: CCEB 62 Characterization Jet Length vs. Jet Velocity

4. Several configurations were tested in order to select the best configuration for the V^2d evaluation. The set-up used for those tests is presented on Figure A-20. The jet characteristics were determined using X-ray pictures. The acquisition was started with a contact gauge located on the front side of the conditioning plate. The delays were adjusted to observe the jet at two relevant positions. The analyzed parameters were the stand-off (s/o) and the conditioning plate definition. The following configurations were considered:

a. Two values for the stand-off (s/o): 0.5 and 2 calibers;

b. Two types of conditioning plates: mild steel and mild steel + High Density Polyethylene (HDPE);

c. Various thicknesses for the conditioning plates.

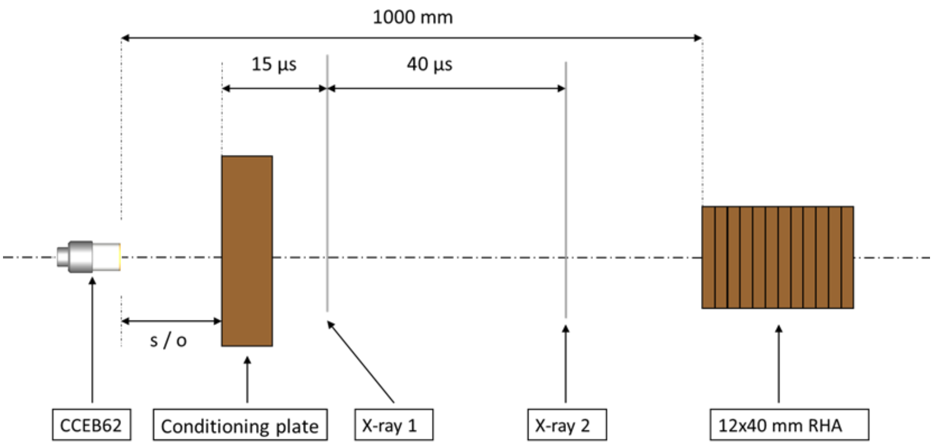


Figure A-20: Experimental Set-up Used for CCEB62 Jet Characterization.

5. The tests highlighted that a proper evaluation of the V^2d value requires a relevant and accurate measurement of the jet diameter. The front jet element shape depends on the characteristics of the conditioning plate (thickness, material…). Figure A-21 presents the influence of the conditioning plate definition on the front jet element shape. Examples 1 and 2 show two configurations considered as unsatisfactory as the jet tip is disturbed and two different diameters could be assessed for the jet. Example 3 provides a configuration limiting these discrepancies. In this configuration, the collapse area in front of the jet is reduced and the jet diameter is easier to identify.

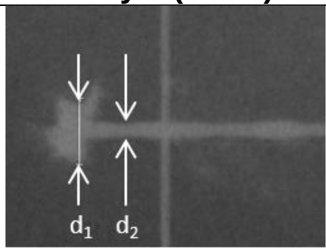
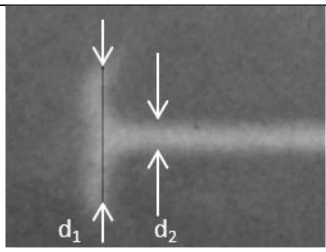
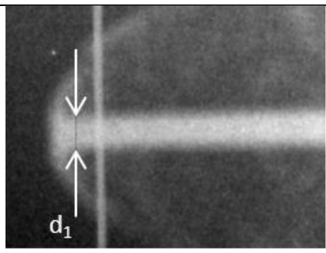
Example	s/o and conditioning plate	X-ray 1 (8 cal.)
1	2 cal. / 10 mm mild steel	
2	2 cal. / 10 mm mild steel + 25 mm HDPE	
3	0.5 cal. / 10 mm mild steel + 50 mm HDPE	

Figure A-21: Examples of the Influence of the Conditioning Plate Definition on the Front Jet Element Shape.

6. The reproducibility of the charge was validated through penetration tests in Rolled Homogeneous Armour (RHA) steel plates. Eight shaped charges were used and the measurements indicated a narrow deviation (2.6%) around the mean value.

A.2.3 French Reference Test Configuration for Shaped Charge Jet

The French test configuration used for the IM evaluation of munition reaction to shaped charge jet aggression is presented in Figure A-22. The conditioning plate is made of the assembly of a 50 mm HDPE plate (density ~ 1) and a 10 mm mild steel type C35 plate. The lateral dimensions of the plates are 250 x 250 mm. The HDPE plate is placed at the back of the steel plate in order to prevent debris (spall effects) from impacting the test article. The stand-off distance between the shaped charge and the conditioning plate is 0.5 caliber (31 mm). The distance between the back of the conditioning plate and the tested munition is 0.75 caliber (46 mm). In this configuration, the velocity of the front jet element is of 7025 m/s and the diameter of the jet is of 2.7 mm (± 0.2 mm). This results in a mean V^2d value of 133 $mm^3/\mu s^2$.

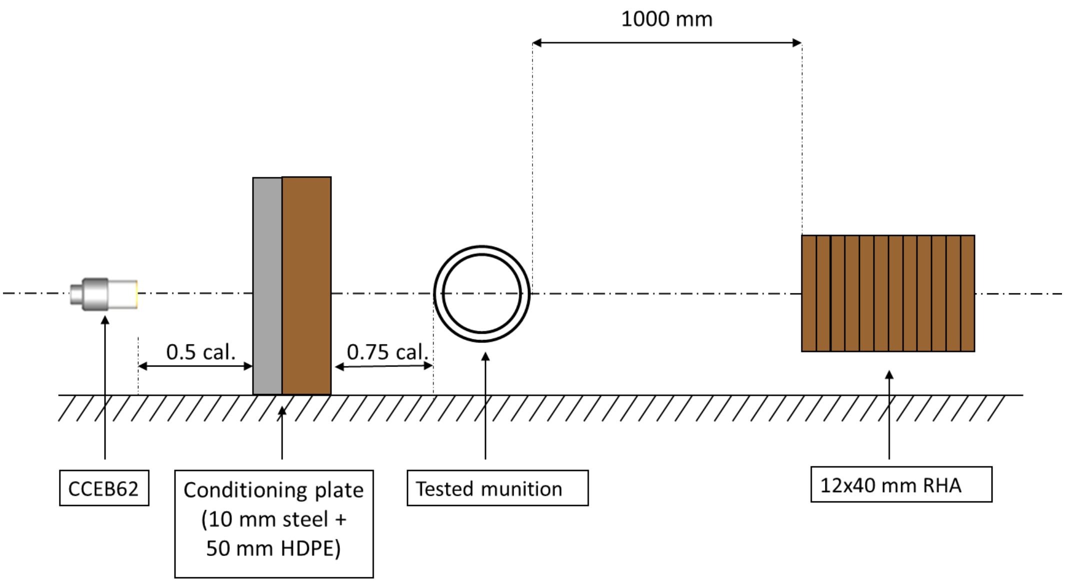


Figure A-22: Recommended Set-up for IM Shaped Charge Jet Test with the CCEB62.

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ANNEX B HISTORICAL OVERVIEW

B.1 REVISION PROCESS

B.1.1 IM Test AOP Standardization Working Group (2020-2021)

1. In the time between April 2020 and April 2021, AOP-39, -39.1, -4240, -4241, -4382, -4396, -4496, and -4526 have been revised. The objectives of these revisions, executed by the IM Test AOP Standardization Working Group, were:

   a. Fix grammatical and spelling mistakes, clerical errors, and enforce a uniform structure, format, and wording across all AOPs for the sake of readability and ease-of-use.

   b. Ensure that the AOPs only contain requirements.

2. Altering any technical content was not permitted, because the group aspired to merely update each AOP's Version and not release entirely new Editions.

3. To achieve the second goal, guidance and best practices were to be moved into the SRD AOP-39.1. However, accomplishing this was not entirely possible. It was agreed that all AOP-specific guidance remains in each AOP's Annex A, while all guidance that applied to two or more AOPs was marked to be moved into the SRD.

4. The IM Test AOP Standardization Working Group also made notes about topics that could potentially be discussed at future gatherings of each AOP's respective Custodian Working Group.

5. A total of 26 meetings took place, all of them virtually. The involved people were the Custodians of the various documents as well as representatives of MSIAC and AC/326 SG/B.

B.1.2 Creation of AOP-4526 Edition A

1. In order to facilitate a beneficial exchange of information between nations, some standardization, as well as characterization of the tests is desirable. For the shaped charge jet munitions test procedure, each member nation had been creating and adopting their own standards because the previous STANAG 4526 was dated and had lost relevance. For example, it referenced US Rockeye Shaped Charge, which is no longer used by any member nation.

2. In meetings and a workshop used in developing this new document, most member nations confirmed some form of the RPG-7 as the predominant threat. This munition, and copies, is produced and sold by many countries and is encountered in a multitude of threat scenarios. Therefore this document uses the RPG-7 as the

representative threat and maintains and documents the French and US test standards that replicate this threat. Additionally this document defines the jet characterization and test configurations so that other test arrangements and hardware can be developed that meet the standard. An alternative threat variation is allowed, based upon a threat hazard Assessment (THA).

3. The development of this document utilized the current understanding of shaped charges and shaped charge initiation was utilized. Criteria, known as the Held criteria has been developed to evaluate the initiability of an explosive impacted by a shaped charge. The Held criteria is the velocity of the jet squared times the diameter (V^2d). Many conditions modify this criteria; confinement and to the extent as to how the Held criteria is extrapolated. Additionally, two different shaped charges which deliver the same V^2d on the outside of a munition or its shielding, may deliver very different reactions when the jet reaches the energetic material. Consequently, full characterization of the jet used was required.

4. To achieve the desired jet characteristics and remove jet tip anomalies and debris, it is necessary to adjust the jet velocity from the shaped charge by using conditioning plates between the shaped charge and the test munition.

B.1.3 Changes from STANAG 4526 Edition 2

1. The following test methods and sections were removed as they were no longer being used for IM evaluation:

   a. Bomblet Shaped Charge.

   b. Rockeye Shaped Charge.

   c. Anti-Tank Missile.

   d. Ballistic Pendulum.

2. Additionally the old, inaccurate V^2d table of Held's Criteria (V^2d) for various shaped charges that could not be verified was removed.

B.2 BACKGROUND AND TEST ORIGIN

Not used.

B.3 REFERENCES

D. Pudlak, K. Tomasello, "Revisions and Improvements to the NATO Insensitive Munitions Test Doctrine Portfolio", NATO AC326 SG/B Spring Meeting, April 15-16, 2021

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