NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

Edition A Version 1

OCTOBER 2020

NORTH ATLANTIC TREATY ORGANIZATION

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NATO LETTER OF PROMULGATION

8 October 2020

1. The enclosed Allied Engineering Publication AEP-97, Edition A, Version 1, MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION, which has been approved by the nations in the NATO ARMY ARMAMENTS GROUP (NAAG – AC/225), is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 4823.

2. AEP-97, Edition A, Version 1, is effective upon receipt.

3. This NATO standardization document is issued by NATO. In case of reproduction, NATO is to be acknowledged. NATO does not charge any fee for its standardization documents at any stage, which are not intended to be sold. They can be retrieved from the NATO Standardization Document Database (https://nso.nato.int/nso/) or through your national standardization authorities.

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

Zoltán GULYÁS
Brigadier General, HUNAF
Director, NATO Standardization Office

RESERVED FOR NATIONAL LETTER OF PROMULGATION

RECORD OF RESERVATIONS

VOLUME	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.	

RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
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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1.0 Introduction

1.1. Overview

The following calibres NATO small arms ammunition standards amplify and interpret the essential NATO military characteristics and specify the technical performance requirements for ammunition designs submitted for NATO Qualification.

4.6 mm x 30 Ammunition	(STANAG / AOP-4820)
5.56 mm x 45 Ammunition and Links	(STANAG / AOP-4172)
5.7 mm x 28 Ammunition	(STANAG / AOP-4509)
7.62 mm x 51 Ammunition and Links	(STANAG / AOP-2310)
9 mm x 19 Ammunition	(STANAG / AOP-4090)
12.7 mm x 99 Ammunition and Links	(STANAG / AOP-4383)

1.2. Purpose

The purpose of this manual is to prescribe standardized proof and inspection procedures for multiple calibres of NATO small arms ammunition to ensure uniform test methods and comparable test data to ensure functional interchangeability on the battlefield.

1.3 Aim

The aim of this standard is to prescribe the uniform test methods, equipment and inspection procedures to assess the technical performance requirements for the NATO small arms ammunition standards to ensure functional interchangeability on the battlefield. AEP-97, The Multi-Caliber Manual of Proof and Inspection Procedures for NATO Small Arms Ammunition, details the following guidelines and procedures in twenty-seven (27) volumes, published separately:

- Volume 1: NATO Ammunition Interchangeability Principles
- Volume 2: NATO Qualification Approval Test
- Volume 3: NATO Production Test
- Volume 4: NATO Surveillance Test
- Volume 5: NATO Ammunition Standardization - Organisational Structure And Responsibilities
- Volume 6: NATO Test Equipment and Visual Standards
- Volume 7: Sentencing of Defects and Incidents Occurring In Tests Other Than Function & Casualty
- Volume 8: NATO Reference Ammunition
- Volume 9: NATO Nominated Weapon (NNW) Guidelines
- Volume 10: List of NATO Nominated Weapons Including Weapon Characteristics and Technical Details
- Volume 11: Classification of Defects and Incidents
- Volume 12: Combination Electronic Pressure Velocity and Action Time (EPVAT) Test Procedures

- Volume 13: Climatic Storage Test Procedures
- Volume 14: Function and Casualty Test Procedures
- Volume 15: Link Test Procedures
- Volume 16: Barrel Erosion Test Procedures
- Volume 17: Smoke and Flash Test Procedures
- Volume 18: Precision Test Procedures
- Volume 19: Terminal Effects Test Procedures
- Volume 20: Trajectory Match Test Procedures
- Volume 21: Tracer Performance Test Procedures
- Volume 22: Residual Stress Test Procedures
- Volume 23: Primer Sensitivity Test Procedures
- Volume 24: Bullet Extraction Test Procedures
- Volume 25: Propellant and Primer Test Procedures
- Volume 26: Waterproof Test Procedures
- Volume 27: Cook Off Test Procedures

AEP-97 is also used to monitor continuing technical compliance of qualified ammunition designs with the requirements of the appropriate standard.

1.4 Superseded Documents

This standard supersedes the following document(s):

- **AC/225(LG3-SG/1)D/8** – Manual of Proof and Inspection Procedures for NATO 5.56 mm Ammunition (MOPI)
- **AC/225(LG/3-SG/1)D9** – Manual of Proof and Inspection Procedures for NATO 7.62 mm Ammunition (MOPI)
- **AC/225 (LG3-SG/1) D/11** – Manual of Proof and Inspection Procedures for NATO 12.7 mm Ammunition (MOPI)
- **AC/225(Panel III/SP.1)D/170** – Manual of Proof and Inspection Procedures (MOPI) for NATO 9 mm Ammunition

1.5 Standards

- **AOP-2310** – Technical Performance Specification Providing For The Interchangeability Of 7.62 mm x 51 Ammunition
- **AOP-4090** – Technical Performance Specification Providing For The Interchangeability Of 9 mm x 19 Ammunition
- **AOP-4172** – Technical Performance Specification Providing For The Interchangeability Of 5.56 mm x 45 Ammunition
- **AOP-4383** – Technical Performance Specification Providing For The Interchangeability Of 12.7 mm x 99 Ammunition
- **AOP-4509** – Technical Performance Specification Providing For The Interchangeability Of 5.7 mm x 28 Ammunition
- **AOP-4820** – Technical Performance Specification Providing For The

Interchangeability Of 5.7 mm x 28 Ammunition
- **STANAG 2310** – Technical Performance Specification Providing For The Interchangeability Of 7.62 mm x 51 Ammunition
- **STANAG 4090** – Technical Performance Specification Providing For The Interchangeability Of 9 mm x 19 Ammunition
- **STANAG 4172** – Technical Performance Specification Providing For The Interchangeability Of 5.56 mm x 45 Ammunition
- **STANAG 4383** – Technical Performance Specification Providing For The Interchangeability Of 12.7 mm x 99 Ammunition
- **STANAG 4509** – Technical Performance Specification Providing For The Interchangeability Of 5.7 mm x 28 Ammunition
- **STANAG 4820** – Technical Performance Specification Providing For The Interchangeability Of 5.7 mm x 28 Ammunition

1.6 Other Related Documents

- **AOP-2** – The Identification of Ammunition
- **AAP-6** – NATO Glossary of Terms and Definitions
- **AAS3P-22** – Safety and Suitability For Service Assessment Testing For Small Calibre Ammunition Less Than 20 mm
- **AC/225 (Panel III/SP.1) D/237** – Drawing Of Primer Sensitivity Test Equipment For Primers Used In NATO Small Arms Ammunition
- **STANAG 2895** – Extreme Climatic Conditions And Derived Conditions For Use In Defining Design/Tests Criteria For NATO Forces Materiel

1.7 General Instructions

1.7.1 Test Procedure And Equipment

Utilisation shall be as follows:

a. The test procedures and equipment described in this manual shall be used for all interchangeability tests except when deviations are specifically authorised by AC/225 (LCGDSS-SG/1) or the equipment is designated as optional.

b. The test procedures and equipment described herein are not mandatory for use for routine national proof. However, the use at a national level of the equipment and technical procedures defined in AEP-97 will enhance the overall objective of standardisation amongst participating NATO nations.

1.7.2 Basic Principles of NATO Testing

The test procedures described in AEP-97 are as detailed and comprehensive as seems practicable and necessary. They cannot, within this context, contain specific instructions covering all possible situations that may arise in testing. It is anticipated that the agencies

for whom AEP-97 is prepared may supplement its provisions with standing operating procedures appropriate to the local situation. It is assumed further that the testing establishments who may use this manual will be cognisant of the basic principles which must govern the conduct of tests and will align their procedures and practices in areas not specifically covered by provisions of AEP-97. However, adherence to the specified procedures and equipment is considered necessary to assure uniformity of test results, and deviations shall not be permitted on official NATO tests of interchangeability without the authorisation of AC/225 (LCGDSS-SG/1).

1.7.3 Defects or Irregularities Not Covered by AEP-97

Any irregularity or defect, even if not covered specifically in AEP-97, which is detected during testing and could, in the opinion of the RTC Superintendents, adversely affect suitability for armed forces use, proper functioning, handling, safety or storage of the ammunition may be grounds for failure of the submitted ammunition. If, in these circumstances, the submitting nation does not accept the decision of the Superintendent of the RTC, the final decision on acceptance or rejection shall be made by AC/225 (LCGDSS-SG/1).

1.7.4 Statistical Analysis

In addition to the detailed procedures given in the individual tests, there are certain general guidelines upon which AC/225 (LCGDSS-SG/1) has agreed, particularly with regard to statistical analysis of results. It has been agreed in general that the various tests are not independent but largely supplementary, and functional characteristics of the ammunition are adequately assured without detailed statistical analysis of all the separate tests.

1.7.5 Recording of Results

The method of recording of results as it applies to the number of decimal places to be recorded for each test parameter is contained in each of the individual test AEP-97 volumes in the “Recording of Results” paragraph.

1.7.6 Standard Deviation

When the acceptability of a performance requirement is to be assessed based on the measurement of standard deviation (*s*), the following formula shall be used in the analysis of the data:

$$s = \sqrt{\frac{\sum \left(x - \bar{x}\right)^2}{n-1}}$$

where x is the individual value, $\bar{x}$ is the mean of the individual values and n is the number of individual values.

1.7.7 Rounding Procedures

When a number is to be rounded to a specific number of significant figures, the rounding procedure shall be carried out in accordance with the following rules:

a. When the next figure after the last place to be retained is less than five (5), the figure in the last place retained shall be kept unchanged, e.g. 0.044 is rounded to 0.04.

b. When the next figure after the last place to be retained is five (5) or greater than five (5), the figure in the last place retained shall be increased by one (1), e.g. 0.045 is rounded to 0.05 and 0.046 is rounded to 0.05.

c. A number shall always be rounded off in one step to the number of figures that are to be recorded and should not be rounded in two or more steps of successive rounding.

1.7.8 Treatment of Outliers

When in a series of values, one value is extremely different from the others, it has been agreed that consideration should be given to excluding the outlying value. A value should not be considered for exclusion on this basis unless it is at least 3.75 mean deviations calculated, including the suspect value (or the equivalent criterion: at least 3.00 standard deviations) from the mean. Where this criterion is met, and if the study of circumstances seems to warrant such rejection, it is important that further steps be taken to try to determine the cause and to judge whether the outlying value may then be rejected. The investigator is reminded that the above criterion is valid only for data sets comprised of eleven (11) or more values. Should further doubt exist as to the validity of a value in a set, it is recommended that more powerful statistical tests be employed (e.g. Dixon criterion) to detect the presence of an outlier.

1.8 Inspection Standards

The visual inspection criteria and photographs in AEP-97 - Volume 6 (Equipment and Drawings), Annex 6-C (Visual Standards for Production Defects) of this manual are prepared for inspection reference purposes. These photographic standards are subject to revision and additions as experience indicates.

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 1

NATO AMMUNTION INTERCHANGEABILITY PRINCIPLES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

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NATO STANDARDIZATION OFFICE (NSO)

1.0 Introduction

1.1. Scope

The scope of this manual is to prescribe the uniform test methods, equipment and inspection procedures to assess the technical performance requirements for the following NATO small arms ammunition standards to ensure functional interchangeability on the battlefield.

STANAG / AOP 4820	4.6 mm x 30 Ammunition
STANAG / AOP 4172	5.56 mm x 45 Ammunition and Links
STANAG / AOP 4509	5.7 mm x 28 Ammunition
STANAG / AOP 2310	7.62 mm x 51 Ammunition and Links
STANAG / AOP 4090	9 mm x 19 Ammunition
STANAG / AOP 4383	12.7 mm x 99 Ammunition and Links

Under the scope of the above standards and this manual, interchangeability is understood if the ammunition is in conformance with the performance, functioning and safety criteria as detailed in AEP-97, Multi-Calibre Manual of Proof and Inspection (MC-MOPI) for NATO Small Arms Ammunition.

Ammunition natures other than those utilised on the battlefield (such as, blank or training ammunition) are outside the scope of the referenced standards and this manual, unless otherwise indicated.

1.2. Authority

This manual and the provisions contained within its associated volumes are codified in accordance with the standards which include this publication by reference.

1.3. Agreement

In ratifying one or more of the above standards, nations agree to the following implementation mechanism applicable to the related calibre:

a. Implementation of the standard will be managed by a NATO body, currently the Sub-Group on NATO Small Arms Ammunition Interchangeability, AC/225 (LCGDSS-SG/1), which will assess the compliance of ammunition designs with the technical performance requirements defined in the relevant standard and will authorise the use of the appropriate NATO Symbol of Interchangeability (Annex 1-A). Volume 5 contains information concerning NATO Ammunition Standardization - Organisational Structure and Responsibilities contains information on the procedure to be followed when urgent SG/1 action is required between plenary meetings.

b. This assessment will consist of tests of interchangeability conducted periodically at NATO certified Regional Test Centres (RTC) or NATO

certified National Test Centres (NTC) as specified in paragraphs 1.6.1, a, b and c, below

c. The nature and frequency of the tests, the test procedures, and the details of NATO Reference Ammunition and test equipment shall be as defined in the applicable volumes of AEP-97.

d. To comply with the standardization drawings and technical specifications in the referenced standards and AEP-97.

e. Nations shall submit samples for tests as specified in accordance with AEP-97.

f. Nations shall adhere to the rules herein laid down governing the use of the appropriate NATO Symbol of Interchangeability (paragraph 1.42 and Annex A).

g. Nations agree to observe the rules herein laid down regarding changes to ammunition designs for which the use of the appropriate NATO Symbol of Interchangeability (Annex 1-A) has already been authorised.

h. Nations agree to accept and comply with the responsibilities listed in AEP-97 - Volume 5.

1.4 National Responsibilities For NATO Ammunition Designs

Each nation recognises the following incumbent responsibilities:

a. Implementation will considered to have been met when ratifying nations have introduced into their armed forces ammunition and/or linked ammunition which has met the requirements of this the related NATO calibre standard and the Multi-Calibre Manual of Proof and Inspection Procedures (AEP-97). The national documentation which demonstrates this shall be identified as the National Implementing Document(s). It should be noted that reference to the STANAG alone as the National Implementing Document does not meet this intent.

b. Each implementing nation shall take prudent efforts to submit ammunition design for NATO Qualification or ensure that procurement of already qualified NATO designs are submitted for the required testing once that ammunition design is fielded by their armed forces.

c. The NATO nation obtaining an official NATO design number for ammunition it has qualified at a NATO Regional Test Centre is only responsible for the actual ammunition that it has procured or produced for its own stockpile. The nation does not assume responsibility of the actual design detail as all NATO nations are entitled (subject to contractual arrangements and design rights

agreement) to procure NATO designs qualified by other NATO nations. However, the procuring nation will retain full responsibility for the ammunition lots that it procures for its stockpile while it bears the appropriate NATO Symbol of Interchangeability.

d. Each nation is required to take steps to assure that the appropriate NATO Symbol of Interchangeability is applied only to ammunition configurations which have been tested in accordance with the provisions of this manual and for which authorisation has been granted by AC/225(LCGDSS-SG/1).

e. Only ammunition that has been qualified by the procedures contained herein and which bears the appropriate NATO Symbol of Interchangeability may be represented as "NATO Interchangeable Ammunition".

1.5 National Responsibilities for Safety and Suitability of Ammunition Submitted for NATO Testing

This standard (AEP-97) does not address the aspect of Safety and Suitability as stated in NATO document, Safety and Suitability for Service Assessment Testing of Small Calibre Ammunition Less Than 20 mm, AAS3P-22. The purpose of the AAS3P-22 document is to guide personnel involved in the planning and implementation of S^3 assessment testing of munitions to enable appropriate evidence to be collected covering the entire life cycle and to provide data to demonstrate that the munitions will be “safe for use” throughout the potential deployment possibilities in NATO service.

Each nation submitting ammunition to a RTC for testing recognises the following incumbent responsibilities:

a. The agreements underlying this manual are inter-governmental. The national authority submitting ammunition for NATO testing, and subsequent use by NATO forces, is required to take steps to assure that adequate governmental control is exercised when ammunition is produced by the defence industry. Each nation is only to submit ammunition that has been accepted nationally and certified by the submitting national authority as being safe and suitable for use by the armed forces.

1. To ensure the safety of Test Centre personnel, the ammunition is to have been proof and function tested under the control[2] of the national authority (which may include a National Test Centre or a ISO 9001 certified production facility) of the submitting nation. The tests must have included a basic Function & Casualty test using, as a minimum, national weapons and an EPVAT test.

Note: “under the control of the national authority” can mean that the test facility, which can be the ammunition manufacturer’s test range, is certified to the relevant ISO standards and is audited by either a resident or visiting government authorised representative.

b. There is no restriction on the nation of origin of ammunition submitted for Qualification Approval testing. The NATO nation submitting the ammunition will retain full responsibility for the ammunition it produces or procures for its own stockpile while it bears the appropriate NATO Symbol of Interchangeability.

1.6. NATO Tests of Interchangeability

1.6.1. Levels of tests

AEP-97 covers three levels of tests for NATO interchangeability designated as follows:

a. **NATO Qualification Approval Test.** This test is conducted initially for each ammunition design submitted and serves to establish the compliance of those designs with the provisions of the appropriate standard. When this test is successfully completed and a design number has been allocated by the Secretary of AC/225 LCGDSS, the submitting nation shall apply the appropriate NATO Symbol of Interchangeability to the outer pack of all ammunition subsequently produced to the exact same design until such times as the ammunition either fails a Production Test or the nation fails to submit the ammunition for a Production Test within the specified time/quantity period. It is not permitted for ammunition producers to sell NATO ammunition marked with the NATO Interchangeability Symbol (cloverleaf) to a non-NATO member nation. However, it is permitted for NATO governments (subject to any “end user” restrictions imposed by the supplier) to sell surplus NATO qualified ammunition to non-NATO member countries.

Note: AEP-97 - Volume 2 contains the detailed procedure for submitting ammunition for Qualification Approval Testing.

b. **NATO Production Test.** This test is conducted to establish that subsequent production of the qualified ammunition design continues to merit the appropriate NATO Symbol of Interchangeability and to detect design or production changes which may have been inadvertently introduced into production in violation of the agreement, paragraph 1.3 above. Failure of the ammunition to meet the applicable requirements may result in suspension of the use of the NATO Symbol of Interchangeability. It may also result in either the removal of the symbol from existing stocks of the relevant production period or the need to constrain/quarantine the affected ammunition (including any adjacent ammunition lots that are affected) from issue to any coalition forces. The procedure to be followed to re-qualify the ammunition production is specified in AEP-97, Volume 3.

Note: AEP-97 - Volume 3 contains the detailed procedure for submitting ammunition for Production Testing.

c. **NATO Surveillance Test.** These tests of qualified stockpiled ammunition are conducted at specified intervals to establish that ammunition bearing a NATO Symbol of Interchangeability continues to meet NATO requirements after the specified storage interval in the relevant climatic storage environment. In the event of failure of the ammunition to meet the applicable requirements, the nation concerned must take corrective action to delete any previously marked interchangeability symbols from applicable segments of the stockpile. As an alternative, the nation may take the necessary logistic actions that will restrict access of any coalition forces to the applicable segments of the nation's concerned stockpile.

Note: AEP-97 - Volume 4 contains the detailed requirements for Surveillance Testing.

1.6.2. NATO Symbol of Interchangeability

The NATO Symbol of Interchangeability, as shown in Annex 1-A of this volume, is the **ONLY** symbol that denotes that the packaged ammunition is interchangeable by NATO Member Forces. The appropriate symbol shall be applied to the ammunition packaging when ammunition has successfully completed Qualification Approval testing in accordance with the AEP-97 requirements and a design number has been issued by the Secretary of AC/225 LCGDSS. The rules regarding the continued use of the NATO Symbol of Interchangeability are contained in the above paragraphs concerning interchangeability testing.

1.6.2.1 NATO Design Mark

Within NATO standardisation of small calibre ammunition, the NATO design mark (cross inside a circle) on its own, without the NATO Symbol of Interchangeability (four leaf clover) on the original outer pack, **has no official significance or definition**. However, it is generally accepted that ammunition marked with the NATO design mark should, **but cannot be guaranteed,** to chamber correctly in a weapon. It should **NOT** be assumed though that it will produce the expected performance or necessary level of safety required by the relevant standard and AEP-97. It is recommended to refrain from using the NATO design mark.

1.6.3 NATO Test Centres

There are two NATO Regional Test Centres (RTC) certified for the conduct of NATO testing of small arms ammunition. The European Regional Test Centre (ERTC) is located in the United Kingdom and the North American Regional Test Centre (NARTC) is located in the United States of America. Each NATO nation may establish its own NATO certified National Test Centre (NTC).

Test Centres at the regional and national levels shall be utilised as follows:

a. **NATO** Qualification Approval (QA) and NATO Production Tests (PT) shall be conducted at a NATO certified RTC on a repayment basis.

b. NATO Surveillance tests shall be conducted at a NATO certified National Test Centre (NTC) equipped to the criteria defined in AEP-97.

Note: The use of the abbreviation NTC throughout this manual applies only to a NTC that has been certified by NATO SG/1 for the specific calibre.

c. RTC or other NATO certified NTC shall conduct surveillance tests, on repayment, for those countries without a certified NTC.

1.6.3.1 Certification of NATO Regional and NATO National Test Centres

The details regarding certification of NATO Regional and National Test Centres are contained in Annex 1-B of this volume.

1.6.3.2 Range Standardisation between Regional and National Test Centres

The detailed procedures for Range Standardisation testing are contained in Annex 1-C of this volume.

1.6.4 NATO Reference Ammunition

The establishment, assessment, and usage of NATO Reference Ammunition shall be undertaken according to the following:

a. NATO Reference Ammunition will be established by AC/225(LCGDSS-SG/1) in accordance with the procedures defined in AEP-97-Volume 8, NATO Reference Cartridges.

b. When the use of a NATO Reference Ammunition is specified in this manual, only the NATO Reference Ammunition will be used

c. The ballistic assessment of the NATO Reference Ammunition will be undertaken by the Superintendents of the RTCs. It is the responsibility of participating nations to ensure that their NTC is using NATO Reference Ammunition and is getting similar results to the RTC.

d. It is not the intention for NATO Reference Ammunition to be used for everyday production control. National authorities should produce or procure their own reference ammunition, matched to the NATO Ammunition, for this purpose. Normally the typical lot size of NATO Reference Ammunition represents official NATO RTC/NTC requirements for several years. AEP-97 - Volume 8, explains the purpose and use of NATO Reference Ammunition in detail.

1.7 NATO Nominated Weapons (NNW)

The NATO Nominated Weapon (NNW) is one of the most important aspects of the NATO Small Arms Ammunition Interchangeability program. These weapons, provided by NATO Member nations, are utilized for the Function and Casualty Test which provides the direct evidence that ammunition designs qualified by NATO Member nations will **ALL** safely and satisfactorily function in another nation's weapon to confirm that the ammunition can be interchanged on the battlefield.

It is imperative that all NATO Member nations ensure that the weapons fielded by their Armed Forces are capable of functioning with NATO Qualified Ammunition. One method of achieving this is by ensuring that a NATO Nations' infantry weapons are submitted as a NNW or are similar in technical stature to an existing NNW in the family of NATO Nominated Weapons per the applicable calibre.

1.7.1 Conditions for Submitting NNW

Member nations proposing to sponsor the introduction of a national weapon as a NNW will be required to meet the conditions specified in AEP-97 - Volume 9, NATO Nominated Weapons Guidelines. Special purpose or limited application weapons (e.g. sniper rifles) are not to be considered as a NNW.

1.7.2 Replacement/Upgrading or Withdrawal of NNW

The conditions and procedures pertaining to replacement, modification, or withdrawal are also contained in AEP-97 - Volume 9.

1.7.3 Ammunition Availability for NNW Test

The Superintendents of the RTCs shall produce a test plan which identifies the NATO Qualified Designs to be used for the Nominated Weapon Evaluation. The NATO Qualified Designs identified will be based on samples remaining from previous successful NATO QA or PT submissions that were held at the RTCs for this specific purpose. As this would indicate, most of these designs are only ACTIVE and PASSIVE NATO Qualified Designs. If a nation has a DORMANT NATO Qualified Design, it will NOT be included as part of the NATO Nominated Weapon Evaluation testing and hence there is no recourse if it fails in subsequent NATO Production Testing. It is incumbent that nations ensure that DORMANT designs are periodically submitted for PT testing in order to keep them in at least a PASSIVE status. In addition, if a specific ammunition design is warranted, the RTC will request the nation of that NATO Qualified Design to submit a sample of the ammunition design for the NNW Evaluation Test.

ANNEX 1-A
NATO SYMBOLS OF INTERCHANGEABILITY

1.A.1. SYMBOL DENOTING INTERCHANGEABILITY OF CARTRIDGE ONLY

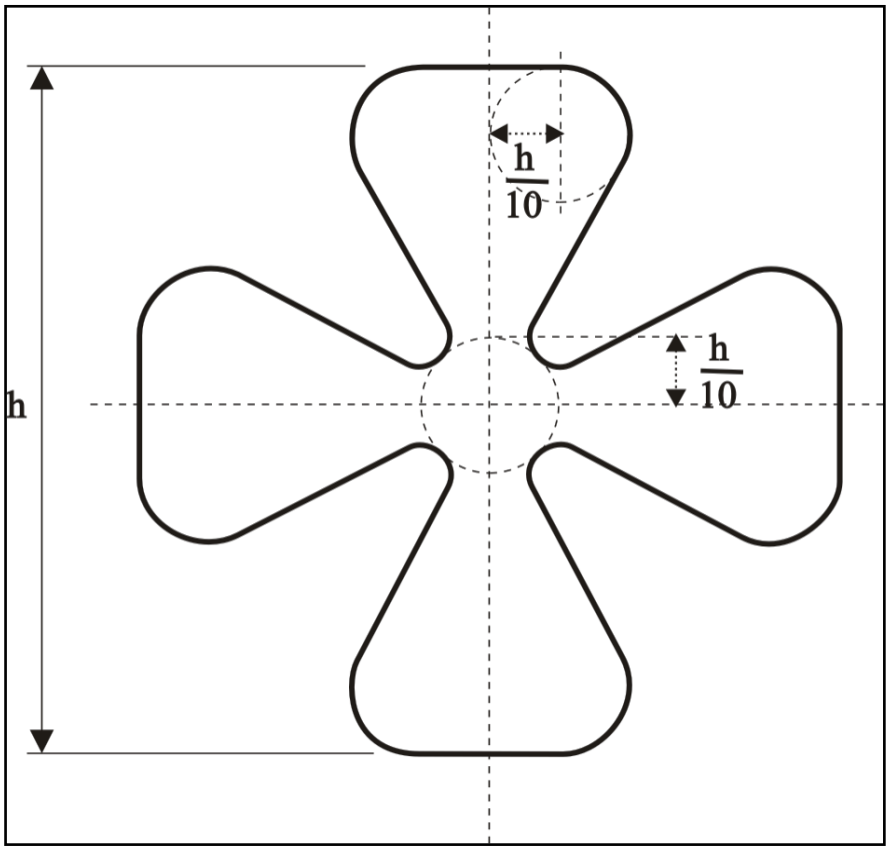

Figure. 1-A-1
Symbol Denoting Interchangeability of Cartridge only
(4.6mm, 5.56 mm, 5.7mm, 7.62 mm, 9 mm)

Symbole Identifiant l'interchangeabilitié de la Cartouche

1.A.2. SYMBOL DENOTING INTERCHANGEABILITY OF CARTRIDGE AND LINK

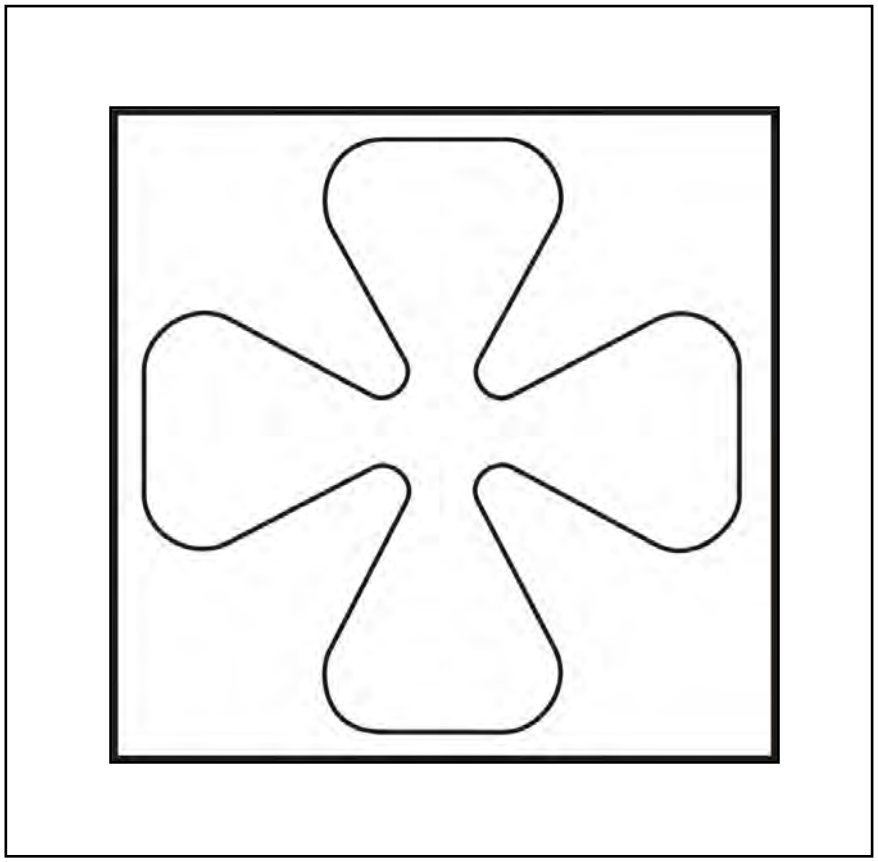

Figure. 1-A-2

Symbol Denoting Interchangeability of Cartridge and Link (5.56 mm, 7.62 mm, 12.7 mm)

Symbole identifiant l'interchangeabilitié de la Cartouche et de l'emballage tactique

ANNEX 1-B
NATO CERTIFICATION OF REGIONAL AND NATIONAL TEST CENTRES

1.B.1 NATO Certification

Before proceeding to carry out testing in accordance with the requirements of AEP-97, the RTC/NTC must obtain NATO certification by AC/225(LCGDSS-SG/1) for specified calibres. RTC certification will be based upon a report and recommendations established by the other RTC Superintendent with the assistance of any national delegates who wish to participate in the certification. NTC certification will be based upon a report and recommendations established by the Superintendents of the RTCs. To maintain certified status, the RTC/NTC must ensure that it updates its equipment and procedures in line with any changes to AEP-97.

1.B.2 RTC Certification Request

When requesting NATO certification, the RTC Superintendent is to specify the certification it requires by calibre. The RTC Superintendent requesting the certification is to submit a request to the SG/1 Chairman asking for a certification inspection visit by the Superintendent of the other RTC and detailing the anticipated time frame. The visiting RTC Superintendent is to be formally asked by the hosting RTC Superintendent to carry out the inspection.

1.B.3 NTC Certification Request

When requesting NATO certification, the SG/1 Head of Delegation of the requesting nation shall submit a request to the SG/1 Chairman asking for the certification inspection visit by the Superintendents of the RTCs, specifying the caliber(s) for which he is requesting certification and detailing the anticipated time frame for the inspection. Both Superintendents are also to be formally asked by the national delegate of the requesting nation to carry out the inspection. NTC national authorities have to demonstrate that testing will be independent of manufacturer/contractor influence as surveillance tests are official NATO interchangeability tests.

1.B.4 Scope of Inspection

The RTC/NTC will be inspected by the appropriate personnel who will determine that the facility(s) has all the necessary equipment and instrumentation as prescribed in AEP-97 and has qualified personnel to carry out the relevant tests in accordance with the AEP-97 procedures. The RTC/NTC will be requested to conduct various tests to demonstrate technical competence and correlation with RTC results. Additional demonstrations of competence may be required if deemed necessary by SG/1 or Superintendent RTC as appropriate.

1.B.5 Use of National Equipment At NTC

After a NTC has been certified, it may request authorisation through SG/1 to use its national equipment in carrying out NATO tests after providing the Superintendent of the RTC with evidence that this equipment gives results equivalent to and as precise as those obtained with the NATO prescribed test equipment. However, the NTC will retain its NATO prescribed test equipment for resolving any test discrepancies.

ANNEX 1-C
RANGE STANDARDISATION

1.C.1 Range Standardisation Between Regional Test Centres

To assure comparability of procedures and correlation of results obtained at both RTCs, range calibration firings will be conducted annually or more often if required. The calibre of ammunition to be tested will be chosen by the Superintendents of the RTCs so that during successive years the entire range of NATO qualified ammunition will be subjected to the Range Standardisation test.

1.C.2 Range Standardisation Between Regional And National Test Centres

Upon request from the SG/1 national delegate to the RTC Superintendents, similar tests may be conducted between the RTC and NTC. The costs for any such test will be paid for by the requesting nation unless otherwise agreed.

1.C.3 Ammunition Samples

Each RTC will select the necessary quantity of a NATO qualified production lot. The following sample of ammunition will be exchanged between the RTCs, with an equal quantity being retained:

NATO Production Cartridges - 640 (from 1 Lot of NATO Qualified Ammunition)

1.C.4 Test Procedures

The tests listed below will be conducted at each test centre using its own test barrels, transducers, and ammunition.

AEP-97 Volume	Test	NATO Qualified Production Cartridges from ERTC	NATO Qualified Production Cartridges from NARTC	Remarks
12	EPVAT	60	60	Thirty (30) cartridges from each of two (2) barrels
18	Precision	120	120	Six (6) - ten (10) round targets from each of two (2) barrels
24	Primer Sensitivity	300	300	Exact ammunition quantity is dependent on performance
25	Bullet Extraction	20	20	Pulling head rate of 15cm per minute is to be applied
	Extra	140	140	For re-test if necessary
	Total	**640**	**640**	

1.C.5 Reporting Of Results

The results of the Range Standardisation test carried out at each RTC will be exchanged between the two Superintendents. One Superintendent, by agreement, will produce a standardisation report for the next AC/225 (LCGDSS-SG/1) meeting. Where there are large differences in results that cannot be explained, the Superintendents are to conduct an investigation and report their findings to the next meeting of SG/1.

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 2

NATO QUALIFICATION APPROVAL TEST

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

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2.1 Introduction

AEP-97, Volume 1, paragraph 1.4.1a, describes the objective of the NATO Qualification Approval (QA) test. This volume covers the eligibility rules and administrative procedures for submitting ammunition for testing, the quantity of ammunition required, and actions to be taken in the event of failing a test.

2.2 Submission of Ammunition for NATO Qualification Approval Testing

2.2.1 Eligibility Rules

For ammunition to be eligible for submission for Qualification Approval testing the following conditions shall apply:

a. The submitting NATO nation shall have already procured[1] or produced the ammunition for use by their armed forces.

b. The national authority of the submitting nation shall have declared the ammunition safe and suitable for use by their armed forces.

c. The ammunition shall conform to the requirements of the relevant standards listed in AEP-97, Volume 1.

d. The ammunition sample submitted for QA shall be a representative sample, from a normal production lot of not less than 100,000 cartridges of ball ammunition (50,000 of all other types), that has passed all national proof and inspection requirements of the submitting nation. The ammunition must have been successfully tested at a National Test Centre or an ISO 9001 certified facility (which could be the ammunition producer). Ammunition accepted by the procuring nation under such a system **does not require** any further testing at a National or Government Test facility prior to submission for a NATO QA test.

e. To ensure the safety of Test Centre personnel, the ammunition is to have been proof and function tested under the control[2] of the national authority (which may include a National Test Centre or an ISO 9001 certified production facility) of the submitting nation. The tests must have included a basic Function & Casualty test using, as a minimum, national weapons and an EPVAT test.

f. It is **NOT** possible for manufacturers or non-NATO nations to independently submit ammunition for NATO QA testing.

Note 1: As stated in AEP-97, Volume 1, there is no restriction on the nation of origin of ammunition submitted for QA testing. The submitting NATO nation will retain full responsibility for all ammunition under its control while it bears the appropriate NATO Symbol of Interchangeability.

Note 2: "under the control of the national authority" can mean that the test facility, which can be the ammunition manufacturer's test range, is certified to the relevant ISO standards and is audited by either a resident or visiting government authorised representative.

2.2.2 Administrative Procedures

The following administrative procedure is to be followed when submitting ammunition for testing:

a. Authority for Submission. Ammunition may only be submitted with the written authority of the SG/1 national delegate of the submitting nation.

b. Ammunition Delivery. Delivery of the ammunition to the RTC is the responsibility of the submitting nation. The ammunition is to be delivered to the RTC free of charge with any relevant import/export, excise duties and transportation charges paid. The quantity and format of the ammunition to be delivered is contained in the table at paragraph 2.2.2.d.

c. Documentation. The following documents must be sent to the Superintendent and Proof Officer of the RTC. The documents are to be sent to the email addresses of the Superintendent and Proof Officer. The correct email addresses can be obtained from the SG/1 Chairman or SG/1 Secretary:

(1) One copy of the Request for NATO Qualification Approval or Production Test Form (Annex 2-G) from this manual signed by the national delegate of the submitting nation. It must be indicated on the form which level of interchangeability is desired, for example with 5.56 mm x 45 there are two levels of testing: cartridge only; cartridge and link.

(2) One copy of the ammunition design data/build standard which shall contain:

- General arrangement/assembly drawing
- Cartridge case drawing
- Bullet drawing
- Primer drawing
- Link drawing (if applicable)
- Propellant composition including tolerances for each ingredient
- Primer composition including tolerances for each ingredient
- Separate drawing issue or control list if applicable

(3) One copy of a detailed chemical analysis report for the Propellant and Primer compositions, issued by a government approved official laboratory. AEP-97, Volume 25 gives comprehensive details on this subject.

(4) One copy (if applicable) of the Certificate of Conformity for the Link Cartridge Stripping (not necessary for 12.7 mm), Dimensional

Characteristics, Visual Inspection and Salt Corrosion Test results certifying that the submitted links meet the national specifications for these tests.

Note: Confidentiality of Information and Documentation. The Superintendent of the RTC shall retain a full set of design data until the ammunition design is declared obsolete by the submitting nation at which time they may request the return of the design data or declaration of destruction. The Superintendent of the RTC shall also retain on a permanent basis a full set of the NATO QA tests results. This information and the information it contains will be held in strict confidence. If there is a justified request from a nation to obtain all necessary information about an ammunition design, this request has to be addressed to the national delegate of the submitting nation. It is the responsibility of the national delegate of the submitting nation to provide the necessary information to the requesting nation. If the submitting nation refuses to provide the information, the question as to whether or not the request was justified will be discussed in the next plenary meeting of SG/1. If the members of SG/1 decide that the request was justified, the submitting nation is obliged to provide the necessary information.

(5) One copy of the original national proof results.

(6) All nations submitting ammunition to the ERTC for testing will have to provide Hazard and Precautionary Statements for the product. It is now a legal obligation for safety information to be available at the ERTC for ammunition being tested at the range. This should include the appropriate abbreviations for the Hazard Information Risk and Safety and other phrases (ERTC Superintendent will forward a copy of these phrases and their abbreviations on request). Also to be included on the Hazard Data Sheet is practical information about any hazardous ingredients including any recommendations about inhalation levels of airborne particles and toxic fumes. Known carcinogens contained in any of the initiating, propelling or trace compositions should also be identified, including details on acceptable inhalation levels. This basic information should be readily available as all western countries have duty of care legislation which would insist on this information being available at the place of manufacture and for the intended user of the product.

(7) Invoicing Address to which request for payment can be sent including contact name, telephone and facsimile numbers and email address.

d. Ammunition Quantity Required. The ammunition quantity to be delivered shall be in accordance with the table below (to the nearest complete box or convenient delivery quantity). If it is necessary for the RTC to link the ammunition for an ammunition QA test, then the costs for this activity will have to be borne by the submitting nation. Tests on linked ammunition are conducted when a submitting nation wants to have its linked configuration NATO qualified. If so, the submitting nation shall provide a sample of ammunition for testing in its linked configuration. If the submitting nation wants to have its cartridge only NATO qualified, then the RTC will have to link the ammunition for the Barrel Erosion Test and the Function and Casualty Test using links available at the RTC. Surplus cartridges from the

sample will be used for re-tests and investigative programmes when necessary. This is particularly relevant if a subsequent PT fails.

Calibre	Nature	Single Cartridges	Linked Cartridges	Total Cartridges
4.6 mm x 30	Ball	21600	--	21600
5.56 mm x 45	Ball	3000	24500	27500
5.56 mm x 45	Tracer	3500	7200	10700
5.7mm x 28	Ball	21230	--	21230
5.7mm x 28	Tracer	4450	--	4450
7.62 mm x 51	Ball	19700	3300	23000
7.62 mm x 51	Tracer	3300	3300	6600
9 mm x 19	Ball	4500	--	4500
12.7 mm x 99	Ball	3700	6500	10200
12.7 mm x 99	Tracer	3700	6500	10200
12.7 mm x 99	Armour Piercing (AP), Armour Piercing Incendiary (API), etc.	3700	6500	10200
12.7 mm x 99	Multi-Purpose (MP)	3700	6500	10200

2.2.3 Payment for Testing

Payment for testing is the responsibility of the SG/1 national delegate, although for administrative purposes the RTC may at its discretion agree to directly invoice the ammunition producer if this has been agreed to between the ammunition producer and the submitting nation. **It is the responsibility of the national delegate to provide a written declaration that this arrangement has been agreed**. In the event of a dispute over payment, the delegate of the submitting nation shall immediately arrange for payment from government funds and then take recovery action against the contractor if deemed appropriate.

2.2.4 Notification of Test Sample Submission and Testing Duration

Nations should endeavour to provide the RTC Superintendent at least three (3) months' notice of their preferred dates for a Qualification Approval Test. The QA test and subsequent reporting will require a minimum of sixteen (16) weeks for completion. The Superintendent will take account of measures such as combining tests to achieve overall cost and time savings and will ensure that the testing is completed as soon as possible after receipt of the ammunition and supporting documentation. It must be noted however that the ERTC and NARTC are not funded by NATO. The RTCs are managed and staffed on a voluntary basis by the United Kingdom and United States who provide the funding to support these test centres for the exclusive benefit of NATO SG/1 and therefore priority cannot always be given for NATO work.

2.2.5 Testing Sequence

Nations submitting samples should contact the relevant RTC Superintendent to discuss in advance the test sequence details. If the RTC Superintendent does not receive contact from the submitting nation, he will use his judgement and conduct the tests in the most efficient order possible. Normally, the thirty (30) day climatic tests will be conducted first as this is the most common area where failures occur. In the event of the ammunition failing any test, the Superintendent will consult with the submitting nation for their decision on whether to proceed with the remainder of the testing.

2.3 List Of NATO Qualification Approval Tests

The Qualification Approval tests to be conducted by the RTCs[3] are contained in the following annexes to this volume:

Annex 2-A 4.6 mm x 30 - NATO QUALFICATION APPROVAL TESTS
Annex 2-B 5.56 mm x 45 - NATO QUALFICATION APPROVAL TESTS
Annex 2-C 5.7 mm x 28 - NATO QUALFICATION APPROVAL TESTS
Annex 2-D 7.62 mm x 51 - NATO QUALFICATION APPROVAL TESTS
Annex 2-E 9 mm x 19 - NATO QUALFICATION APPROVAL TESTS
Annex 2-F 12.7 mm x 99 - NATO QUALFICATION APPROVAL TESTS

Note 3: The submitting nation is responsible for some additional tests prior to submission, such as Propellant and Primer composition analysis, certain Link Tests and the 12.7 mm Cook-Off Test.

2.4 Conditions And Procedures Applicable During Testing

Until an ammunition design has passed the tests required by the above annexes, the procedures and conditions contained in the following paragraphs shall apply:

a. No production shall be authorised to use any NATO Symbol of Interchangeability.

b. If the ammunition design fails any of the tests, the Superintendent will consult with the submitting nation who can decide whether to proceed with the remainder of the tests. The submitting nation shall pay the RTC for the work completed to date. The design or production process may be improved and a new sample submitted, along with new documentation where appropriate, to the RTC, for such re-tests as the Superintendent of the RTC may consider necessary. All extra testing will be conducted on a repayment basis. The costs will be agreed to between the RTC and the submitting nation prior to commencing the re-test. Alternatively, the national delegate to SG/1 may withdraw the ammunition design.

c. Should the second sample fail the re-test, this procedure shall be repeated until the design has met the AOP/AEP (MOPI) requirements or the submitting nation withdraws the ammunition design. To protect the reputation of the nation and ammunition producer in the interim period, the ammunition will be deemed to be “undergoing testing” and the test results

will be treated as “in-confidence” between the RTC and the submitting national delegate.

d. When the design has passed all of the QA tests, the appropriate NATO Symbol of Interchangeability will then be authorised for use in subsequent production until such time as a PT failure or the failure of a nation to submit the ammunition for PT in accordance with the requirements of AEP-97. Ammunition contracts requiring the application of the NATO Symbol of Interchangeability should also contain a clause stating that the Symbol of Interchangeability is only to be applied to ammunition produced for that individual contract. Manufacturers are not permitted to independently apply the NATO Symbol of Interchangeability.

e. In the event of a borderline test failure, or if a national delegate disputes the results obtained by the RTC, the submitting nation may request a review by SG/1.

f. If a sample is submitted in a linked configuration and the links fail the applicable link tests but all ammunition test requirements are met, then the qualification will be given only for the ammunition design (cloverleaf only).

2.5 Issuance Of NATO Design Number

Upon successful completion of the QA tests the following procedure shall apply:

a. The Superintendent of the RTC shall submit to the Advisor of AC/225 (LCGDSS) the summary of test results and an assembly drawing of the cartridge and link (if the QA is for linked configuration) stamped with the appropriate NATO Symbol of Interchangeability. The Superintendent will also propose a design number to the Advisor of AC/225 (LCGDSS). The Superintendent of the RTC where the QA was conducted will also send a copy of these documents to the Chairman and Secretary of SG/1 and to the other RTC Superintendent.

b. The Advisor of AC/225 (LCGDSS) shall assign a NATO Design Number and publish the documents provided by the RTC Superintendent as a formal NATO document on the NATO website. The NATO document to be published on the website shall be the cover letter assigning the NATO Design Number, the summary sheets of test results and the cartridge (and link if applicable) drawing(s).

c. The national delegate of the submitting nation will be issued with a full set of test results.

d. The RTC shall retain **in strict confidence,** a full set of test results which will only be released with the permission of the submitting national delegate under the conditions contained in the **NOTE** attached to paragraph 2.2.2.

e. If the QA fails to meet NATO requirements, the procedures listed in paragraphs 2.4, a, b and c, shall apply. The submitting nation has the option of asking SG/1 to review the failed QA test results for consideration of requesting a waiver for the qualification of the ammunition only or ammunition/link configuration.

2.6 Changes to a Previously NATO Qualified Design or Change of Ammunition Manufacturer

Nations contemplating a change to a previously qualified ammunition design or ammunition/link design will supply a detailed description of the proposed design change to the Superintendent of the RTC. If only minor changes are made to a previously qualified ammunition or link design, a full new QA test may not be necessary. Major changes could include design or manufacturing changes, or both. The following procedures and conditions shall apply:

a. Upon receipt of the proposed change, the two Superintendents will consult and, if deemed necessary, the appropriate Superintendent will prepare a test programme, defining the tests which must be carried out to evaluate the proposed design or manufacturing change.

b. The appropriate Superintendent will forward to the Chairman and Secretary of SG/1 and the Head of Delegation of the submitting nation details of the proposed change, together with the test programme if required, stating whether or not the magnitude of the change necessitates the allocation of a new NATO Design Number.

c. Upon successful completion of the relevant test programme, the Superintendent of the RTC shall submit to the Advisor of AC/225 (LCGDSS) the summary of test results and an assembly drawing of the modified cartridge and link (if the design change is for the linked configuration) stamped with the appropriate NATO Symbol of Interchangeability per AEP-97, Volume 1, paragraph 1.4.2. The Superintendent shall also note in the NATO Qualification reporting package to the Advisor of AC/225 (LCGDSS) whether or not the magnitude of the design change necessitates the allocation of a new NATO Design Number. If a new NATO Design Number is necessary, the Superintendent will propose the number to the Advisor of AC/225 (LCGDSS). The Superintendent of the RTC where the test programme was conducted will also send a copy of these documents to the Chairman and Secretary of SG/1 and to the other RTC Superintendent. The national delegate of the submitting nation will be issued with a full set of test results. The RTC shall retain on a permanent basis the modified design data as the build standard for the modified ammunition design and a full set of test results. This information will only be released with the permission of the submitting national delegate.

d. The Advisor of AC/225 (LCGDSS) shall publish the documents provided by the RTC Superintendent as a formal NATO document on the NATO website. The NATO document to be published on the website shall consist of a cover

letter either assigning a new NATO Design Number (based on the RTC Superintendent's recommendation) or noting in the cover letter that the NATO Design Number will remain the same; the summary of test results; and the cartridge design (and link if applicable) drawing(s).

e. If the re-design sample fails to meet NATO requirements, the procedures listed in paragraphs 2.4, a, b and c, shall apply and the submitting nation shall pay the RTC for the work completed to date. The design or manufacturing process may either be improved and a new sample submitted, along with new documentation where appropriate, to the RTC for such tests as the Superintendents of the RTC may consider necessary, or the ammunition design may be withdrawn. All testing will be conducted on a repayment basis. The costs shall be agreed between the RTC and the submitting nation prior to commencing the test(s). To protect the reputation of producers in the interim period, the ammunition will be deemed to be "undergoing testing" and the test results will be treated as "in-confidence" between the RTC and the submitting national delegate.

The submitting nation has the option of requesting SG/1 to review the design change test results for consideration of requesting a waiver for the qualification of the ammunition only or ammunition/link configuration.

f. The submitting nation also has the option of continuing to produce or procure ammunition manufactured to a previously approved NATO design.

ANNEX 2-A

4.6 mm x 30 NATO QUALIFICATION APPROVAL - LIST OF APPLICABLE RTC TESTS

4.6 mm NATO Qualification Approval Test	AEP-97 Volume	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure			
EPVAT (Fired @ +21°C)	**12**	**30**	**60**
EPVAT (Fired @ +52°C)	**12**	**30**	**60**
EPVAT (Fired @ - 54°C)	**12**	**30**	**60**
Climatic Storage Test Procedures			
Waterproof - Continuous (Cont.) Heating	**13/26**	**20**	**20**
Waterproof - Exposed (Exp.) Desert	**13/26**	**20**	**20**
Waterproof - Continuous (Cont.) Arctic	**13/26**	**20**	**20**
EPVAT[2] - Untreated	**12**	**30**	**30**
EPVAT – Cont. Heating (Fired @ +21°C)	**13/12**	**30**	**30**
EPVAT – Exp. Desert (Fired @ +21°C)	**13/12**	**30**	**60**
EPVAT – Cont. Arctic (Fired @ +21°C)	**13/12**	**30**	**60**
Action Time – Cont. Heating (Fired @ - 54°C)	**13/12**	**30**	**60**
Action Time – Exp. Desert (Fired @ - 54°C)	**13/12**	**30**	**60**
Action Time – Cont. Arctic (Fired @ - 54°C)	**13/12**	**30**	**60**
Function & Casualty Test Procedure			
Weapon 1 - Gun, Sub-Machine, MP7 (Fired @ +21°C)	**14**	**252**	**252**
Gun, Sub-Machine, MP7 (Fired @ +52°C)	**14**	**124**	**124**
Gun, Sub-Machine, MP7 (Fired @ - 54°C)	**14**	**124**	**124**
Weapon 2 - Gun, Sub-Machine, MP7 (Fired @ +21°C)	**14**	**252**	**252**
Gun, Sub-Machine, MP7 (Fired @ +52°C)	**14**	**124**	**124**
Gun, Sub-Machine, MP7 (Fired @ - 54°C)	**14**	**124**	**124**
Total F & C Test Quantity		**1000**	**1000**
Barrel Erosion	**16**	**7060**	**10080**
Smoke and Flash Test Procedure	**17**	**Quantity Included in F&C Test Procedure**	
Precision Test Procedure	**18**	**90**	**N/A**
Terminal Effects	**19**	**20**	**20**

4.6 mm NATO Qualification Approval Test	AEP-97 Volume	Test Quantity	Re-Test Quantity[1]
Trajectory Match Test Procedure[3]			
Trajectory Match at 50m	**20**	**60**	**60**
Trajectory Match at 100m	**20**	**60**	**60**
Residual Stress	**22**	**50**	**100**
Primer Sensitivity Test Procedure	**23**	**300**	**600**
Bullet Extraction Test Procedure	**24**	**20**	**20**
Waterproof Test Procedure	**26**	**20**	**20**
TOTAL QUANTITY REQUIRED		**9040**	**12560**
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		**21600**	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

Note 2: This separate firing of untreated ammunition may not be necessary if the EPVAT Test and Climatic Test are conducted in the same firing session using the same equipment.

ANNEX 2-B

5.56 mm x 45 NATO QUALIFICATION APPROVAL - LIST OF APPLICABLE RTC TESTS

5.56 mm NATO Qualification Approval Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test [1] Quantity	Test Quantity	Re-Test [1] Quantity
EPVAT Test Procedure					
EPVAT (Fired @ +21°C)	**12**	**30**	**60**	**30**	**60**
EPVAT (Fired @ +52°C)	**12**	**30**	**60**	**30**	**60**
EPVAT (Fired @ - 54°C)	**12**	**30**	**60**	**30**	**60**
Climatic Storage Test Procedures					
Waterproof - Continuous (Cont.) Heating	**13/26**	**20**	**20**	**20**	**20**
Waterproof - Exposed (Exp.) Desert	**13/26**	**20**	**20**	**20**	**20**
Waterproof - Continuous (Cont.) Arctic	**13/26**	**20**	**20**	**20**	**20**
EPVAT[2] - Untreated	**12**	**30**	**30**	**30**	**30**
EPVAT – Cont. Heating (Fired @ +21°C)	**13/12**	**30**	**30**	**30**	**30**
EPVAT – Exp. Desert (Fired @ +21°C)	**13/12**	**30**	**60**	**30**	**60**
EPVAT – Cont. Arctic (Fired @ +21°C)	**13/12**	**30**	**60**	**30**	**60**
Action Time – Cont. Heating (Fired @ - 54°C)	**13/12**	**30**	**60**	**30**	**60**
Action Time – Exp. Desert (Fired @ - 54°C)	**13/12**	**30**	**60**	**30**	**60**
Action Time – Cont. Arctic (Fired @ - 54°C)	**13/12**	**30**	**60**	**30**	**60**
Trace Distance					
Untreated – Rifle, M16A2/A4	**21**	**N/A**	**N/A**	**50**	**50**
Cont. Heat – Rifle, M16A2/A4	**13/21**	**N/A**	**N/A**	**50**	**50**
Exp. Desert – Rifle, M16A2/A4	**13/21**	**N/A**	**N/A**	**50**	**50**
Cont. Arctic – Rifle, M16A2/A4	**13/21**	**N/A**	**N/A**	**50**	**50**
Trace Quality					
Untreated – Gun, Machine, Minimi Mk1	**21**	**N/A**	**N/A**	**50**	**50**
Cont. Heat – Gun, Machine, Minimi Mk1	**13/21**	**N/A**	**N/A**	**50**	**50**
Exp. Desert – Gun, Machine, Minimi Mk1	**13/21**	**N/A**	**N/A**	**50**	**50**
Cont. Arctic – Gun, Machine, Minimi Mk1	**13/21**	**N/A**	**N/A**	**50**	**50**

5.56 mm Qualification Approval Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test [1] Quantity	Test Quantity	Re-Test [1] Quantity
Function & Casualty Test Procedure					
MG, Minimi Mk1 - Free Hang. Belt (Fired @ +21°C)	14	200	200	200	200
MG, Minimi - NATO Chute (Fired @ +21°C)	14	200	200	200	200
Rifle, L85A2 (Fired @ +21°C)	14	180	180	180	180
Rifle, M16A2/A4 (Fired @ +21°C)	14	180	180	180	180
Rifle, AR 70/90 (Fired @ +21°C)	14	180	180	180	180
Rifle, G36/A1 (Fired @ +21°C)	14	180	180	180	180
MG, Minimi Mk1 - Free Hang. Belt (Fired @ +52°C)	14	150	150	150	150
MG, Minimi Mk1 - NATO Chute (Fired @ +52°C)	14	150	150	150	150
Rifle, L85A2 (Fired @ +52°C)	14	160	160	160	160
Rifle, M16A2/A4 (Fired @ +52°C)	14	160	160	160	160
Rifle, AR 70/90 (Fired @ +52°C)	14	160	160	160	160
Rifle, G36/A1 (Fired @ +52°C)	14	160	160	160	160
MG, Minimi Mk1 - Free Hang. Belt (Fired @ -54°C)	14	150	150	150	150
MG, Minimi Mk1 - NATO Chute (Fired @ -54°C)	14	150	150	150	150
Rifle, L85A2 (Fired @ -54°C)	14	160	160	160	160
Rifle, M16A2/A4 (Fired @ -54°C)	14	160	160	160	160
Rifle, AR 70/90 (Fired @ -54°C)	14	160	160	160	160
Rifle, G36/A1 (Fired @ -54°C)	14	160	160	160	160
Total F & C Test Quantity		3000	3000	3000	3000
Link Test Procedure	15	135	270	135	270
Barrel Erosion Test Procedure	16	7060	10080	N/A	N/A
Smoke and Flash Test Procedure	17	Quantity Included in Barrel Erosion and Function & Casualty Test			
Precision Test Procedure	18	90	N/A	90	N/A
Terminal Effects	19	20	20	N/A	N/A
Trajectory Match Test Procedure					
Trajectory Match at 300m	20	60	60	60	60
Trajectory Match at 550m	20	60	60	60	60
Trace Test Procedure	21	Quantity Included in Climatic Test			
Residual Stress	22	50	100	50	100

5.56 mm NATO Qualification Approval Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test [1] Quantity	Test Quantity	Re-Test [1] Quantity
Primer Sensitivity Test Procedure	23	300	600	300	600
Bullet Extraction Test Procedure	24	20	20	20	20
Waterproof Test Procedure	26	20	20	20	20
TOTAL QUANTITY REQUIRED		11175	14830	4495	5130
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		26005		9625	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

Note 2: This separate firing of untreated ammunition may not be necessary if the EPVAT Test and Climatic Test are conducted in the same firing session using the same equipment.

ANNEX 2-C

5.7 mm x 28 NATO QUALIFICATION APPROVAL - LIST OF APPLICABLE RTC TESTS

5.7 mm NATO Qualification Approval Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test Quantity[1]	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure					
EPVAT (Fired @ +21°C)	**12**	**30**	**60**	**30**	**60**
EPVAT (Fired @ +52°C)	**12**	**30**	**60**	**30**	**60**
EPVAT (Fired @ - 54°C)	**12**	**30**	**60**	**30**	**60**
Climatic Storage Test Procedures					
Waterproof – Continuous (Cont.) Heating	**13/26**	**20**	**20**	**20**	**20**
Waterproof – Exposed (Exp.) Desert	**13/26**	**20**	**20**	**20**	**20**
Waterproof – Continuous (Cont.) Arctic	**13/26**	**20**	**20**	**20**	**20**
EPVAT[2] – Untreated	**12**	**30**	**30**	**30**	**30**
EPVAT – Cont. Heating (Fired @ +21°C)	**13/12**	**30**	**30**	**30**	**30**
EPVAT – Exp. Desert (Fired @ +21°C)	**13/12**	**30**	**60**	**30**	**60**
EPVAT – Cont. Arctic (Fired @ +21°C)	**13/12**	**30**	**60**	**30**	**60**
Action Time – Cont. Heating (Fired @ - 54°C)	**13/12**	**30**	**60**	**30**	**60**
Action Time – Exp. Desert (Fired @ - 54°C)	**13/12**	**30**	**60**	**30**	**60**
Action Time – Cont. Arctic (Fired @ - 54°C)	**13/12**	**30**	**60**	**30**	**60**
Trace Distance					
Untreated – Gun, Sub-Machine, P90	**21**	**N/A**	**N/A**	**50**	**50**
Cont. Heat – Gun, Sub-Machine, P90	**13/21**	**N/A**	**N/A**	**50**	**50**
Exp. Desert – Gun, Sub-Machine, P90	**13/21**	**N/A**	**N/A**	**50**	**50**
Cont. Arctic – Gun, Sub-Machine, P90	**13/21**	**N/A**	**N/A**	**50**	**50**
Trace Quality					
Untreated – Gun, Sub-Machine, P90	**21**	**N/A**	**N/A**	**50**	**50**
Cont. Heat – Gun, Sub-Machine, P90	**13/21**	**N/A**	**N/A**	**50**	**50**
Exp. Desert – Gun, Sub-Machine, P90	**13/21**	**N/A**	**N/A**	**50**	**50**
Cont. Arctic – Gun, Sub-Machine, P90	**13/21**	**N/A**	**N/A**	**50**	**50**
Function & Casualty Test Procedure					
Gun, Sub-Machine, P90 (Fired @ +21°C)	**14**	**252**	**252**	**252**	**252**
Pistol, Five-seveN (Fired @ +21°C)	**14**	**155**	**155**	**155**	**155**
Gun, Sub-Machine, P90 (Fired @ +52°C)	**14**	**124**	**124**	**124**	**124**
Pistol, Five-seveN (Fired @ +52°C)	**14**	**80**	**80**	**80**	**80**
Gun, Sub-Machine, P90 (Fired @ - 54°C)	**14**	**124**	**124**	**124**	**124**
Pistol, Five-seveN (Fired @ - 54°C)	**14**	**80**	**80**	**80**	**80**
Total F & C Test Quantity		**815**	**815**	**815**	**815**

5.7 mm NATO Qualification Approval Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test Quantity[1]	Test Quantity	Re-Test Quantity[1]
Barrel Erosion Test Procedure	16	7060	10080	N/A	N/A
Smoke and Flash Test Procedure	17	Quantity Included in Barrel Erosion and Function & Casualty Test			
Precision Test Procedure	18	90	N/A	90	N/A
Terminal Effects	19	20	20	N/A	N/A
Trajectory Match Test Procedure					
Trajectory Match at 50m	20	60	60	60	60
Trajectory Match at 100m	20	60	60	60	60
Trace Test Procedure	21	Quantity Included in Climatic Test			
Residual Stress	22	50	100	50	100
Primer Sensitivity Test Procedure	23	300	600	300	600
Bullet Extraction Test Procedure	24	20	20	20	20
Waterproof Test Procedure	26	20	20	20	20
TOTAL QUANTITY REQUIRED		8855	12375	2175	2675
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		21230		4850	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

Note 2: This separate firing of untreated ammunition may not be necessary if the EPVAT Test and Climatic Test are conducted in the same firing session using the same equipment.

ANNEX 2-D

7.62 mm x 51 NATO QUALIFICATION APPROVAL - LIST OF APPLICABLE RTC TESTS

7.62 mm NATO Qualification Approval Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test Quantity[1]	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure					
EPVAT (Fired @ +21°C)	**12**	**30**	**60**	**30**	**60**
EPVAT (Fired @ +52°C)	**12**	**30**	**60**	**30**	**60**
EPVAT (Fired @ - 54°C)	**12**	**30**	**60**	**30**	**60**
Climatic Storage Test Procedures					
Waterproof – Continuous (Cont.) Heating	**13/26**	**20**	**20**	**20**	**20**
Waterproof – Exposed (Exp.) Desert	**13/26**	**20**	**20**	**20**	**20**
Waterproof – Continuous (Cont.) Arctic	**13/26**	**20**	**20**	**20**	**20**
EPVAT[2] – Untreated	**12**	**30**	**30**	**30**	**30**
EPVAT – Cont. Heating (Fired @ +21°C)	**13/12**	**30**	**30**	**30**	**30**
EPVAT – Exp. Desert (Fired @ +21°C)	**13/12**	**30**	**60**	**30**	**60**
EPVAT – Cont. Arctic (Fired @ +21°C)	**13/12**	**30**	**60**	**30**	**60**
Action Time – Cont. Heating (Fired @ - 54°C)	**13/12**	**30**	**60**	**30**	**60**
Action Time – Exp. Desert (Fired @ - 54°C)	**13/12**	**30**	**60**	**30**	**60**
Action Time – Cont. Arctic (Fired @ - 54°C)	**13/12**	**30**	**60**	**30**	**60**
Trace Distance					
Untreated – MG, T65/E1 or M240B	**21**	**N/A**	**N/A**	**50**	**50**
Cont. Heat – MG, T65/E1 or M240B	**21**	**N/A**	**N/A**	**50**	**50**
Exp. Desert – MG, T65/E1 or M240B	**13/21**	**N/A**	**N/A**	**50**	**50**
Cont. Arctic – MG, T65/E1 or M240B	**13/21**	**N/A**	**N/A**	**50**	**50**
Trace Quality					
Untreated – MG, T65/E1 or M240B	**21**	**N/A**	**N/A**	**50**	**50**
Cont. Heat – MG, T65/E1 or M240B	**13/21**	**N/A**	**N/A**	**50**	**50**
Exp. Desert – MG, T65/E1 or M240B	**13/21**	**N/A**	**N/A**	**50**	**50**
Cont. Arctic – MG, T65/E1 or M240B	**13/21**	**N/A**	**N/A**	**50**	**50**
Function & Casualty Test Procedure					
Gun, Machine, L7A2 (Fired @ +21°C)	**14**	**200**	**200**	**200**	**200**
Gun, Machine, M240B (Fired @ +21°C)	**14**	**200**	**200**	**200**	**200**
Gun, Machine,, L7A2 (Fired @ +52°C)	**14**	**150**	**150**	**150**	**150**
Gun, Machine, M240B (Fired @ +52°C)	**14**	**150**	**150**	**150**	**150**
Gun, Machine, L7A2 (Fired @ - 54°C)	**14**	**150**	**150**	**150**	**150**
Gun, Machine, M240B (Fired @ - 54°C)	**14**	**150**	**150**	**150**	**150**
Total F & C Test Quantity		**1000**	**1000**	**1000**	**1000**

7.62 mm NATO Qualification Approval Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test Quantity[1]	Test Quantity	Re-Test Quantity[1]
Link Test Procedure	15	435	870	435	870
Barrel Erosion Test Procedure	16	7060	10080	N/A	N/A
Smoke and Flash Test Procedure	17	Quantity Included in Barrel Erosion and Function & Casualty Test			
Precision Test Procedure	18	90	N/A	90	N/A
Terminal Effects	19	20	20	N/A	N/A
Trajectory Match Test Procedure					
Trajectory Match at 300m	20	60	60	60	60
Trajectory Match at 550m	20	60	60	60	60
Trace Test Procedure	21	Quantity Included in Climatic Test			
Residual Stress	22	50	100	50	100
Primer Sensitivity Test Procedure	23	300	600	300	600
Bullet Extraction Test Procedure	24	20	20	20	20
Waterproof Test Procedure	26	20	20	20	20
TOTAL QUANTITY REQUIRED		9475	13430	2795	3730
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		22905		6525	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

Note 2: This separate firing of untreated ammunition may not be necessary if the EPVAT Test and Climatic Test are conducted in the same firing session using the same equipment.

ANNEX 2-E

9 mm x 19 NATO QUALIFICATION APPROVAL - LIST OF APPLICABLE RTC TESTS

9 mm NATO Qualification Approval Test	AEP-97 Volume	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure			
EPVAT (Fired @ +21°C)	**12**	**30**	**60**
EPVAT (Fired @ +52°C)	**12**	**30**	**60**
EPVAT (Fired @ - 54°C)	**12**	**30**	**60**
Climatic Storage Test Procedures			
Waterproof – Continuous (Cont.) Heating	**13/26**	**20**	**20**
Waterproof – Exposed (Exp.) Desert	**13/26**	**20**	**20**
Waterproof – Continuous (Cont.) Arctic	**13/26**	**20**	**20**
EPVAT[2] – Untreated	**12**	**30**	**30**
EPVAT – Cont. Heating (Fired @ +21°C)	**13/12**	**30**	**30**
EPVAT – Exp. Desert (Fired @ +21°C)	**13/12**	**30**	**60**
EPVAT – Cont. Arctic (Fired @ +21°C)	**13/12**	**30**	**60**
Action Time – Cont. Heating (Fired @ - 54°C)	**13/12**	**30**	**60**
Action Time – Exp. Desert (Fired @ - 54°C)	**13/12**	**30**	**60**
Action Time – Cont. Arctic (Fired @ - 54°C)	**13/12**	**30**	**60**
Function & Casualty Test Procedure			
Gun, Sub-Machine, PM12S/S2 – Horizontal (Fired @ +21°C)	**14**	**128**	**128**
Pistol, 92F/92FS – Horizontal (Fired @ +21°C)	**14**	**80**	**80**
Gun, Sub-Machine, PM12S/S2 – Depressed (Fired @ +21°C)	**14**	**124**	**124**
Pistol, 92F/92FS – Depressed (Fired @ +21°C)	**14**	**75**	**75**
Gun Sub-Machine, PM12S/S2 – Horizontal (Fired @ +52°C)	**14**	**124**	**124**
Pistol, 92F/92FS – Horizontal (Fired @ +52°C)	**14**	**80**	**80**
Gun, Sub-Machine, PM12S/S2 – Horizontal (Fired @ - 54°C)	**14**	**124**	**124**
Pistol, 92F/92FS – Horizontal (Fired @ - 54°C)	**14**	**80**	**80**
Total F & C Test Quantity		**815**	**815**
Smoke and Flash Test Procedure	**17**	**Quantity Included in Function & Casualty Test**	
Precision Test Procedure	**18**	**90**	**N/A**
Terminal Effects	**19**	**See Volume 19 for details**	

9 mm NATO Qualification Approval Test	AEP-97 Volume	Test Quantity	Re-Test Quantity[1]
Residual Stress	22	50	100
Primer Sensitivity Test Procedure	23	300	600
Bullet Extraction Test Procedure	24	20	20
Waterproof Test Procedure	26	20	20
TOTAL QUANTITY REQUIRED		1655	2155
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		3810	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

Note 2: This separate firing of untreated ammunition may not be necessary if the Temperature Test and Climatic Test are conducted in the same firing session using the same equipment

ANNEX 2-F

12.7 mm x 99 NATO QUALIFICATION APPROVAL - LIST OF APPLICABLE RTC TESTS

12.7 mm NATO Qualification Approval Test	AEP-97 Volume	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure			
EPVAT (Fired @ +21°C)	**12**	**30**	**60**
EPVAT (Fired @ +52°C)	**12**	**30**	**60**
EPVAT (Fired @ - 54°C)	**12**	**30**	**60**
Climatic Storage Test Procedures			
Waterproof – Continuous (Cont.) Heating	**13/26**	**20**	**20**
Waterproof – Exposed (Exp.) Desert	**13/26**	**20**	**20**
Waterproof – Continuous (Cont.) Arctic	**13/26**	**20**	**20**
EPVAT[2] - Untreated	**12**	**30**	**30**
EPVAT – Cont. Heating (Fired @ +21°C)	**13/12**	**30**	**30**
EPVAT – Exp. Desert (Fired @ +21°C)	**13/12**	**30**	**60**
EPVAT – Cont. Arctic (Fired @ +21°C)	**13/12**	**30**	**60**
Action Time – Cont. Heating (Fired @ - 54°C)	**13/12**	**30**	**60**
Action Time – Exp. Desert (Fired @ - 54°C)	**13/12**	**30**	**60**
Action Time – Cont. Arctic (Fired @ - 54°C)	**13/12**	**30**	**60**
Terminal Effects			
Perforation / Incendiary / Explosive – Untreated[3]	**19**	**60**	**60**
Perforation / Incendiary / Explosive – Cont. Heating[3]	**13/19**	**60**	**60**
Perforation / Incendiary / Explosive – Exp. Desert[3]	**13/19**	**60**	**60**
Perforation / Incendiary / Explosive – Cont. Arctic[3]	**13/19**	**60**	**60**
Trace Distance			
Untreated – Gun, Machine, M2HB	**21**	**50**	**50**
Cont. Heat – Gun, Machine, M2HB	**13/21**	**50**	**50**
Exp. Desert – Gun, Machine, M2HB	**13/21**	**50**	**50**
Cont. Arctic – Gun, Machine, M2HB	**13/21**	**50**	**50**
Trace Quality			
Untreated – Gun, Machine, M2HB	**21**	**50**	**50**
Cont. Heat – Gun, Machine, M2HB	**13/21**	**50**	**50**
Exp. Desert – Gun, Machine, M2HB	**13/21**	**50**	**50**
Cont. Arctic – Gun, Machine, M2HB	**13/21**	**50**	**50**

12.7 mm NATO Qualification Approval Test	AEP-97 Volume	Test Quantity	Re-Test Quantity[1]
Function & Casualty Test Procedure			
Weapon 1 – Gun, Machine, M2HB (Fired @ +21°C)	**14**	**200**	**200**
Gun, Machine, M2HB (Fired @ +52°C)	**14**	**150**	**150**
Gun, Machine, M2HB (Fired @ - 54°C)	**14**	**150**	**150**
Weapon 2 – Gun, Machine, M2HB (Fired @ +21°C)	**14**	**200**	**200**
Gun, Machine, M2HB (Fired @ +52°C)	**14**	**150**	**150**
Gun, Machine, M2HB (Fired @ - 54°C)	**14**	**150**	**150**
Total F & C Test Quantity		**1000**	**1000**
Link Test Procedure	**15**	**136**	**272**
Barrel Erosion Test Procedure	**16**	**2040**	**2040**
Smoke and Flash Test Procedure	**17**	**Quantity Included in Barrel Erosion Test & Function & Casualty Test**	
Precision Test Procedure	**18**	**90**	**N/A**
Terminal Effects [(3)]	**19**	**Quantity Included in Climatic Test**	
Trajectory Match Test Procedure [(4)]			
Trajectory Match at 550 m	**20**	**60**	**60**
Trajectory Match at 900 m	**20**	**60**	**60**
Trace Test Procedure	**21**	**Quantity Included in Climatic Test**	
Residual Stress	**22**	**50**	**100**
Primer Sensitivity Test Procedure	**23**	**300**	**600**
Bullet Extraction Test Procedure	**24**	**20**	**20**
Waterproof Test Procedure	**26**	**20**	**20**
TOTAL QUANTITY REQUIRED		**4776**	**5412**
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		**10188**	

See next page (2-F-3) for notes.

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

Note 2: This separate firing of untreated ammunition may not be necessary if the EPVAT Test and Climatic Test are conducted in the same firing session using the same equipment.

Note 3: The quantity for the Terminal Effects Test may be less according to ammunition type.

Note 4: Sixty (60) cartridges fired at 550m target and sixty (60) cartridges fired at 900 m target.

ANNEX 2-G

REQUEST FORM FOR NATO QUALIFICATION APPROVAL OR PRODUCTION TEST

The Request Form for either the NATO Qualification Approval Test or the NATO Production Test is presented on the next three (3) pages found in Annex 2-G (pages 2-G-2, 2-G-3 & 2-G-4).

2.G.1 SHEET 1 - REQUEST FORM FOR NATO QUALIFICATION APPROVAL OR PRODUCTION TEST

REQUEST FORM for NATO QUALIFICATION APPROVAL or PRODUCTION TEST PLEASE ANSWER ALL QUESTIONS AND PROVIDE ALL INFORMATION REQUIRED	
Submitting Nation	
Type of Test Requested (Enter: QA or PT)	
Link Test (Enter: YES / NO) (if ammunition is submitted in a linked configuration)	
NATO Design Number (if already qualified)	
Type of Ammunition (e.g. Ball, Tracer, etc.)	
Nomenclature/Model Number (e.g. Cartridge, 5.56mm, Ball, SS109)	
NATO/National Stock Number (list all for that Cartridge Model Number)	
Ammunition Manufacturer & Headstamp Identification	
Ammunition Lot Number & Month/Year of manufacture (mm/yyyy)	
Production Period Covered (Enter: "Start of Production" if for a QA Test)	
Continuous Production (Enter: YES / NO)	
If NO, provide dates from start (mm/yyyy) to finish (mm/yyyy) of last production run	
Number of Lots Produced (*approx. number of Lots since last PT*) Enter "N/A" for QA or Start-Up PT	
Total Quantity of Cartridges Manufactured (*approx. number of Lots since last PT*) Enter "N/A" for QA or Start-Up PT	
Link Model Number & Manufacturer (if submitted for Link Pack testing)	
Please confirm that Links have met "National Requirements" of the submitting nation (Enter: YES / NO) (Attach results or Certificate of Conformity for each "Nationally Certified" test)	
Page 1 of 3	

2.G.2 SHEET 2 - REQUEST FORM FOR NATO QUALIFICATION APPROVAL OR PRODUCTION TEST

For QA Test Only: Ammunition Design Drawings are attached for: (mandatory for QA)	
Cartridge Case (Enter: YES / NO)	
Bullet (Enter: YES / NO)	
Primer (Enter: YES / NO)	
Propellant Composition (Enter: YES / NO) (including tolerances on ingredients)	
Primer Composition (Enter: YES / NO) (including tolerances on ingredients)	
For QA Test Only: (Enter: YES / NO) **Propellant Analysis results are attached.** (mandatory for QA)	
For QA Test Only: (Enter: YES / NO) **Primer Composition Analysis results are attached.** (mandatory for QA)	
For PT Test Only: (Enter: YES / NO) **Please confirm that the propellant composition contained in the ammunition meets the chemical composition and tolerances as provided for the original QA Test.** (Attach results or Certificate of Conformity)	
For PT Test Only: (Enter: YES / NO) **Please confirm that the primer composition contained in the ammunition meets the chemical composition and tolerances as provided for the original QA Test.** (Attach results or Certificate of Conformity)	
Proof Acceptance Test Results (Enter: YES / NO) **for the ammunition are attached** (Mandatory) (Contractor results are acceptable)	
Hazard Data & Safety Information is attached (Enter: YES, NO or "Information already provided") (Mandatory requirement for testing at ERTC)	
Page 2 of 3	

2.G.3 SHEET 3 - REQUEST FORM FOR NATO QUALIFICATION APPROVAL OR PRODUCTION TEST

INVOICE DETAILS	
Invoice to be sent to: Postal Address (formatted as required by your postal service)	
Invoice Contact Details Name: Telephone: Facsimile: Email:	
Order Number to be Quoted (if applicable)	
REPORTING DETAILS	
Electronic report to be sent to: Name: Email:	
Hard copies of report to be sent to: Postal Address (formatted as required by your postal service)	
1. The ammunition submitted for NATO Qualification Approval or Production Testing has been introduced into service and accepted as safe and suitable for normal service use by the armed forces of the submitting nation. 2. In the situation where the Regional Test Centre is prepared to invoice the ammunition manufacturer directly, the government department of the submitting SG/1 national delegate will take full responsibility for payment of the invoice in the event of non-payment by the manufacturer.	
Submitting Delegate **(NAAG-LCGDSS-SG/1 Delegate)**	
Name:	
Signature:	
Date:	
Telephone:	
Email:	
Postal Address:	
Page 3 of 3	

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 3

NATO PRODUCTION TEST

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

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3.1 Introduction

AEP-97, Volume 1, paragraph 1.6.1.b, describes the objective of the NATO Production Test (PT). This volume covers the rules and administrative procedures for submitting ammunition for NATO Production Testing, the quantity of ammunition required, and actions to be taken in the event of failing a PT.

3.1.1 Frequency Of Ammunition For NATO Production Testing (PT)

For ammunition to remain NATO qualified it must be submitted for a PT in accordance with the following conditions:

a. If any NATO qualified ammunition is procured or produced by a submitting nation within a calendar year, a PT sample shall be submitted to the NATO RTC. However, if a short production period of less than 4 months overlaps calendar years, it will only be necessary to submit a PT at the end of that production period.

b. **For ammunition designs in continuous production:** a sample shall be submitted at one year intervals following the qualification date. The qualification date is the date on the official document from NATO allocating the NATO design number. The PT sample will represent ammunition manufactured during the twelve (12) months up to the month of manufacture of the ammunition lot sample submitted.

If there is a "break" in continuous production for NATO qualified ammunition designs where a period of twelve (12) months or more has elapsed since the qualification date or last PT[1], the first lot produced when production resumes shall be submitted to the RTC for a start-up PT[2] to reinstate the NATO ACTIVE status. After which, PT samples are then due twelve (12) months after the start-up PT submittal.

It is recognized that ammunition manufactured during the last twelve months prior to NATO Production Test sample submission are being marked at risk with the NATO Symbol of Interchangeability. This risk, due to a NATO PT failure, is discussed in paragraph 3.4.2.

Note 1: Date of last PT is the Month/Year of production of the ammunition Lot from which the last PT sample was selected.

Note 2: Start-up PT is not representative of any ammunition production period but is conducted to confirm that the standard of the original production is being maintained.

c. **For ammunition designs in non-continuous production:**
It is understood that many ammunition designs are not in continuous production, and there may be short (less than twelve months) or longer periods (more than five years) of no production for a NATO Qualified Design (see NATO Design Number Designation in paragraph 3.1.1.d). Any anticipated production of a NATO Qualified Design should be coordinated prior to production with the RTC Superintendent to arrange NATO Production Test Sample submission.

It is recognized that ammunition manufactured during the length of the manufacturing period prior to NATO Production Test sample submission are being marked at risk with the NATO Symbol of Interchangeability (see paragraph 3.4.3).

d. Lack of PT Submission - NATO Design Number Designation: It is the responsibility of the national delegate to ensure that ammunition samples for NATO qualified designs are submitted in accordance with paragraphs b and c above. It should be noted, however, that in some nations may not meet these stipulations. In 2017, AC/225 (LCGDSS/SG/1) derived the following designations to account for the status of NATO qualified designs concerning PT submissions. SG1/ observed the need to account for the varying ammunition acquisitions of nations and timelines of procurement cycles and ammunition production of qualified ammunition designs.

1. ACTIVE - A qualified design that has been submitted to a Regional Test Centre for Production Testing in the last year (twelve months).
2. PASSIVE - A qualified design that has **NOT** been submitted to a Regional Test Centre for Production Testing in over one (1) year (twelve months).
3. DORMANT - A qualified design that has **NOT** been submitted to a Regional Test Centre for Production Testing in at least five (5) years.
4. OBSOLETE - A qualified design that will no longer be produced (i.e. no longer fielded / out dated design /manufacturer no longer exists).

3.1.1.1 Lack of Submittal Of Ammunition For NATO Production Testing (PT)

If the ammunition is not submitted for a PT within the prescribed time frame, then production since the last successful NATO Production Test will no longer be regarded as NATO Qualified until it has been submitted and passed a PT. This current production must not be marked with any of the NATO Symbol of Interchangeability presented in AEP-97, Volume 1, Annex 1-A. The official NATO list of qualified designs will annotate the NATO Qualified Ammunition Design in accordance with the NATO Design Number Designation listed above.

3.1.2 NATO Production Test Sample Requirements

The following conditions apply to the Production Test sample:

a. The ammunition sample submitted for a PT shall be a representative sample, from a normal production lot of not less than 100,000 cartridges of ball ammunition (50,000 of all other types) that has passed all national proof and inspection requirements of the submitting nation. The ammunition must have been successfully tested at a National Test Centre or an ISO 9001 certified facility (which could be the ammunition producer). Ammunition accepted by the procuring nation under such a system **does not require** any further

testing at a National or Government Test facility prior to submission for a NATO Production Test.

b. When **more than one manufacturer** is producing cartridges of the same NATO qualified design, a sample from each production source shall be submitted to the RTC for separate Production Tests.

c. The nation that submitted the ammunition for Qualification Approval remains responsible for submitting the ammunition for Production Tests until it is no longer procuring the ammunition. Once this occurs, responsibility for submission of PT samples falls to the nation procuring the design, if any. When two or more nations are simultaneously procuring the same NATO qualified design, it is the responsibility for each procuring nation to submit the ammunition for a PT. However, it is acceptable for an agreement to be reached between the nations for the submission of only one PT. National delegates are encouraged to contact the producer, and other procuring NATO nations, to determine if additional nations are procuring the same qualified design. **Delegates must not ignore their STANAG/AEP-97 obligations by assuming that another nation is submitting the ammunition for a PT.**

d. When two or more nations procure the same NATO qualified design, detailed records (delivery dates, lot numbers, etc.) must be kept by all parties. In the event of a PT failure, these records will be needed to isolate any suspect lot(s) and to identify the procuring nation(s). All procuring nation(s) would then be responsible for removing the NATO Symbol of Interchangeability or quarantining from any affected ammunition lot(s).

e. To ensure the safety of Test Centre personnel, the ammunition is to have been proof and function tested under the control[3] of the national authority (which may include a National Test Centre or an ISO 9001 certified production facility) of the submitting nation. The tests must have included a basic Function & Casualty test using, as a minimum, national weapons and an EPVAT test.

Note 3: "under the control of the national authority" can mean that the test facility, which can be the ammunition manufacturer's test range, is certified to the relevant ISO standards and is audited by either a resident or visiting government authorised representative.

f. It is **NOT** possible for manufacturers or non-NATO nations to independently submit ammunition for NATO Production Testing.

3.2 Submission Of Ammunition For NATO Production Testing

3.2.1 Administrative Procedures

The National Delegate to AC/225 (LCGDSS-SG/1) shall certify, upon submission of a sample that no changes have been made to the build standard of the ammunition design that obtained NATO Qualification Approval/NATO Design Number and that the ammunition is from the same production facility. The sample submitted shall be from ammunition lots which have passed national proof and inspection requirements. The following

administrative procedure is to be followed when submitting ammunition for NATO Interchangeability Testing:

a. Authority for Submission. Ammunition may only be submitted with the authority of the SG/1 national delegate of the submitting nation.

b. Ammunition Delivery. Delivery of the ammunition to the RTC is the responsibility of the submitting nation. The ammunition is to be delivered to the RTC free of charge with any relevant import/export, excise duties and transportation charges paid by the submitting nation. The quantity and format of the ammunition to be delivered is contained in the table in paragraph 3.2.1.d, below.

c. Documentation. The following documents must be sent to the Superintendent and Proof Officer of the applicable RTC. The documents are to be sent to the email addresses of the Superintendent and Proof Officer. The correct email addresses can be obtained from the SG/1 Chairman or SG/1 Secretary:

(1) One copy of the Request for NATO Qualification Approval or Production Test Form (Annex 3-G) signed by the national delegate of the submitting nation.

(2) One copy of the Certificate of Conformity for the Propellant and Primer compositions confirming that the compositions meet the build standard and tolerances defined in the detailed chemical analysis report submitted with the original NATO qualified design and (if applicable) the Certificate of Conformity for the Link Cartridge Stripping (not necessary for 12.7 mm), Dimensional Characteristics, Visual Inspection and Salt Corrosion Test results certifying that the submitted links meet the national specifications for these tests.

(3) One copy of the original national proof results.

(4) All nations submitting ammunition to the ERTC for testing will now have to provide Hazard Information Risk and Safety the product. It is now a legal obligation for safety information to be available at the ERTC for ammunition being tested at the range. This should include the appropriate abbreviations for the Hazard Information Risk and Safety and other phrases (ERTC Superintendent will forward a copy of these phrases and their abbreviations on request.) Also to be included on the Hazard Data Sheet is practical information about any hazardous ingredients including any recommendations about inhalation levels of airborne particles and toxic fumes. Known carcinogens contained in any of the initiating, propelling or trace compositions should also be identified including details on acceptable inhalation levels. This basic information should be readily available as all western nations have duty of care legislation which would insist on this information being available at the place of manufacture and for the intended user of the product. **This information is not required if it was provided for the Qualification Approval Test and there have been no subsequent amendments.**

(5) Invoicing Address to which request for payment is to be sent including telephone, facsimile and email numbers along with a contact name.

e. Ammunition Quantity Required. The ammunition quantity to be delivered shall be in accordance with the table below (to the nearest complete box or convenient delivery quantity). If it is necessary for the RTC to link the ammunition for an ammunition PT, then the costs for this activity will have to be borne by the submitting nation. This also applies to de-linking of ammunition for single cartridge tests if the complete quantity is delivered linked. If the original QA was for a linked configuration and the submitting nation wishes to maintain the qualified status of linked configuration, then the number of cartridges listed under Linked Cartridges in the table below must be submitted to the RTC for the PT. If the original QA was for cartridges only and the submitting nation provides the PT sample as single cartridges based on the total in the table below, then the RTC will have to link the ammunition for the Function & Casualty Test using links available at the RTC. Surplus cartridges from the sample will be used for re-tests/investigative programmes/range standardisation/NNW tests etc.

Calibre	Nature	Single Cartridges	Linked Cartridges	Total Cartridges
4.6 mm x 30	Ball	3770	--	3770
5.56 mm x 45	Ball	6800	2400	9200
5.56 mm x 45	Tracer	6950	2400	9350
5.7 mm x 28	Ball	3400	--	3400
5.7 mm x 30	Tracer	3460	--	3460
7.62 mm x 51	Ball	1800	3300	5100
7.62 mm x 51	Tracer	1950	3300	5250
9 mm x 19	Ball	3800	--	3800
12.7 mm x 99	Ball	2100	2400	4500
12.7 mm x 99	Tracer	2100	2400	4500
12.7 mm x 99	Armour Piercing, Armour Piercing Incendiary, etc.	2100	2400	4500
12.7 mm x 99	Multi-Purpose	2100	2400	4500

3.2.2 Payment For Testing

Payment for testing is the responsibility of the SG/1 national delegate, although for administrative purposes the RTC may at its discretion agree to directly invoice the ammunition producer if this has been agreed between the ammunition producer and the submitting nation. **It is the responsibility of the national delegate to provide a written declaration that this arrangement has been agreed**. In the event of a dispute over payment, the delegate of the submitting nation shall immediately arrange for payment from government funds and then take recovery action against his contractor if deemed appropriate.

3.2.3 Notification Of Test Sample Submission And Testing Duration

Nations should endeavour to provide the RTC Superintendent at least three (3) months' notice of the preferred dates for a Production Test. As a minimum, these tests and subsequent reporting will require a minimum of ten (10) weeks for completion. The RTC Superintendent will take account of measures such as combining tests to achieve overall costs and time savings and will ensure that the testing is completed as soon as possible after receipt of the ammunition and supporting documentation. It must be noted, however, that the ERTC and NARTC are not funded by NATO. The RTCs are managed and staffed on a voluntary basis by the United Kingdom and United States who provide the funding to support these test centres for the exclusive benefit of NATO SG/1 and therefore priority cannot always be given for NATO work.

3.2.4 Testing Sequence

Nations submitting samples should contact the relevant RTC Superintendent to discuss in advance the test sequence details. If the RTC Superintendent does not receive contact from the submitting nation, he will use his judgement and conduct the tests in the most efficient order possible. In the event of the ammunition failing any test, the Superintendent will consult with the submitting nation for their decision on whether to proceed with the remainder of the testing.

3.3 List Of NATO Production Acceptance Tests

The NATO Production Tests to be conducted at the RTCs[4] are contained in the following annexes to this volume:

Annex 3-A 4.6 mm x 30 - NATO PRODUCTION TESTS
Annex 3-B 5.56 mm x 45 - NATO PRODUCTION TESTS
Annex 3-C 5.7 mm x 28 - NATO PRODUCTION TESTS
Annex 3-D 7.62 mm x 51 - NATO PRODUCTION TESTS
Annex 3-E 9 mm x 19 - NATO PRODUCTION TESTS
Annex 3-F 12.7 mm x 99 - NATO PRODUCTION TESTS

Note 4: The submitting nation is responsible for some tests prior to submission, such as Propellant and Primer composition analysis, certain Link Tests and the 12.7 mm Cook-Off Test.

3.4 Reporting of NATO Production Test Results

3.4.1 Production Test Meets NATO Requirements

3.4.1.1 If the cartridges and links (when the sample is submitted in a linked configuration following linked configuration NATO Qualification Approval) meet all NATO Production Test (PT) requirements, the RTC Superintendent will notify the SG/1 Head of Delegation (HoD) of the submitting nation of the successful completion of the PT with a document containing the following information:

- **a.** The submitting nation
- **b.** Ammunition calibre and nature
- **c.** NATO Design Number
- **d.** Ammunition manufacturer and headstamp on the cartridge case
- **e.** Date of manufacture of the sample ammunition lot
- **f.** Date of last successful NATO Production Test

3.4.1.2 The RTC Superintendent will also issue a full set of test results to the SG/1 HoD of the submitting nation and, if requested by the HoD, will issue a full set of test results to the manufacturer of the ammunition.

3.4.1.3 The RTC shall retain, on a permanent basis, a copy of the full test results. This information will only be released outside of the RTCs with the permission of the SG/1 HoD of the submitting nation.

3.4.2 Production Test Fails to Meet NATO Requirements

3.4.2.1 If the cartridges and/or links (when the sample is submitted in a linked configuration following linked configuration NATO Qualification Approval) fail to meet all NATO Production Test requirements (after all tests within a PT have been completed to fully assess the submitted sample), the RTC Superintendent will notify the SG/1 Chairman and HoD of the submitting nation of the failure of the Production Test.

3.4.2.2 The Chairman will convene a committee of SG/1 members including the RTC Superintendents, the HoD of the submitting nation and any other SG/1 members who the Chairman determines are needed in order to determine the acceptability of the current sample and the acceptability of previous ammunition production including the marking of the ammunition with the NATO Symbol of Interchangeability (prior to the failed PT sample). The outcome of the decision of this SG/1 committee will be noted in the SG/1 minutes and published, as a NATO document, on the NATO website.

3.4.2.3 If the SG/1 committee determines that the Production Test failure is of a serious nature to affect the interchangeability of the ammunition, the SG/1 Chairman will notify the HoD of the submitting nation of this decision.

3.4.2.4 The HoD of the submitting nation must take the following action(s) upon notification of the failure by the RTC Superintendent:

- **a.** Immediately, notify the ammunition manufacturer to stop applying the NATO Symbol of Interchangeability to the outer pack of current and future production

of the NATO qualified ammunition design

b. Suspend the NATO qualified status of all the ammunition produced since the last successful PT.

c. Disqualify the use of the NATO Symbol of Interchangeability until a new sample of cartridges drawn randomly from corrected productions has passed the production tests in the RTC. The new sample may be selected from any period of subsequent production at the discretion of the nation concerned provided that it is certified as required at paragraph 3.2.1 that the sample complies with the design for which Qualification Approval was given.

d. If the ammunition is currently in use by NATO multi-national forces, the national delegate is to immediately notify the appropriate authorities of the suspension from use of the affected ammunition lots as interchangeable ammunition.

e. Note the failure of the PT in the National Activity Report submitted prior to each SG/1 meeting.

f. Provide SG/1 an update on the above actions taken and the results of the failure investigation into the Production Test Failure along with corrective actions accomplished to address the failure.

3.4.3 Assumption of Satisfactory NATO Production Test

During the course of production it can be assumed, at the submitting nation and/or producer's own risk, for the purpose of packing and marking, that the ammunition will pass subsequent NATO Production Tests. However, in the event the production test sample fails to meet the NATO standards, the nation(s) concerned must take corrective action, at its (their) own expense, to either delete any previously marked NATO Symbol of Interchangeability from the production representative of the failed PT sample or constrain/quarantine the affected ammunition (including any adjacent ammunition lots that are affected) from issue to any coalition forces.

3.4.4 Reports by the RTC Superintendents

The RTC Superintendents will note the results (success/failure) of all PTs conducted during the six-month period between SG/1 meetings in the RTC Activity Report presented at each meeting. The Superintendents will also update the NATO Design Number List to ensure that the status of the design designation (Active/Passive/Dormant/Obsolete) is up-to-date.

ANNEX 3-A

4.6 mm x 30 NATO PRODUCTION TEST - LIST OF APPLICABLE RTC TESTS

4.6 mm NATO Production Test	AEP-97 Volume	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure			
EPVAT (Fired @ +21°C)	**12**	**30**	**60**
EPVAT (Fired @ +52°C)	**12**	**30**	**60**
EPVAT (Fired @ - 54°C)	**12**	**30**	**60**
Function & Casualty Test Procedure			
Weapon 1 - Gun, Sub-Machine, MP7 (Fired @ +21°C)	**14**	**250**	**250**
Gun, Sub-Machine, MP7 (Fired @ +52°C)	**14**	**125**	**125**
Gun, Sub-Machine, MP7 (Fired @ - 54°C)	**14**	**125**	**125**
Weapon 2 - Gun, Sub-Machine, MP7 (Fired @ +21°C)	**14**	**250**	**250**
Gun, Sub-Machine, MP7 (Fired @ +52°C)	**14**	**125**	**125**
Gun, Sub-Machine, MP7 (Fired @ - 54°C)	**14**	**125**	**125**
Total F &C Test Quantity		**1000**	**1000**
Smoke and Flash Test Procedure	**17**	**Quantity Included in Function & Casualty Test**	
Precision Test Procedure	**18**	**90**	**N/A**
Terminal Effects	**19**	**20**	**20**
Trajectory Match Test Procedure			
Trajectory Match at 50m	**20**	**60**	**60**
Trajectory Match at 100m	**20**	**60**	**60**
Residual Stress	**22**	**50**	**100**
Primer Sensitivity Test Procedure	**23**	**300**	**600**
Bullet Extraction Test Procedure	**24**	**20**	**20**
Waterproof Test Procedure	**26**	**20**	**20**
TOTAL QUANTITY REQUIRED		**1710**	**2060**
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		**3770**	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

ANNEX 3-B

5.56 mm x 45 NATO PRODUCTION TEST - LIST OF APPLICABLE RTC TESTS

5.56 mm NATO Production Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test[1] Quantity	Test Quantity	Re-Test[1] Quantity
EPVAT Test Procedure					
EPVAT (Fired @ +21°C)	12	30	60	30	60
EPVAT (Fired @ +52°C)	12	30	60	30	60
EPVAT (Fired @ - 54°C)	12	30	60	30	60
Function & Casualty Test Procedure					
MG, Minimi Mk1 - Free Hang. Belt (Fired @ +21°C)	14	200	200	200	200
MG, Minimi Mk1 - NATO Chute (Fired @ +21°C)	14	200	200	200	200
Rifle, L85A2 (Fired @ +21°C)	14	180	180	180	180
Rifle, M16A2/A4 (Fired @ +21°C)	14	180	180	180	180
Rifle, AR 70/90 (Fired @ +21°C)	14	180	180	180	180
Rifle, G36/A1 (Fired @ +21°C)	14	180	180	180	180
MG, Minimi Mk1 - Free Hang. Belt (Fired @ +52°C)	14	150	150	150	150
MG, Minimi Mk1 - NATO Chute (Fired @ +52°C)	14	150	150	150	150
Rifle, L85A2 (Fired @ +52°C)	14	160	160	160	160
Rifle, M16A2/A4 (Fired @ +52°C)	14	160	160	160	160
Rifle, AR 70/90 (Fired @ +52°C)	14	160	160	160	160
Rifle, G36/A1 (Fired @ +52°C)	14	160	160	160	160
MG, Minimi Mk1 - Free Hang. Belt (Fired @ -54°C)	14	150	150	150	150
MG, Minimi Mk1 - NATO Chute (Fired @ -54°C)	14	150	150	150	150
Rifle, L85A2 (Fired @ -54°C)	14	160	160	160	160
Rifle, M16A2/A4 (Fired @ -54°C)	14	160	160	160	160
Rifle, AR 70/90 (Fired @ -54°C)	14	160	160	160	160
Rifle, G36/A1 (Fired @ -54°C)	14	160	160	160	160
Total F & C Test Quantity		3000	3000	3000	3000
Link Test Procedure	15	135	270	135	270
Smoke and Flash Test Procedure	17	Quantity Included Function & Casualty Test			
Precision Test Procedure	18	90	N/A	90	N/A
Terminal Effects	19	20	20	N/A	N/A
Trajectory Match Test Procedure					
Trajectory Match at 300m	20	60	60	60	60
Trajectory Match at 550m	20	60	60	60	60

5.56 mm NATO Production Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test[1] Quantity	Test Quantity	Re-Test[1] Quantity
Trace Test Procedure (Fired @+21°C)					
- Trace Distance					
Rifle, M16A2/A4	**21**	**N/A**	**N/A**	**50**	**50**
- Trace Quality					
Gun, Machine, Minimi Mk1	**21**	**N/A**	**N/A**	**50**	**50**
Residual Stress	**22**	**50**	**100**	**50**	**100**
Primer Sensitivity Test Procedure	**23**	**300**	**600**	**300**	**600**
Bullet Extraction Test Procedure	**24**	**20**	**20**	**20**	**20**
Waterproof Test Procedure	**26**	**20**	**20**	**20**	**20**
TOTAL QUANTITY REQUIRED		**3845**	**4330**	**3925**	**4410**
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		**8175**		**8335**	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

ANNEX 3-C

5.7 mm x 28 NATO PRODUCTION TEST - LIST OF APPLICABLE RTC TESTS

5.7 mm NATO Production Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test[1] Quantity	Test Quantity	Re-Test[1] Quantity
EPVAT Test Procedure					
EPVAT (Fired @ +21°C)	12	30	60	30	60
EPVAT (Fired @ +52°C)	12	30	60	30	60
EPVAT (Fired @ - 54°C)	12	30	60	30	60
Function & Casualty Test Procedure					
Gun, Sub-Machine, P90 (Fired @ +21°C)	14	200	200	200	200
Pistol, Five-seveN (Fired @ +21°C)	14	115	115	115	115
Gun, Sub-Machine, P90 (Fired @ +52°C)	14	150	150	150	150
Pistol, Five-seveN (Fired @ +52°C)	14	100	100	100	100
Gun, Sub-Machine, P90 (Fired @ - 54°C)	14	150	150	150	150
Pistol, Five-seveN (Fired @ - 54°C)	14	100	100	100	100
Total F & C Test Quantity		815	815	815	815
Smoke and Flash Test Procedure	17	Quantity Included Function & Casualty Test			
Precision Test Procedure	18	90	N/A	90	N/A
Terminal Effects	19	20	20	N/A	N/A
Trajectory Match Test Procedure					
Trajectory Match at 50m	20	60	60	60	60
Trajectory Match at 100m	20	60	60	60	60
Trace Test Procedure (Fired @+21°C)					
- Trace Distance					
Gun, Sub-Machine, P90	21	N/A	N/A	50	50
- Trace Quality					
Gun, Sub-Machine, P90	21	N/A	N/A	50	50
Residual Stress	22	50	100	50	100
Primer Sensitivity Test Procedure	23	300	600	300	600
Bullet Extraction Test Procedure	24	20	20	20	20

5.7 mm NATO Production Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test[1] Quantity	Test Quantity	Re-Test[1] Quantity
Waterproof Test Procedure	26	20	20	20	20
TOTAL QUANTITY REQUIRED		3845	4330	3975	4460
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		8175		8435	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

ANNEX 3-D

7.62 mm x 51 NATO PRODUCTION TEST - LIST OF APPLICABLE RTC TESTS

7.62 mm NATO Production Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test Quantity[1]	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure					
EPVAT (Fired @ +21°C)	12	30	60	30	60
EPVAT (Fired @ +52°C)	12	30	60	30	60
EPVAT (Fired @ -54°C)	12	30	60	30	60
Function & Casualty Test Procedure					
Gun, Machine, L7A2 (Fired @ +21°C)	14	200	200	200	200
Gun, Machine, M240B (Fired @ +21°C)	14	200	200	200	200
Gun, Machine,, L7A2 (Fired @ +52°C)	14	150	150	150	150
Gun, Machine, M240B (Fired @ +52°C)	14	150	150	150	150
Gun, Machine, L7A2 (Fired @ - 54°C)	14	150	150	150	150
Gun, Machine, M240B (Fired @ - 54°C)	14	150	150	150	150
Total F & C Test Quantity		1000	1000	1000	1000
Link Test Procedure	15	435	870	435	870
Smoke and Flash Test Procedure	17	Quantity Included in Function & Casualty Test			
Precision Test Procedure	18	90	N/A	90	N/A
Terminal Effects	19	20	20	N/A	N/A
Trajectory Match Test Procedure					
Trajectory Match at 300m	20	60	60	60	60
Trajectory Match at 550m		60	60	60	60
Trace Test Procedure (Fired @+21°C)					
- Trace Distance					
Gun, Machine, T65E1 or M240B	21	N/A	N/A	50	50
- Trace Quality					
Gun, Machine, T65E1 or M240B	21	N/A	N/A	50	50
Residual Stress	22	50	100	50	100
Primer Sensitivity Test Procedure	23	300	600	300	600

7.62 mm NATO Production Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test Quantity[1]	Test Quantity	Re-Test Quantity[1]
Bullet Extraction Test Procedure	24	20	20	20	20
Waterproof Test Procedure	26	20	20	20	20
TOTAL QUANTITY REQUIRED		2145	2930	2225	3010
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		5075		5235	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

ANNEX 3-E

9 mm X 19 NATO PRODUCTION TEST - LIST OF APPLICABLE RTC TESTS

9 mm NATO Production Test	AEP-97 Volume	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure			
EPVAT (Fired @ +21°C)	**12**	**30**	**60**
EPVAT (Fired @ +52°C)	**12**	**30**	**60**
EPVAT (Fired @ -54°C)	**12**	**30**	**60**
Function & Casualty Test Procedure			
Gun, Sub-Machine, PM12S/S2 - Horizontal (Fired @ +21°C)	**14**	**128**	**128**
Pistol, 92F/92FS - Horizontal (Fired @ +21°C)	**14**	**80**	**80**
Gun, Sub-Machine, PM12S - Depressed (Fired @ +21°C)	**14**	**124**	**124**
Pistol, 92F/92FS – Depressed (Fired @ +21°C)	**14**	**75**	**75**
Gun Sub-Machine, PM12S/S2 - Horizontal (Fired @ +52°C)	**14**	**124**	**124**
Pistol, 92F/92FS - Horizontal (Fired @ +52°C)	**14**	**80**	**80**
Gun, Sub-Machine, PM12S/S2 - Horizontal (Fired @ - 54°C)	**14**	**124**	**124**
Pistol, 92F/92FS - Horizontal (Fired @ - 54°C)	**14**	**80**	**80**
Total F &C Test Quantity		**815**	**815**
Smoke and Flash Test Procedure	**17**	**Quantity Included in Function & Casualty Test**	
Precision Test Procedure	**18**	**90**	**N/A**
Terminal Effects	**19**	**See Volume 19 for details**	
Residual Stress	**22**	**50**	**100**
Primer Sensitivity Test Procedure	**23**	**300**	**600**
Bullet Extraction Test Procedure	**24**	**20**	**20**
Waterproof Test Procedure	**26**	**20**	**20**
TOTAL QUANTITY REQUIRED		**1385**	**1385**
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		**3120**	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

ANNEX 3-F

12.7 mm x 99 NATO PRODUCTION TEST - LIST OF APPLICABLE RTC TESTS

12.7 mm NATO Production Test	AEP-97 Volume	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure			
EPVAT (Fired @ +21°C)	**12**	**30**	**60**
EPVAT (Fired @ +52°C)	**12**	**30**	**60**
EPVAT (Fired @ -5 4°C)	**12**	**30**	**60**
Function & Casualty Test Procedure			
Weapon 1 - Gun, Machine, M2HB (Fired @ +21°C)	**14**	**200**	**200**
Gun, Machine, M2HB (Fired @ +52°C)	**14**	**150**	**150**
Gun, Machine, M2HB (Fired @ - 54°C)	**14**	**150**	**150**
Weapon 2 - Gun, Machine, M2HB (Fired @ +21°C)	**14**	**200**	**200**
Gun, Machine, M2HB (Fired @ +52°C)	**14**	**150**	**150**
Gun, Machine, M2HB (Fired @ - 54°C)	**14**	**150**	**150**
Total F & C Test Quantity		**1000**	**1000**
Link Test Procedure	**15**	**136**	**272**
Smoke and Flash Test Procedure	**17**	**Quantity Included in Function & Casualty Test**	
Precision Test Procedure	**18**	**90**	**N/A**
Terminal Effects			
Perforation, Incendiary, or Explosive Test[2]	**19**	**20**	**20**
Trajectory Match Test Procedure			
Trajectory Match at 550 m	**20**	**60**	**60**
Trajectory Match at 900 m	**20**	**60**	**60**
Trace Test Procedure (Fired @ +21°C)			
- Trace Distance			
Gun, Machine, M2HB	**21**	**50**	**50**
- Trace Quality			
Gun, Machine, M2HB	**21**	**50**	**50**
Residual Stress	**22**	**50**	**100**
Primer Sensitivity Test Procedure	**23**	**300**	**600**

12.7 mm NATO Production Test	AEP-97 Volume	Test Quantity	Re-Test Quantity[1]
Bullet Extraction Test Procedure	24	20	20
Waterproof Test Procedure	26	20	20
TOTAL QUANTITY REQUIRED		1946	2432
TOTAL QUANTITY REQUIRED (Including re-test Quantity)		4378	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

Note 2: The quantity for the Terminal Effects Test may be less according to ammunition type.

ANNEX 3-G

REQUEST FORM FOR NATO QUALIFICATION APPROVAL OR PRODUCTION TEST

The Request Form for either the NATO Qualification Approval Test or the NATO Production Test is presented on the next three (3) pages found in Annex 3-G (pages 3-G-2, 3-G-3 & 3-G-4).

3.G.1 SHEET 1 - REQUEST FORM FOR NATO QUALIFICATION APPROVAL OR PRODUCTION TEST

REQUEST FORM for NATO QUALIFICATION APPROVAL or PRODUCTION TEST PLEASE ANSWER ALL QUESTIONS AND PROVIDE ALL INFORMATION REQUIRED	
Submitting Nation	
Type of Test Requested (Enter: QA or PT)	
Link Test (Enter: YES / NO) (if ammunition is submitted in a linked configuration)	
NATO Design Number (if already qualified)	
Type of Ammunition (e.g. Ball, Tracer, etc.)	
Nomenclature/Model Number (e.g. Cartridge, 5.56mm, Ball, SS109)	
NATO/National Stock Number (list all for that Cartridge Model Number)	
Ammunition Manufacturer & Headstamp Identification	
Ammunition Lot Number & Month/Year of manufacture (mm/yyyy)	
Production Period Covered (Enter: "Start of Production" if for a QA Test)	
Continuous Production (Enter: YES / NO)	
If NO, provide dates from start (mm/yyyy) to finish (mm/yyyy) of last production run	
Number of Lots Produced (*approx. number of Lots since last PT*) Enter "N/A" for QA or Start-Up PT	
Total Quantity of Cartridges Manufactured (*approx. number of Lots since last PT*) Enter "N/A" for QA or Start-Up PT	
Link Model Number & Manufacturer (if submitted for Link Pack testing)	
Please confirm that Links have met "National Requirements" of the submitting nation (Enter: YES / NO) (Attach results or Certificate of Conformity for each "Nationally Certified" test)	
Page 1 of 3	

3.G.2 SHEET 2 - REQUEST FORM FOR NATO QUALIFICATION APPROVAL OR PRODUCTION TEST

For QA Test Only: Ammunition Design Drawings are attached for: (mandatory for QA)	
Cartridge Case (Enter: YES / NO)	
Bullet (Enter: YES / NO)	
Primer (Enter: YES / NO)	
Propellant Composition (Enter: YES / NO) (including tolerances on ingredients)	
Primer Composition (Enter: YES / NO) (including tolerances on ingredients)	
For QA Test Only: (Enter: YES / NO) **Propellant Analysis results are attached.** (mandatory for QA)	
For QA Test Only: (Enter: YES / NO) **Primer Composition Analysis results are attached.** (mandatory for QA)	
For PT Test Only: (Enter: YES / NO) **Please confirm that the propellant composition contained in the ammunition meets the chemical composition and tolerances as provided for the original QA Test.** (Attach results or Certificate of Conformity)	
For PT Test Only: (Enter: YES / NO) **Please confirm that the primer composition contained in the ammunition meets the chemical composition and tolerances as provided for the original QA Test.** (Attach results or Certificate of Conformity)	
Proof Acceptance Test Results for the ammunition are attached. (Mandatory) (Contractor results are acceptable) (Enter: YES / NO)	
Hazard Data & Safety Information is attached (Enter: YES, NO or "Information already provided") (Mandatory requirement for testing at ERTC)	
Page 2 of 3	

3.G.3 SHEET 3 - REQUEST FORM FOR NATO QUALIFICATION APPROVAL OR PRODUCTION TEST

INVOICE DETAILS	
Invoice to be sent to: Postal Address (formatted as required by your postal service)	
Invoice Contact Details Name: Telephone: Facsimile: Email:	
Order Number to be Quoted (if applicable)	
REPORTING DETAILS	
Electronic report to be sent to: Name: Email:	
Hard copies of report to be sent to: Postal Address (formatted as required by your postal service)	
1. The ammunition submitted for NATO Qualification Approval or Production Testing has been introduced into service and accepted as safe and suitable for normal service use by the armed forces of the submitting nation. 2. In the situation where the Regional Test Centre is prepared to invoice the ammunition manufacturer directly, the government department of the submitting SG/1 national delegate will take full responsibility for payment of the invoice in the event of non-payment by the manufacturer.	
Submitting Delegate **(NAAG-LCGDSS-SG/1 Delegate)**	
Name:	
Signature:	
Date:	
Telephone:	
Email:	
Postal Address:	
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NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 4

NATO SURVEILLANCE TEST

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

4.1 Introduction

Surveillance tests of NATO qualified stockpiled ammunition are to be conducted at pre-defined intervals to establish that ammunition bearing the NATO Symbol of Interchangeability continues to meet NATO performance requirements after the specified storage interval in the relevant climatic environment. The acceptance parameters shall be the same (with the exception for Tracer performance) as for new production ammunition. NATO performance requirements are often not as severe as national standards and a reduction in performance could result in the ammunition not meeting the minimum acceptable performance requirements. If the existing performance requirements were not met it could risk compromising battlefield interchangeability.

4.1.1 Continued Suitability for Storage and Transportation - Propellant Stability

In addition to the requirements of NATO Surveillance Testing, it is the responsibility of the nation owning the stockpile ammunition to ensure that it continues to meet the requirements of the nation's competent authority with regard to safety for storage and transportation. This is likely to necessitate a Propellant Analysis test and a specific evaluation of the remaining stabiliser levels in comparison to the original results for the same ammunition lot. It is recommended that if the stabiliser level has fallen to less than 50 % (30 % is the legal minimum for some nations) of the original level, actually measured quantity, then the ammunition should be withdrawn from use.

4.2 Responsibility For Testing

4.2.1 NATO Surveillance Testing

It is the responsibility of the nation owning the stockpile to ensure it is submitted for testing at a NATO certified National Test Centre (NTC) at the appropriate time intervals as specified in the table below. This is the maximum permitted time interval for assessing the performance against NATO requirements.

Minimum NATO Surveillance Test Intervals	
Ammunition Nature	**Test Interval**
Ammunition with projectiles containing inert materials	- First test at 10 years from date of manufacture - Subsequent tests at 5 year intervals up to 20 years then at 4 year intervals
Ammunition with projectiles containing energetic material(s) (includes conventional tracer)	- First test at 8 years from date of manufacture - Subsequent tests at 3 year intervals

4.2.2 National Surveillance Testing

National surveillance requirements and knowledge of the particular ammunition may result in the necessity to test the ammunition nationally at more frequent intervals. Ammunition that is showing signs of deterioration during national testing shall be immediately subjected

to NATO surveillance testing or constrained/withdrawn from use by other NATO coalition forces.

4.2.3 NATO Certified National Test Centres

Only NATO certified National Test Centres (NTC) are permitted to conduct official NATO Surveillance Testing (ST). This is necessary to establish that ammunition bearing the NATO Symbol of Interchangeability continues to meet NATO requirements by testing with officially approved and assessed test equipment that meets NATO requirements. It may be possible in extreme circumstances for the Surveillance Testing to be conducted at a Regional Test Centre on a repayment basis. However, this is to be avoided where possible as it causes wear to NATO Nominated Weapons that have to replaced free of charge by sponsoring nations. AEP-97 - Volume 1, Annex 1-B, contains the information and requirements for NATO certification of a NTC. Subject to the agreement of the host country regarding availability and repayment, the submitting nation may use any NATO National Test Centre that has been certified by NATO for that calibre.

4.3 Rationale Of Sample Selection - Different Environments

Each national authority shall determine the number of distinct environments under which the ammunition has been stored. STANAG 2895[1] shall be used as a guide for this purpose. Consideration should also be given to separately categorising ammunition that has been moved from one type of environment to another.

Note 1: STANAG 2895 – Extreme Climatic Conditions And Derived Conditions For Use In Defining Design/Tests Criteria For NATO Forces Materiel

4.3.1 Sample Selection - Different Environments

NATO surveillance test samples shall be drawn from two ammunition lots from each type of climatic environment in which the ammunition is stored.

4.4 List Of NATO Surveillance Tests

The sample from each lot shall be tested and sentenced separately in accordance with relevant Annex. The testing procedure is to be conducted for ammunition from each distinct environment according to the Annexes listed below:

Annex 4-A 4.6 mm x 30 - NATO SURVEILLANCE TESTS
Annex 4-B 5.56 mm x 45 - NATO SURVEILLANCE TESTS
Annex 4-C 5.7 mm x 28 - NATO SURVEILLANCE TESTS
Annex 4-D 7.62 mm x 51 - NATO SURVEILLANCE TESTS
Annex 4-E 9 mm x 19 - NATO SURVEILLANCE TESTS
Annex 4-F 12.7 mm x 99 - NATO SURVEILLANCE TESTS

4.5 Sentencing and Reporting Of NATO Surveillance Test Results

4.5.1 NATO Surveillance Test Meets Requirements

4.5.1.1 If both of the Surveillance Test samples drawn from the specified climatic conditions meet NATO requirements, no other tests are necessary and all lots of ammunition produced that year and stored under that climatic condition shall continue to bear the NATO Symbol of Interchangeability.

4.5.1.2 The SG/1 Head of Delegation of the nation conducting the Surveillance Test shall report the results in the National Activity Report submitted prior to each SG/1 meeting. This information is to be sent to the SG/1 Chairman and Secretary at least two weeks prior to the meeting. The reporting details are to include the following information:

- **a.** Ammunition calibre and nature
- **b.** NATO Design Number
- **c.** Ammunition manufacturer and cartridge case headstamp
- **d.** Year of manufacture
- **e.** Climatic environment(s) under which the sample was stored
- **f.** Lot numbers[2] subjected to the ST during the period since the last National Activity Report

Note 2: This is necessary since another nation may have procured ammunition from the same production facility during the same production period.

4.5.1.3 Detailed results of ammunition successfully completing the ST are to be maintained by the national authority.

4.5.2 Surveillance Test Fails to Meet Requirements

4.5.2.1 If either of the Surveillance Test samples fails to meet NATO requirements, then all of the production/stockpile for that year of production that is stored or used in that environment shall be disqualified from NATO use. The responsible NATO nation and any other nation(s) holding any stock relevant to the period of production and environment concerned shall remove the NATO Symbol of Interchangeability from all relevant ammunition lots or constrain/withdraw the use of the ammunition by NATO coalition forces. If the ammunition is currently in use by NATO coalition forces, the relevant national delegate shall immediately notify the appropriate authorities of the suspension from use of the affected lot(s) as interchangeable ammunition.

4.5.2.2 The SG/1 Head of Delegation of the nation conducting the Surveillance Test must immediately forward the following information to all other SG/1 Heads of Delegation so that they can determine if their nation holds any stockpile relevant to the producer/production period/storage environment and can investigate the condition of their stock:

- **a.** Ammunition calibre and nature
- **b.** NATO Design Number
- **c.** Ammunition manufacturer and cartridge case headstamp
- **d.** Year of manufacture

e. Climatic environment(s) under which the sample was stored
f. Lot number(s) of the failed lot(s)
g. Summary of test results

This reporting requirement is also applicable for NATO qualified ammunition that has been submitted to the ST earlier than required by AEP-97 since some nations commence national surveillance testing earlier than required by NATO.

4.5.2.3 Detailed results of ammunition failing the ST are to be maintained by the national authority.

4.5.2.4 If the nature of the failure is marginal, then the SG/1 Head of Delegation of the nation conducting the Surveillance Test may request that SG/1 evaluate the test results before making a decision on the interchangeability status of the affected ammunition. In the interim period, the interchangeability status of the ammunition lot(s) affected is (are) suspended with the nation(s) concerned being responsible for the control of, use and issue of stock.

4.5.2.5 The SG/1 Head of Delegation of the nation conducting the Surveillance Test shall report the results in the National Activity Report submitted prior to each SG/1 meeting. This information is to be sent to the SG/1 Chairman and Secretary at least two weeks prior to the meeting.

ANNEX 4-A

4.6 mm x 30 NATO SURVEILLANCE TEST - LIST OF APPLICABLE RTC / NTC TESTS

4.6 mm NATO Surveillance Test	AEP-97 Volume	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure			
EPVAT (Fired @ +21°C)	**12**	**30**	**60**
EPVAT (Fired @ +52°C)	**12**	**30**	**60**
EPVAT (Fired @ - 54°C)	**12**	**30**	**60**
Function & Casualty Test Procedure			
Weapon 1 - Gun, Sub-Machine, MP7 (Fired @ +21°C)	**14**	**250**	**250**
Gun, Sub-Machine, MP7 (Fired @ +52°C)	**14**	**125**	**125**
Gun, Sub-Machine, MP7 (Fired @ - 54°C)	**14**	**125**	**125**
Weapon 2 - Gun, Sub-Machine, MP7 (Fired @ +21°C)	**14**	**250**	**250**
Gun, Sub-Machine, MP7 (Fired @ +52°C)	**14**	**125**	**125**
Gun, Sub-Machine, MP7 (Fired @ - 54°C)	**14**	**125**	**125**
Total F & C Test Quantity		**1000**	**1000**
Smoke and Flash Test Procedure[2]	**17**	**See Note[2] below**	
Precision Test Procedure	**18**	**90**	**N/A**
Trajectory Match Test Procedure[3]			
Trajectory Match at 50m	**20**	**60**	**60**
Trajectory Match at 100m	**20**	**60**	**60**
TOTAL QUANTITY REQUIRED		**1300**	**1300**
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		**2600**	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

Note 2: The Smoke and Flash Test is only to be conducted if deemed necessary by paragraph 14.6.1.f of the Function & Casualty Test, this could possibly require firing a further two-hundred 200 cartridges.

Note 3: The Trajectory Match Test is only required if the Velocity criteria of the EPVAT Test is not met or the original lot acceptance data and/or transducer type is not available to conduct a comparative velocity test.

4.A.1 4.6 mm x 30 NATO SURVEILLANCE TEST - SENTENCING CRITERIA

Test	Test Requirements	AEP-97 Volume
EPVAT	No change permitted from requirements contained in EPVAT Volume 12 except for Velocity. Velocity shall be within 1.5 % of + 21 ºC EPVAT value from original lot acceptance test.	**12**
Function & Casualty	Must meet the requirements of Volume 14. No reduction in performance is permitted.	**14**
Smoke and Flash Test	Must meet the requirements of Volume 17. No reduction in performance is permitted.	**17**
Precision	Must meet the requirements of Volume 18. No reduction in performance is permitted.	**18**
Trajectory Match	If velocity of the EPVAT test is outside the 1.5 % limit then a Trajectory Match test shall be conducted and sentenced in accordance with Volume 20. If the Trajectory Match test is successful then the ammunition shall then be deemed acceptable	**20**
Visual Inspection	Ammunition shall be submitted in the original packaging and shall be examined for visual deterioration. If there is a question about the degree of deterioration (excessive/not excessive) and the testing agency feels it needs further clarification, the ammunition sample shall be photographed and the details presented to the national authority and SG/1 delegate for sentencing.	**6**

ANNEX 4-B

5.56 mm x 45 NATO SURVEILLANCE TEST - LIST OF APPLICABLE RTC / NTC TESTS

5.56 mm NATO Surveillance Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test [1] Quantity	Test Quantity	Re-Test [1] Quantity
EPVAT Test Procedure					
EPVAT (Fired @ +21°C)	12	30	60	30	60
EPVAT (Fired @ +52°C)	12	30	60	30	60
EPVAT (Fired @ - 54°C)	12	30	60	30	60
Function & Casualty Test Procedure[2]					
Minimi Mk1 - Free Hang. Belt (Fired @ +21°C)	14	200	200	200	200
Minimi Mk1 - NATO Chute (Fired @ +21°C)	14	200	200	200	200
Rifle, L85A2 (Fired @ +21°C)	14	180	180	180	180
Rifle, M16A2/A4 (Fired @ +21°C)	14	180	180	180	180
Rifle, AR 70/90 (Fired @ +21°C)	14	180	180	180	180
Rifle, G36/A1 (Fired @ +21°C)	14	180	180	180	180
Minimi Mk1 - Free Hang. Belt (Fired @ +52°C)	14	150	150	150	150
Minimi Mk1 - NATO Chute (Fired @ +52°C)	14	150	150	150	150
Rifle, L85A2 (Fired @ +52°C)	14	160	160	160	160
Rifle, M16A2/A4 (Fired @ +52°C)	14	160	160	160	160
Rifle, AR 70/90 (Fired @ +52°C)	14	160	160	160	160
Rifle, G36/A1 (Fired @ +52°C)	14	160	160	160	160
Minimi Mk1 - Free Hang. Belt (Fired @ -54°C)	14	150	150	150	150
Minimi Mk1 - NATO Chute (Fired @ -54°C)	14	150	150	150	150
Rifle, L85A2 (Fired @ -54°C)	14	160	160	160	160
Rifle, M16A2/A4 (Fired @ -54°C)	14	160	160	160	160
Rifle, AR 70/90 (Fired @ -54°C)	14	160	160	160	160
Rifle, G36/A1 (Fired @ -54°C)	14	160	160	160	160
Total F & C Test Quantity		3000	3000	3000	3000
Smoke and Flash Test Procedure[3]	17	See Note[3] below			
Precision Test Procedure	18	90	N/A	90	N/A
Trajectory Match Test Procedure[4]					
Trajectory Match at 300m	20	60	60	60	60
Trajectory Match at 550m	20	60	60	60	60

5.56 mm NATO Surveillance Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test [1] Quantity	Test Quantity	Re-Test [1] Quantity
Trace Test Procedure (Fired @+21°C)					
- Trace Distance					
Rifle, M16A2/A4	**21**	**N/A**	**N/A**	**50**	**N/A**
- Trace Quality					
Gun, Machine, Minimi Mk1	**21**	**N/A**	**N/A**	**50**	**N/A**
TOTAL QUANTITY REQUIRED		**3300**	**3300**	**3400**	**3300**
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		**6600**		**6700**	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

Note 2: The NATO Chute test will only be required for linked ammunition which was previously tested in a linked configuration.

Note 3: The Smoke and Flash Test is only to be conducted if deemed necessary by paragraph 14.6.1.f of the Function & Casualty Test, this could possibly require firing a further two-hundred 200 cartridges.

Note 4: The Trajectory Match Test is only required if the velocity criteria of the EPVAT Test is not met or the original lot acceptance data and/or transducer type is not available to conduct a comparative velocity test.

4.B.1 5.56 mm x 45 NATO SURVEILLANCE TEST - SENTENCING CRITERIA

Test	Test Requirements	AEP-97 Volume
EPVAT	No change permitted from requirements contained in Volume 12 except for Velocity. Velocity shall be within 1.5% of +21ºC EPVAT value from original lot acceptance test.	**12**
Function & Casualty	Must meet the requirements of Volume 14. No reduction in performance is permitted.	**14**
Smoke and Flash Test	Must meet the requirements of Volume 17. No reduction in performance is permitted.	**17**
Precision	Must meet the requirements of Volume 18. No reduction in performance is permitted.	**18**
Trajectory Match	If velocity of the EPVAT test is outside the 1.5% limit then a Trajectory Match Test shall be conducted and sentenced in accordance with Volume 20. If the Trajectory Match Test is successful then the ammunition shall then be deemed acceptable.	**20**
Trace	Must meet the requirements of Volume 21 with the exception that visible trace performance for both distance and quality shall be at least 60%. **No retest is permitted.**	**21**
Visual Inspection	Ammunition and links (when the sample is tested in its linked configuration) shall be submitted in the original packaging and shall be examined for visual deterioration. If there is a question about the degree of deterioration (excessive/not excessive) and the testing agency feels it needs further clarification, the ammunition sample shall be photographed and the details presented to the national authority and SG/1 delegate for sentencing.	**6**

ANNEX 4-C

5.7 mm x 28 NATO SURVEILLANCE TEST - LIST OF APPLICABLE RTC / NTC TESTS

5.7 mm NATO Surveillance Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test Quantity[1]	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure					
EPVAT (Fired @ +21°C)	12	30	60	30	60
EPVAT (Fired @ +52°C)	12	30	60	30	60
EPVAT (Fired @ - 54°C)	12	30	60	30	60
Function & Casualty Test Procedure					
Gun, Sub-Machine, P90 (Fired @ +21°C)	14	200	200	200	200
Pistol, Five-seveN (Fired @ +21°C)	14	115	115	115	115
Gun, Sub-Machine, P90 (Fired @ +52°C)	14	150	150	150	150
Pistol, Five-seveN (Fired @ +52°C)	14	100	100	100	100
Gun, Sub-Machine, P90 (Fired @ - 54°C)	14	150	150	150	150
Pistol, Five-seveN (Fired @ - 54°C)	14	100	100	100	100
Total F & C Test Quantity		815	815	815	815
Smoke and Flash Test Procedure[2]	17	See Note[2] below			
Precision Test Procedure	18	90	N/A	90	N/A
Trajectory Match Test Procedure[3]					
Trajectory Match at 50m	20	60	60	60	60
Trajectory Match at 100m	20	60	60	60	60
Trace Test Procedure (Fired @+21°C)					
- Trace Distance					
Gun, Sub-Machine, P90	21	N/A	N/A	50	N/A
- Trace Quality					
Gun, Sub-Machine, P90	21	N/A	N/A	50	N/A
TOTAL QUANTITY REQUIRED		1115	1115	1215	1115
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		2230		2330	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

Note 2: The Smoke and Flash Test is only to be conducted if deemed necessary by paragraph 14.6.1.f of the Function & Casualty Test, this could possibly require firing a further two-hundred 200 cartridges.

Note 3: The Trajectory Match Test is only required if the Velocity criteria of the EPVAT Test is not met or the original lot acceptance data and/or transducer type is not available to conduct a comparative velocity test.

4.C.1 5.7 mm x 28 NATO SURVEILLANCE TEST - SENTENCING CRITERIA

Test	Test Requirements	AEP-97 Volume
EPVAT	No change permitted from requirements contained in Volume 12 except for Velocity. Velocity shall be within 1.5% of +21ºC EPVAT value from original lot acceptance test.	**12**
Function & Casualty	Must meet the requirements of Volume 14. No reduction in performance is permitted.	**14**
Smoke and Flash Test	Must meet the requirements of Volume 17. No reduction in performance is permitted.	**17**
Precision	Must meet the requirements of Volume 18. No reduction in performance is permitted.	**18**
Trajectory Match	If velocity of the EPVAT test is outside the 1.5% limit then a Trajectory Match Test shall be conducted and sentenced in accordance with Volume 20. If the Trajectory Match Test is successful then the ammunition shall then be deemed acceptable.	**20**
Trace	Must meet the requirements of Volume 21 with the exception that visible trace performance for both distance and quality shall be at least 60%. **No retest is permitted.**	**21**
Visual Inspection	Ammunition and links (when the sample is tested in its linked configuration) shall be submitted in the original packaging and shall be examined for visual deterioration. If there is a question about the degree of deterioration (excessive/not excessive) and the testing agency feels it needs further clarification, the ammunition sample shall be photographed and the details presented to the national authority and SG/1 delegate for sentencing.	**6**

ANNEX 4-D

7.62 mm x 51 NATO SURVEILLANCE TEST - LIST OF APPLICABLE RTC / NTC TESTS

7.62 mm NATO Surveillance Test	AEP-97 Volume	Ball		Tracer	
		Test Quantity	Re-Test Quantity[1]	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure					
EPVAT (Fired @ +21°C)	12	30	60	30	60
EPVAT (Fired @ +52°C)	12	30	60	30	60
EPVAT (Fired @ - 54°C)	12	30	60	30	60
Function & Casualty Test Procedure					
Gun, Machine, L7A2 (Fired @ +21°C)	14	200	200	200	200
Gun, Machine, M240B (Fired @ +21°C)	14	200	200	200	200
Gun, Machine,, L7A2 (Fired @ +52°C)	14	150	150	150	150
Gun, Machine, M240B (Fired @ +52°C)	14	150	150	150	150
Gun, Machine, L7A2 (Fired @ - 54°C)	14	150	150	150	150
Gun, Machine, M240B (Fired @ - 54°C)	14	150	150	150	150
Total F & C Test Quantity		1000	1000	1000	1000
Smoke and Flash Test Procedure[2]	17	See Note[2] below			
Precision Test Procedure	18	90	N/A	90	N/A
Trajectory Match Test Procedure[3]					
Trajectory Match at 300m	20	60	60	60	60
Trajectory Match at 550m	20	60	60	60	60
Trace Test Procedure (Fired @+21°C)					
- Trace Distance					
Gun, Machine, T65E1 or M240B	21	N/A	N/A	50	N/A
- Trace Quality					
Gun, Machine, T65E1 or M240B	21	N/A	N/A	50	N/A
TOTAL QUANTITY REQUIRED		1300	1300	1400	1300
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		2600		2700	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

Note 2: The Smoke and Flash Test is only to be conducted if deemed necessary by paragraph 14.6.1.f of the Function & Casualty Test, this could possibly require firing a further two-hundred 200 cartridges.

Note 3: The Trajectory Match Test is only required if the Velocity criteria of the EPVAT Test is not met or the original lot acceptance data and/or transducer type is not available to conduct a comparative velocity test.

4.D.1 7.62 mm x 51 NATO SURVEILLANCE TEST - SENTENCING CRITERIA

Test	Test Requirements	AEP-97 Volume
EPVAT	No change permitted from requirements contained in Volume 12 except for Velocity. Velocity to be within 1.5% of +21ºC EPVAT value from original lot acceptance test.	**12**
Function & Casualty	Must meet the requirements of Volume 14. No reduction in performance is permitted.	**14**
Smoke and Flash Test	Must meet the requirements of Volume 17. No reduction in performance is permitted.	**17**
Precision	Must meet the requirements of Volume 18. No reduction in performance is permitted.	**18**
Trajectory Match	If velocity of the EPVAT test is outside the 1.5% limit then a Trajectory Match Test shall be conducted and sentenced in accordance with Volume 20. If the Trajectory Match Test is successful then the ammunition shall then be deemed acceptable.	**20**
Trace	Must meet the requirements of Volume 21 with the exception that visible trace performance for both distance and quality shall be at least 60%. **No retest is permitted.**	**21**
Visual Inspection	Ammunition and links (when the sample is tested in its linked configuration) shall be submitted in the original packaging and shall be examined for visual deterioration. If there is a question about the degree of deterioration (excessive/not excessive) and the testing agency feels it needs further clarification, the ammunition sample shall be photographed and the details presented to the national authority and SG/1 delegate for sentencing.	**6**

ANNEX 4-E

9 mm x 19 NATO SURVEILLANCE TEST - LIST OF APPLICABLE RTC / NTC TESTS

9 mm NATO Surveillance Test	AEP-97 Volume	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure			
EPVAT (Fired @ +21°C)	**12**	**30**	**60**
EPVAT (Fired @ +52°C)	**12**	**30**	**60**
EPVAT (Fired @ - 54°C)	**12**	**30**	**60**
Function & Casualty Test Procedure			
Gun, Sub-Machine, PM12S/S2 - Horizontal (Fired @ +21°C)	**14**	**128**	**128**
Pistol, 92F/92FS - Horizontal (Fired @ +21°C)	**14**	**80**	**80**
Gun, Sub-Machine, PM12S/S2 - Depressed (Fired @ +21°C)	**14**	**124**	**124**
Pistol, 92F/92FS – Depressed (Fired @ +21°C)	**14**	**75**	**75**
Gun Sub-Machine, PM12S/S2 - Horizontal (Fired @ +52°C)	**14**	**124**	**124**
Pistol, 92F/92FS - Horizontal (Fired @ +52°C)	**14**	**80**	**80**
Gun, Sub-Machine, PM12S/S2 - Horizontal (Fired @ - 54°C)	**14**	**124**	**124**
Pistol, 92F/92FS - Horizontal (Fired @ - 54°C)	**14**	**80**	**80**
Total F & C Test Quantity		**815**	**815**
Smoke and Flash Test Procedure[2]	**17**	**See Note[2] below**	
Precision Test Procedure	**18**	**90**	**N/A**
TOTAL QUANTITY REQUIRED		**995**	**995**
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		**1990**	

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

Note 2: The Smoke and Flash Test is only to be conducted if deemed necessary by paragraph 14.6.1.f of the Function & Casualty Test, this could possibly require firing a further two-hundred 200 cartridges.

4.E.1 9 mm x 19 NATO SURVEILLANCE TEST - SENTENCING CRITERIA

Test	Test Requirements	AEP-97 Volume
EPVAT	Must meet the requirements of Volume 12. No reduction in performance is permitted.	**12**
Function & Casualty	Must meet the requirements of Volume 14. No reduction in performance is permitted.	**14**
Smoke and Flash Test	Must meet the requirements of Volume 17. No reduction in performance is permitted.	**17**
Precision	Must meet the requirements of Volume 18. No reduction in performance is permitted.	**18**
Visual Inspection	Ammunition shall be submitted in the original packaging and shall be examined for visual deterioration. If there is a question about the degree of deterioration (excessive/not excessive) and the testing agency feels it needs further clarification, the ammunition sample shall be photographed and the details presented to the national authority and SG/1 delegate for sentencing.	**6**

ANNEX 4-F

12.7 mm x 99 NATO SURVEILLANCE TEST - LIST OF APPLICABLE RTC / NTC TESTS

12.7 mm NATO Surveillance Test	AEP-97 Volume	Test Quantity	Re-Test Quantity[1]
EPVAT Test Procedure			
EPVAT (Fired @ +21°C)	**12**	**30**	**60**
EPVAT (Fired @ +52°C)	**12**	**30**	**60**
EPVAT (Fired @ - 54°C)	**12**	**30**	**60**
Function & Casualty Test Procedure			
Weapon 1 - Gun, Machine, M2HB (Fired @ +21°C)	**14**	**200**	**200**
Gun, Machine, M2HB (Fired @ +52°C)	**14**	**150**	**150**
Gun, Machine, M2HB (Fired @ - 54°C)	**14**	**150**	**150**
Weapon 2 - Gun, Machine, M2HB (Fired @ +21°C)	**14**	**200**	**200**
Gun, Machine, M2HB (Fired @ +52°C)	**14**	**150**	**150**
Gun, Machine, M2HB (Fired @ - 54°C)	**14**	**150**	**150**
Total F & C Test Quantity		**1000**	**1000**
Smoke and Flash Test Procedure[2]	**17**	**See Note[2] below**	
Precision Test Procedure	**18**	**90**	**N/A**
Terminal Effects[3]			
Explosive Test	**19**	**20**	**20**
Incendiary Test	**19**	**20**	**20**
Trajectory Match Test Procedure[4]			
Trajectory Match at 550 m	**20**	**60**	**60**
Trajectory Match at 900 m	**20**	**60**	**60**
Trace Test Procedure[5] (Fired @ +21°C)			
- Trace Distance			
Gun, Machine, M2HB	**21**	**50**	**N/A**
- Trace Quality			
Gun, Machine, M2HB	**21**	**50**	**N/A**
TOTAL QUANTITY REQUIRED		**1440**	**1340**
TOTAL QUANTITY REQUIRED (Including Re-Test Quantity)		**2780**	

See next page (4-F-2) for notes.

Note 1: This is the maximum quantity required for re-test. The quantity may be less according to type of defect.

Note 2: The Smoke and Flash Test is only to be conducted if deemed necessary by paragraph 14.6.1.f of the Function & Casualty Test, this could possibly require firing a further two-hundred 200 cartridges.

Note 3: The quantity will vary according to the ammunition type.

Note 4: The Trajectory Match Test is only required if the Velocity criteria of the EPVAT Test is not met or the original lot acceptance data and/or transducer type is not available to conduct a comparative velocity test.

Note 5: Trace Test is only required for designs containing a tracer function.

4.F.1 12.7 mm x 99 NATO SURVEILLANCE TEST - SENTENCING CRITERIA

Test	Test Requirements	AEP-97 Volume
EPVAT	No change is permitted from requirements contained in Volume 12 except for Velocity. Velocity to be within 1.5% of + 21ºC EPVAT value from original lot acceptance test.	**12**
Function & Casualty	Must meet the requirements of Volume 14. No reduction in performance is permitted.	**14**
Smoke and Flash Test	Must meet the requirements of Volume 17. No reduction in performance is permitted.	**17**
Precision	Must meet the requirements of Volume 18. No reduction in performance is permitted.	**18**
Terminal Effects	Perforation Test is not applicable. No change allowed for either Explosive or Incendiary Test stated in Volume 19.	**19**
Trajectory Match	If velocity of the EPVAT test is outside the 1.5% limit then a Trajectory Match Test shall be conducted and sentenced in accordance with Volume 20. If the Trajectory Match Test is successful then the ammunition shall then be deemed acceptable	**20**
Trace	Must meet the requirements of Volume 21 with the exception that visible trace performance for both distance and quality shall be at least 60%. **No retest is permitted.**	**21**
Visual Inspection	Ammunition and links (when the sample is tested in its linked configuration) shall be submitted in the original packaging and shall be examined for visual deterioration. If there is a question about the degree of deterioration (excessive/not excessive) and the testing agency feels it needs further clarification, the ammunition sample shall be photographed and the details presented to the national authority and SG/1 delegate for sentencing.	**6**

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 5

NATO AMMUNITION STANDARDIZATION ORGANIZATIONAL STRUCTURE AND RESPONSIBILITIES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

5.1 NATO Structure

The organizational chart below represents the hierarchy of the NATO groups responsible for the standardization of small arms ammunition:

North Atlantic Council (NAC)

⇓

Conference of National Armament Directors (CNAD)

⇓

NATO Army Armaments Group (NAAG)

⇓

Land Capability Group on Dismounted Soldier Systems (LCGDSS)

⇓

Sub-Group 1 on Small Arms Ammunition Interchangeability (SG/1)

⇓ ⇓

European Regional Test Centre (ERTC)
&
North American Regional Test Centre (NARTC)

⇓

National Test Centres (NTC)

5.1.1 North Atlantic Council

The North Atlantic Council (NAC) is the principal decision-making authority of the North Atlantic Alliance. The Council is the only body within the Alliance which derives its authority explicitly from the North Atlantic Treaty. The Council itself was given responsibility under the Treaty for setting up subsidiary bodies as may be necessary for implementing the Treaty.

5.1.2 Conference of National Armament Directors

The Conference of National Armament Directors (CNAD) is the senior body under the North Atlantic Council dealing with production logistics. The CNAD promotes NATO armaments cooperation and considers political, economic and technical aspects of the development and procurement of equipment for NATO forces. This is accomplished by identifying opportunities for collaboration in the research, development and production of military equipment and weapon systems for the armed forces.

5.1.3 NATO Army Armaments Group

The NATO Army Armaments Group (NAAG) is one of three Main Armaments Groups (MAG) under the CNAD. Under its Terms of Reference, the NAAG is responsible for promoting cooperation and standardization in the area of land armaments via information exchange and collective activities. The basic mission of the NAAG is to work towards the objectives of NATO armaments cooperation. The NAAG promotes interoperability of Alliance and NATO Interoperability Platform armed forces by means of information exchange, standardization and cooperative activities to satisfy the core functions of the NATO Armaments Review. The main task of the NAAG is to promote cooperation, technology, development and standardization for military equipment and systems.

5.1.4 Land Capability Group on Dismounted Soldier Systems

The Land Capability Group on Dismounted Soldier Systems (LCGDSS) is responsible for the system aspects and all equipment of dismounted operations. The dismounted soldier system is defined as the soldier and all the equipment that the soldier wears, uses or carries for individual or small team use. The group is also responsible for simulators and simulation techniques related to the training of the dismounted units. LCGDSS will develop and maintain standards related to the interoperability of national dismounted systems in the critical areas of capability to include hardware, ammunition, software and training.

5.1.5 Sub-Group 1 on Small Arms Ammunition Interchangeability

Sub-Group 1 (SG/1) on Small Arms Ammunition Interchangeability is responsible for the standardization of all technical aspects of small calibre ammunition up to and including 40 mm and of ancillary items such as links, clips, magazines, bandoliers, etc. SG/1 will provide technical advice and foster interoperability in the areas of small arms ammunition on test practices and production processes. SG/1 will prepare standards, drawings and other texts necessary to ensure the standardization interchangeability of small calibre ammunition and ancillary items. SG/1 will oversee the interchangeability testing at Regional Test Centres and approved National Test Centres and will authorize and control the use of the NATO Symbol of Interchangeability of all ammunition and ancillary items bearing that symbol.

5.1.5.1 SG/1 Executive Committee

SG/1 can establish an Executive Committee to carry on the responsibilities of SG/1 during periods when SG/1 is not in session. The Executive Committee is composed of the Chairman of SG/1 and the Superintendents of the RTCs, one or two SG/1 Delegates from Europe and North America designated by the Chairman on the basis of their competence and quick availability, and the representatives of the nations concerned. It is inevitable in the diverse operations of SG/1 that unforeseen situations will arise for which detailed provisions have not been addressed here in AEP-97 or in other official documents. The function of the Executive Committee under the leadership of the Chairman is to deal with such situations, for and on behalf of SG/1, until SG/1 meets again in plenary session. The Executive Committee is empowered by SG/1 to apply the policy and principles laid down in the governing SG/1 documents, either by meeting or correspondence as

appropriate, and to decide whether problems or situations presented to it could reasonably be solved within this guidance or whether an emergency meeting of the SG/1 should be summoned. The Chairman shall obtain the coordinated recommendation of the Executive Committee regarding all decisions to be taken before the next meeting of SG/1. The Executive Committee shall then take this decision in the name of SG/1. SG/1 guidance further provides that the Executive Committee shall report its activities to SG/1 at each plenary session.

5.1.6 North American and European Regional Test Centres

The North American and European Regional Test Centres were established to implement the standardization of small calibre ammunition and associated equipment through direct evidence testing of these commodities. To achieve this end, the RTCs are certified by NATO to conduct Qualification Approval, Production Testing and, if required, Surveillance Testing.

5.1.7 National Test Centres

National Test Centres are established by member countries within NATO to conduct direct evidence testing, at a national level, of small arms ammunition by calibre and associated equipment. NTCs are certified by NATO (SG/1) to conduct Surveillance Testing only.

5.2 National Delegate (Head Of Delegation) Responsibilities To Sub-Group 1

a. Perform duties as defined in the latest edition of the NATO Main Armaments Group (MAG) Handbook.

b. Ensure that ammunition produced or procured for general service use is submitted for NATO Qualification Approval in accordance with the appropriate requirements per the applicable standard and AEP-97.

c. Monitor the design build standard (technical data package) for the NATO qualified design and control the use of the NATO Symbol of Interchangeability during the life of the design. Inform Sub-Group 1 of any changes to the design build standard.

d. Ensure timely submission of NATO qualified designs to RTCs for Production Testing in accordance with the requirements of the relevant standard and AEP-97.

e. In the event of a failure during Qualification, Production or Surveillance testing, take the appropriate action as specified in AEP-97, Volumes 2, 3 or 4.

f. Ensure timely submission of NATO qualified warstock to NTCs for Surveillance Testing in accordance with the requirements of the relevant standard and AEP-97.

g. Ensure new or updated standards and AEP-97 Volumes are properly staffed within their nation for ratification and implementation procedures.

h. Ensure relevant national users of standards and AEP-97 are provided with current versions of the documents.

i. Produce National Activity Report prior to each SG/1 meeting in the format defined by SG/1. This report is to be in electronic format using Microsoft Excel and emailed to the Chairman of SG/1 at least 10 working days before the meeting.

j. Ensure national infantry weapons for each calibre are adequately represented in each family of NATO Nominated Weapons (NNW).

k. Where a nation sponsors a NNW, serve as liaison between weapon manufacturer/national logistics organisations and RTCs/ NTCs for NNWs, spare parts and technical information, in a timely manner. This is to ensure that the correct model NNW is held and supported by the RTC/NTC.

l. Monitor current status of NNW and inform SG/1 of any changes to the weapons build standard or armed force usage status.

m. Ensure that there is proper National representation, not only at SG/1 level, but at the subordinate Team of Experts/Working Group level. This may require extensive research, discussion and co-ordination with appropriate subject experts across various national services.

n. If relevant, serve as custodian for specific standards and AEPs (MOPIs).

o. Supply drawings and technical information, on request, for any equipment listed as mandatory in the AEP (MOPI), for which their nation is custodian.

p. Ensure that ammunition samples scheduled for RTC or NTC submission have met all national requirements and the relevant documentation, as listed in the appropriate volume of AEP-97, has been completed and delivered to the RTC with the associated ammunition.

5.3 RTC Superintendent Responsibilities

a. Coordinate and conduct NATO Qualification Approval and Production Tests on request of National delegates.

b. Report the results of Qualification Approval Tests to the LCGDSS Secretary for issuance of a NATO Design Number. Report the results of Qualification Approval, Production and Surveillance (if conducted at the RTC) Tests to the SG/1 Chairman (this is accomplished in the RTC Activity Report).

c. Ensure RTCs hold up to date versions of all relevant standards and AEPs (MOPIs).

d. Conduct, upon request, NATO Certification Inspections of National Test Centres.

e. Ensure that all NATO Nominated Weapons (NNW) held at the RTC have an adequate supply of spare parts, technical manuals and gauges and RTC staff are properly trained on the use of the NNW.

f. Produce RTC Activity Report and forward to SG/1 Chairman prior to each SG/1 meeting.

g. Provide information to LCGDSS Secretary and SG/1 Chairman on the status of NTCs.

h. Produce updated list of NATO Reference Ammunition assessed values and current performance.

i. Attend SG/1 meetings and provide technical assistance to the group where possible.

j. Attend relevant meetings of Team of Experts/Working Groups, especially where the work may lead to the production of an AEP (MOPI) with standardisation testing being conducted at the RTCs. This may require extensive research, discussion and co-ordination with appropriate subject experts across various national services.

NATO STANDARD

AEP-97

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VOLUME 6

NATO TEST EQUIPMENT AND VISUAL STANDARDS

Edition A Version 1

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6.1 Applicability

Commonality of test equipment among NATO Test Centres is the cornerstone for comparability of test results. Through certification inspections of both Regional and National Test Centres, SG/1 can be assured that every Test Centre has the same basic test equipment to conduct NATO ammunition interchangeability tests. This basic set of test equipment is specified in each volume of this Manual of Proof and Inspection.

6.2 Test Equipment

6.2.1 A basic list of drawings for the following tests in this manual is contained in Annex 6-A.

6.A.1 Volume 12 – Electronic Pressure, Velocity, and Action Time (EPVAT)
6.A.2 Volume 14 – Function and Casualty Test
6.A.3 Volume 15 – Link Test
6.A.4 Volume 16 – Barrel Erosion Test
6.A.5 Volume 18 – Precision Test

6.2.2 A complete set of drawings for all test equipment is available from either RTC Superintendent.

6.2.3 The photographs contained in Annex 6-B should be used for informational purposes only, as a representation of a generic test set-up. The individual test volumes contain the requirements for the equipment that is necessary to complete each test.

6.3 Inspection Standards

6.3.1 The visual inspection standards contained in Annex 6-C are provided for inspection reference purposes. These standards are subject to revision as experience indicates.

ANNEX 6-A

NATO DRAWINGS (BASIC SET)

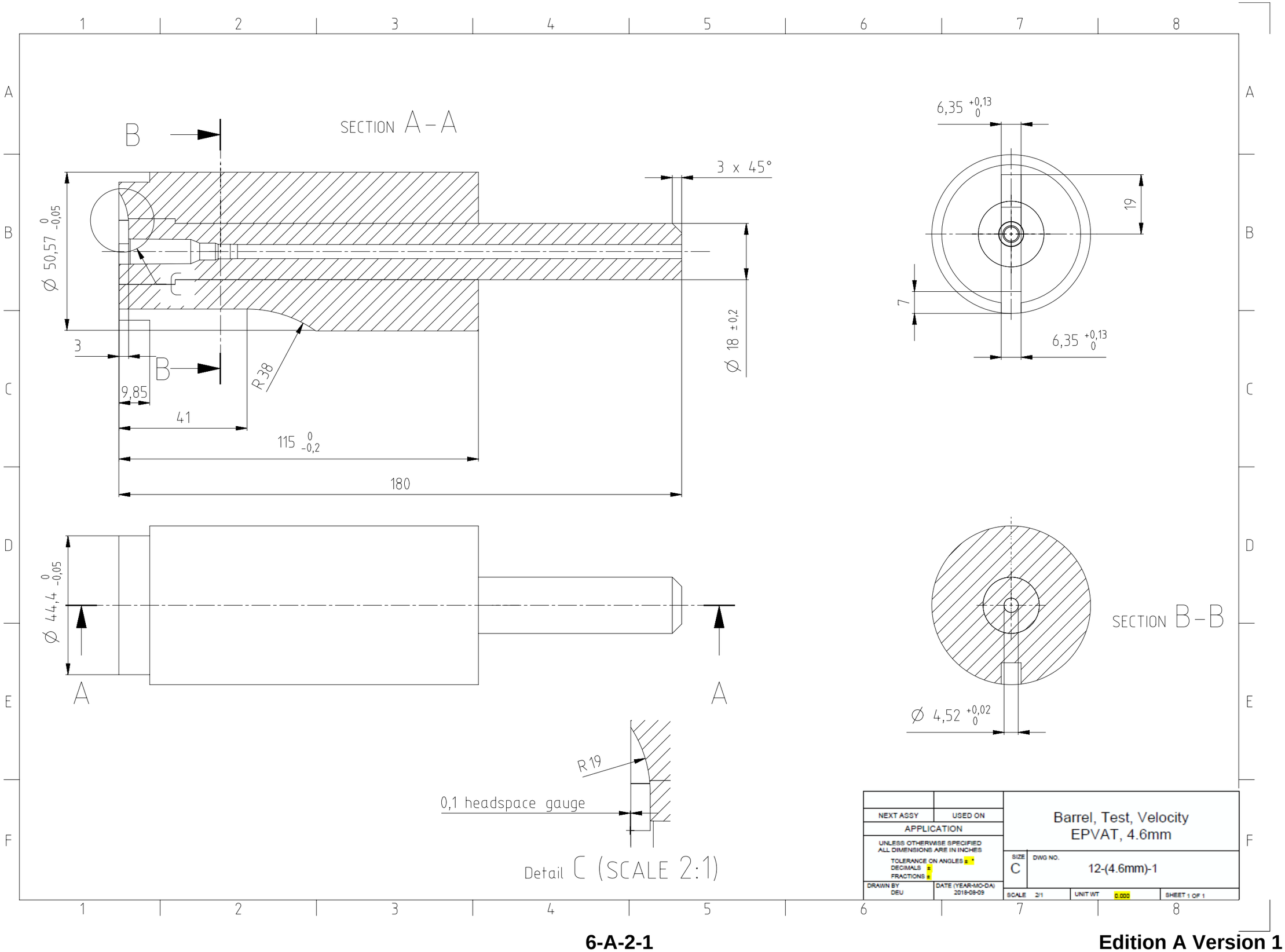
6.A.1 AEP-97, VOLUME 12 – COMBINATION ELECTRONIC PRESSURE, VELOCITY, AND ACTION TIME (EPVAT) TEST PROCEDURE

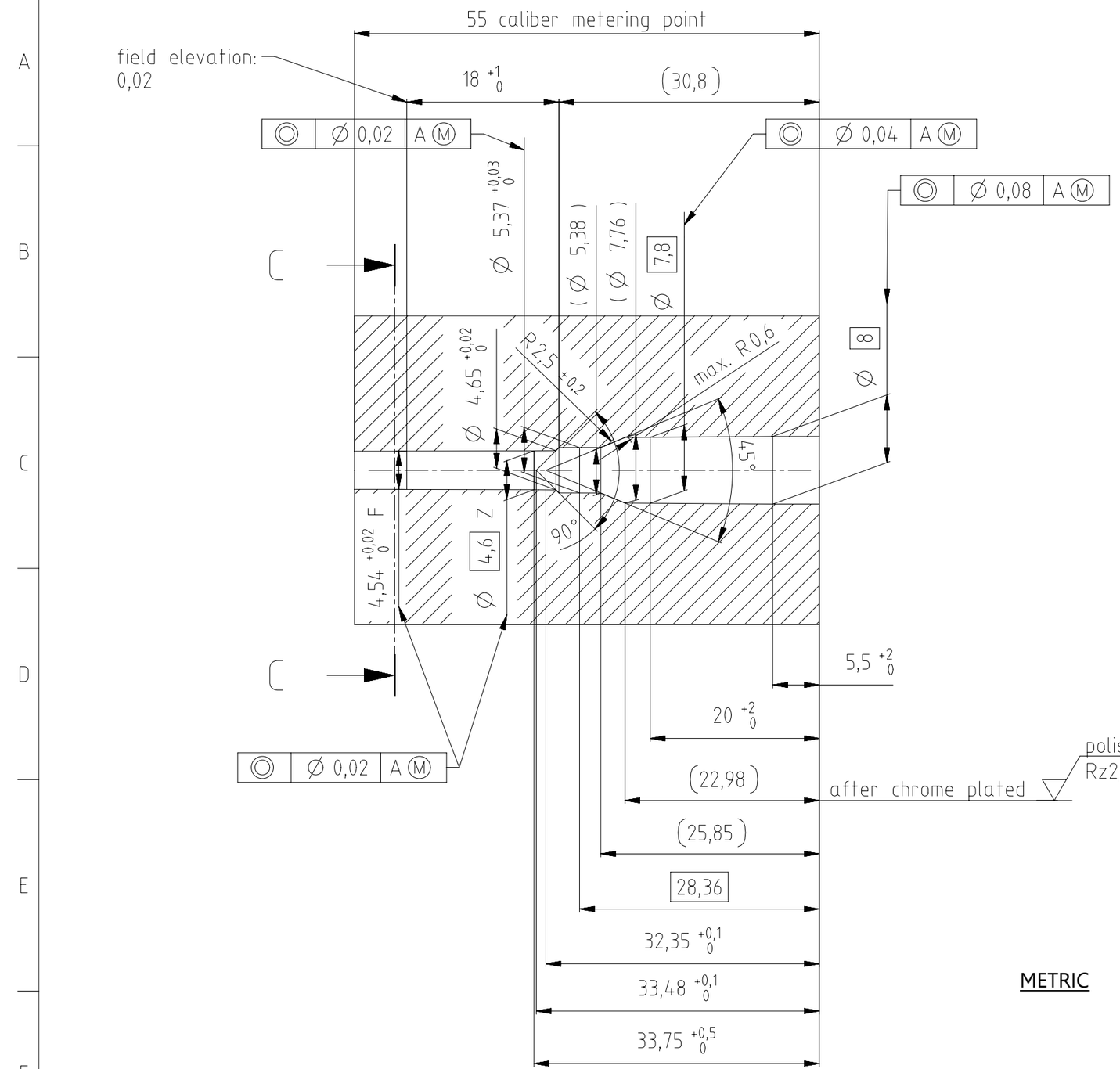
***Note: Unless annotated otherwise (METRIC) presume all drawings are in English units.**

DRAWING NUMBER	DRAWING TITLE
12-(4.6mm)-1	Barrel, Test, Velocity (EPVAT), 4.6mm
12-(4.6mm)-2	Barrel, Test, Chamber and Bore, 4.6mm
12-(4.6mm)-3	Barrel, Test, EPVAT, 6215 or GP6 Transducer, 4.6mm
12-(MC)-2	Firing Pin, Universal Receiver, 4.6mm, 5.56mm and 5.7mm
12-(MC)-3	Plate, Firing Pin, Universal Receiver, 4.6mm, 5.56mm and 5.7mm
12-(4.6mm)-6	Gage, Firing Pin Indent, 4.6mm
12-(4.6mm)-6-1	Holder, Body, Firing Pin Indent Gage, 4.6mm
12-(4.6mm)-6-2	Ejector, Firing Pin Indent Gage, 4.6mm
12-(4.6mm)-7	Gage, Headspace, 4.6mm
12-(5.56mm)-1	Barrel, Test, Velocity (EPVAT), 5.56mm
12-(5.56mm)-2	Barrel, Test, Chamber and Bore, 5.56mm
12-(5.56mm)-3	Barrel, Test, EPVAT, 6215 or GP6 Transducer, 5.56mm
12-(5.56mm)-4	Firing Pin, Universal Receiver -**Replaced by Drawing 12-(MC)-2**
12-(5.56mm)-5	Plate, Firing Pin, Universal Receiver -**Replaced by Drawing 12-(MC)-3**
12-(5.56mm)-6	Gage, Firing Pin Indent, 5.56mm
12-(5.56mm)-6-1	Holder, Body, Firing Pin Indent Gage, 5.56mm
12-(5.56mm)-6-2	Ejector, Firing Pin Indent Gage, 5.56mm
12-(5.56mm)-7	Gage, Headspace, 5.56mm
12-(5.7mm)-1	Barrel, Test, Velocity (EPVAT), 5.7mm
12-(5.7mm)-2	Barrel, Test, Chamber and Bore, 5.7mm
12-(5.7mm)-3	Barrel, Test, EPVAT, 6215 or GP6 Transducer, 5.7mm
12-(MC)-2	Firing Pin, Universal Receiver, 4.6mm, 5.56mm and 5.7mm
12-(MC)-3	Plate, Firing Pin, Universal Receiver, 4.6mm, 5.56mm and 5.7mm
12-(5.7mm)-6	Gage, Firing Pin Indent, 5.7mm
12-(5.7mm)-6-1	Holder, Firing Pin Indent Gage, 5.7mm
12-(5.7mm)-6-2	Ejector, Firing Pin Indent Gage, 5.7mm
12-(5.7mm)-7	Gage, Headspace, 5.7mm
12-(7.62mm)-1	Barrel, Test, Velocity (EPVAT), 7.62mm
12-(7.62mm)-2	Barrel, Test, EPVAT, 7.62mm
12-(7.62mm)-3	Adapter, EPVAT Barrel, 6215 or GP6 Transducer, 7.62mm
12-(7.62mm)-4	Firing Pin, Universal Receiver, 7.62mm
12-(MC)-1	Plate, Firing Pin, Universal Receiver, 7.62 mm, 9 mm & 12.7mm
12-(7.62mm)-5	Gage, Firing Pin Indent, 7.62mm
12-(7.62mm)-5-1	Holder, Body, Firing Pin Indent Gage, 7.62mm
12-(7.62mm)-5-2	Ejector, Firing Pin Indent Gage, 7.62mm
12-(7.62mm)-5-3	Pin, Firing Pin Indent Gage, 7.62mm
12-(7.62mm)-6	Gage, Headspace, 7.62mm
12-(9mm)-1	Barrel, Test, Velocity (EPVAT), 9mm
12-(9mm)-2	Barrel, Test, EPVAT, 6203 Transducer, 9mm
12-(9mm)-3	Barrel, Test, EPVAT, 6215 or GP6 Transducer, 9mm
12-(9mm)-4	Adapter, Barrel, Test, EPVAT, 9mm
12-(9mm)-5	Firing Pin, Universal Receiver, 9mm

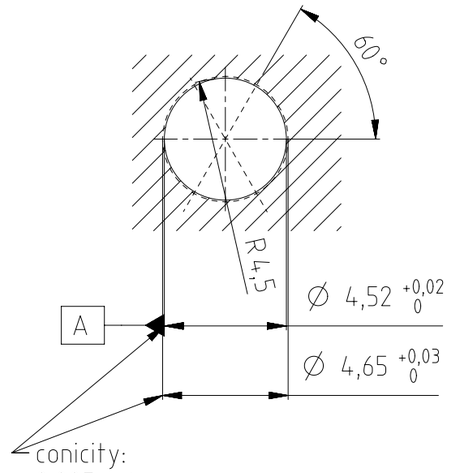
DRAWING NUMBER	DRAWING TITLE
12-(9mm)-6	Gage, Firing Pin Indent, 9mm
12-(MC)-1	Plate, Firing Pin, Universal Receiver, 7.62 mm, 9 mm & 12.7mm
12-(9mm)-7	Gage, Headspace, 9mm
12-(12.7mm)-1	Barrel, Test, Velocity (EPVAT), 12.7mm
12-(12.7mm)-2	Barrel, Test, EPVAT, 6215 or GP6 Transducer, 12.7mm
12-(12.7mm)-3	Firing Pin, Universal Receiver, 12.7mm
12-(12.7mm)-4	Gage, Firing Pin Indent, 12.7mm
12-(MC)-1	Plate, Firing Pin, Universal Receiver, 7.62 mm, 9 mm & 12.7mm
12-(12.7mm)-5	Gage, Headspace, 12.7mm
12-(MC)-1	Plate, Firing Pin, Universal Receiver, 7.62 mm, 9 mm & 12.7mm
12-(MC)-2	Firing Pin, Universal Receiver, 4.6mm, 5.56mm and 5.7mm
12-(MC)-3	Plate, Firing Pin, Universal Receiver, 4.6mm, 5.56mm and 5.7mm

***Note: Unless annotated otherwise (METRIC) presume all drawings are in English units.**


SECTION A – A
B
B
C
Ø 50,57 0 -0,05
3 x 45°
Ø 18 ±0,2
3
9,85
41
R38
115 0 -0,2
180
6,35 +0,13 0
19
7
6,35 +0,13 0
Ø 44,4 0 -0,05
A
A
SECTION B – B
Ø 4,52 +0,02 0
R 19
0,1 headspace gauge
Detail C (SCALE 2:1)
NEXT ASSY
USED ON
APPLICATION
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± °
DECIMALS ±
FRACTIONS ±
DRAWN BY DEU
DATE (YEAR-MO-DA) 2018-08-09
Barrel, Test, Velocity EPVAT, 4.6mm
SIZE C
DWG NO. 12-(4.6mm)-1
SCALE 2/1
UNIT WT 0.000
SHEET 1 OF 1



Detail D (SCALE 5:1)

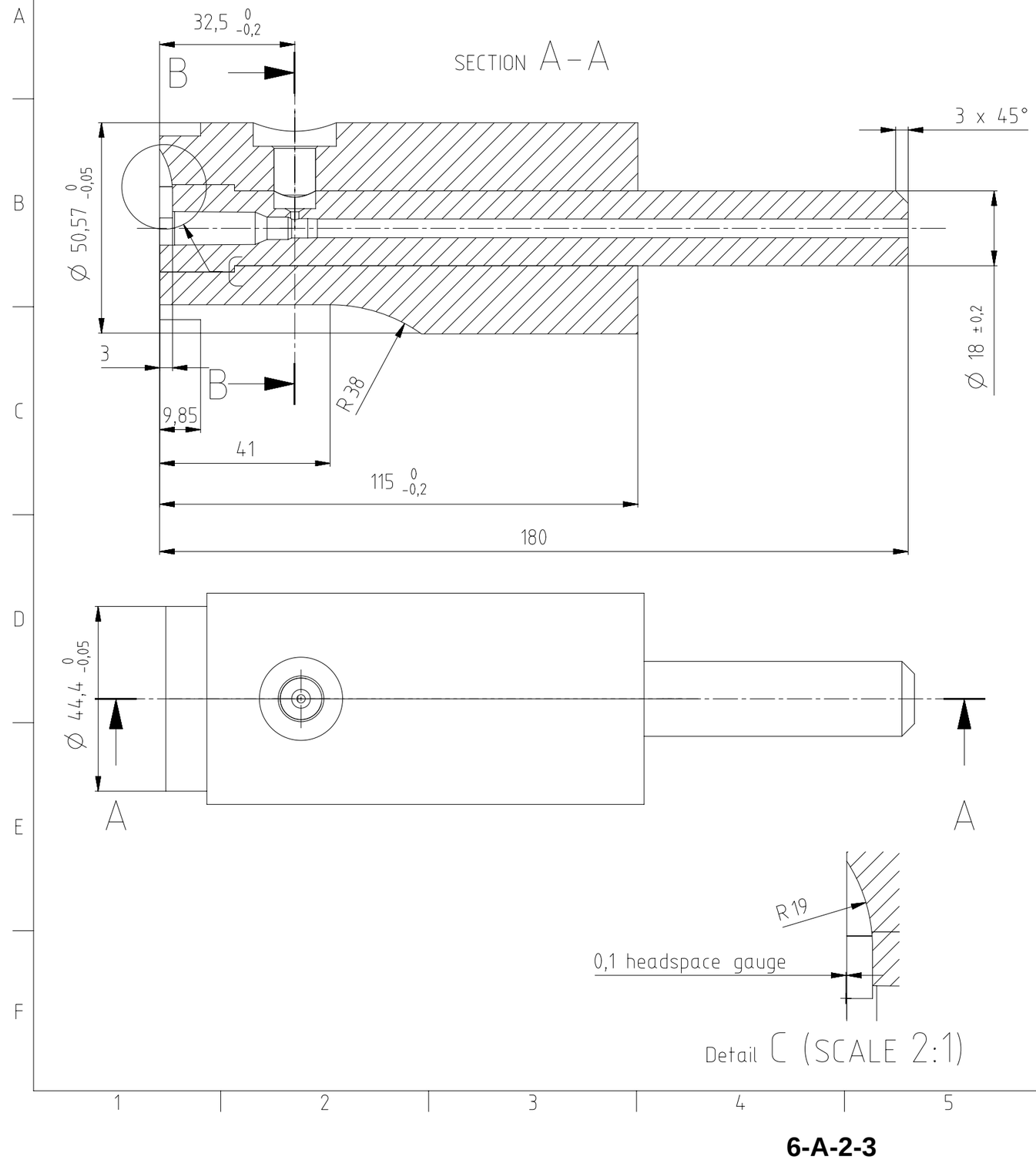


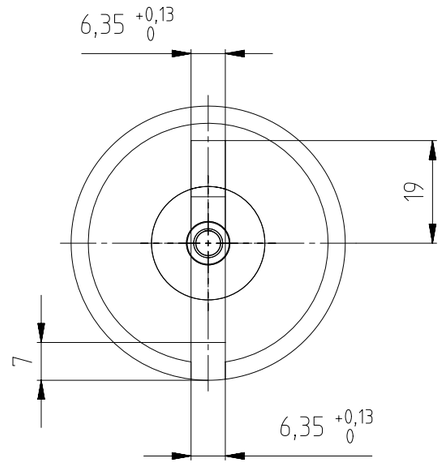
conicity:
0,005 min
0,015 max
in direction of muzzle constricted

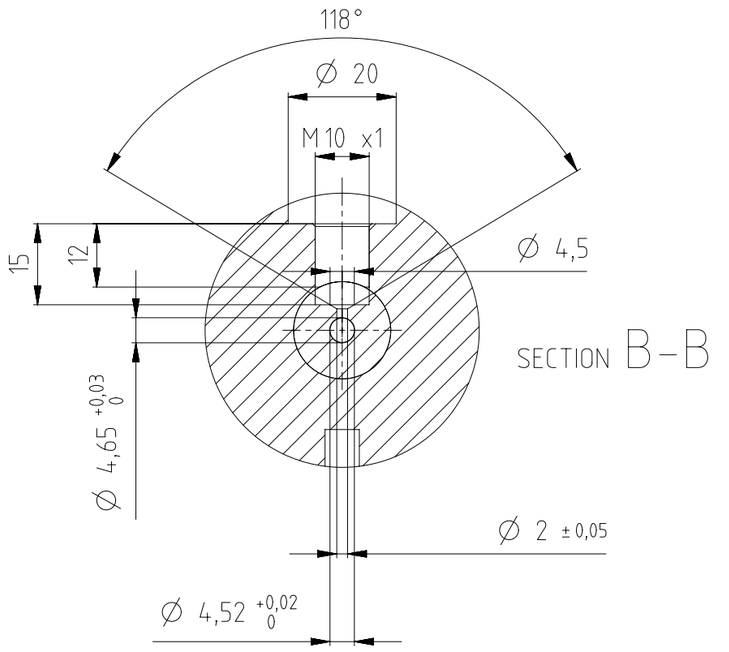
Details of Rifling:
6 Grooves - Right Hand Twist (Polygonal)
1 - Turn in - 160 mm
Barrel Length = 180 mm

METRIC

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± 0° 30' DECIMALS ± .01 FRACTIONS ± 1/64	Barrel, Test, Chamber and Bore, 4.6mm
DRAWN BY DEU	DATE (YEAR-MO-DA) 2018-07-27
SIZE D	DWG NO. 12-(4.6mm)-2
SCALE 5/1	UNIT WT 0.000 SHEET 1 OF 1



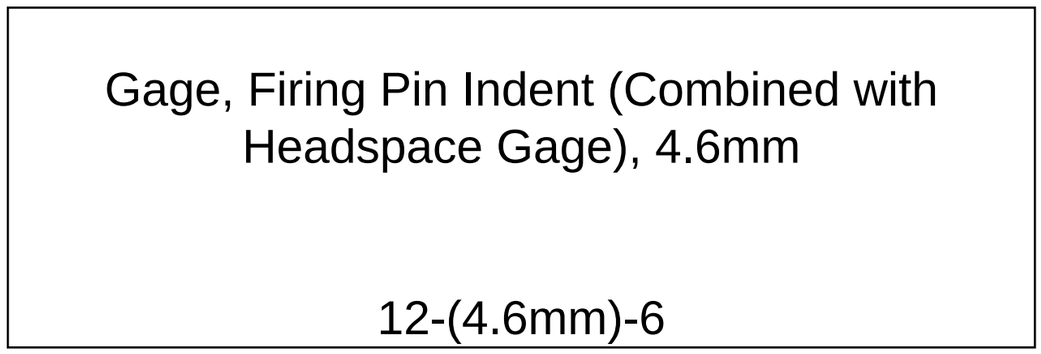




METRI

NEXT ASSY / USED ON	Barrel, Test, EPVAT, 6215 or GP6 Transducer, 4.6mm
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN METRIC TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	SIZE C — DWG NO. 12-(4.6mm)-3
DRAWN BY DEU — DATE (YEAR-MO-DA) 2018-08-09	SCALE 2/1 — UNIT WT — SHEET 1 OF 1

Gage, Firing Pin Indent (Combined with Headspace Gage), 4.6mm



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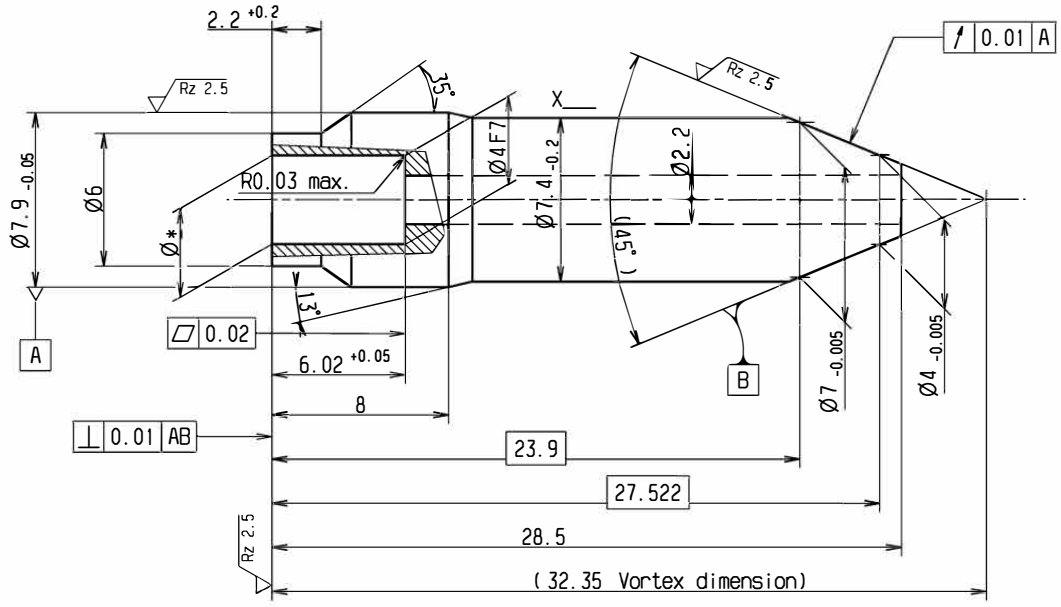
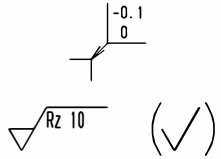




* Permissible within the tolerance
only increasing towards the outside

Hardened HRc 58 to 60

Surfaces not ground phosphated

Inscription acc. to DIN 1451-1 C2.5 / DIN 2239

X__ Inscr.: 94368-200 L7 ; 32.35 ; Go ; a
351203

					1st ANGLE PROJECTION		NSN
					STANDARD TOLERANCE ISO 2768-m-H	SURFACE ROUGHNESS COVERED BY ISO 1302	SCALE 5:1 / A 3
							SEMIFINISHED MATERIAL, MATERIAL: 90MnCrV8 / WEIGHT: -
						DATE	NAME
					DRAWN	01.10.18	Gruber
					CHECKED	01.10.18	Fleck
					APPROVED		
							TITLE: Headspace gauge, 4.6 mm
							TITLE GERMAN: Go
							DRG.No. 94368-200 L7 / SHEET 1 OF 1
							ID-No. 351203
a							
ISSUE	MOD. No.	DATE	NAME	ORIGIN			

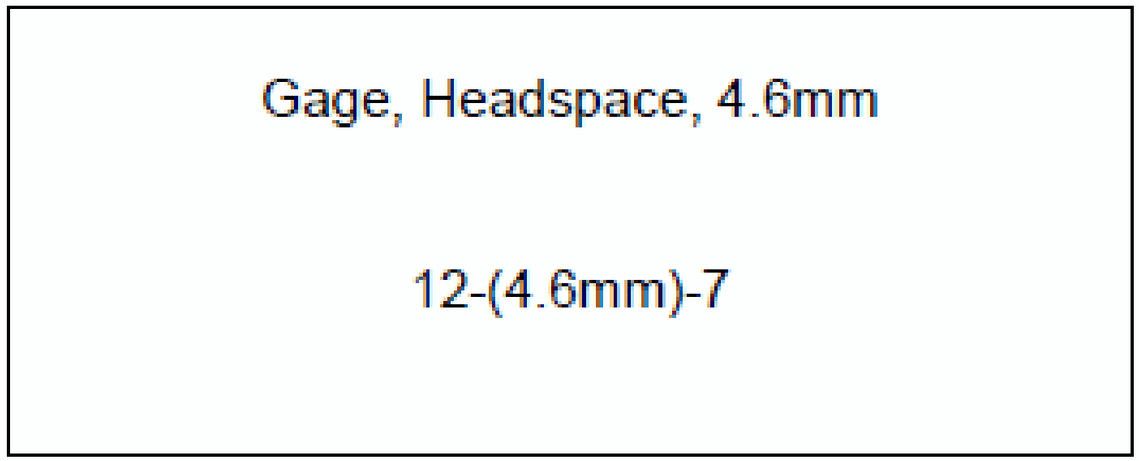
Holder, Body, Firing Pin Indent Gage, 4.6mm

12-(4.6mm)-6-1

Does not exist

Ejector, Firing Pin Indent Gage, 4.6mm

12-(4.6mm)-6-2



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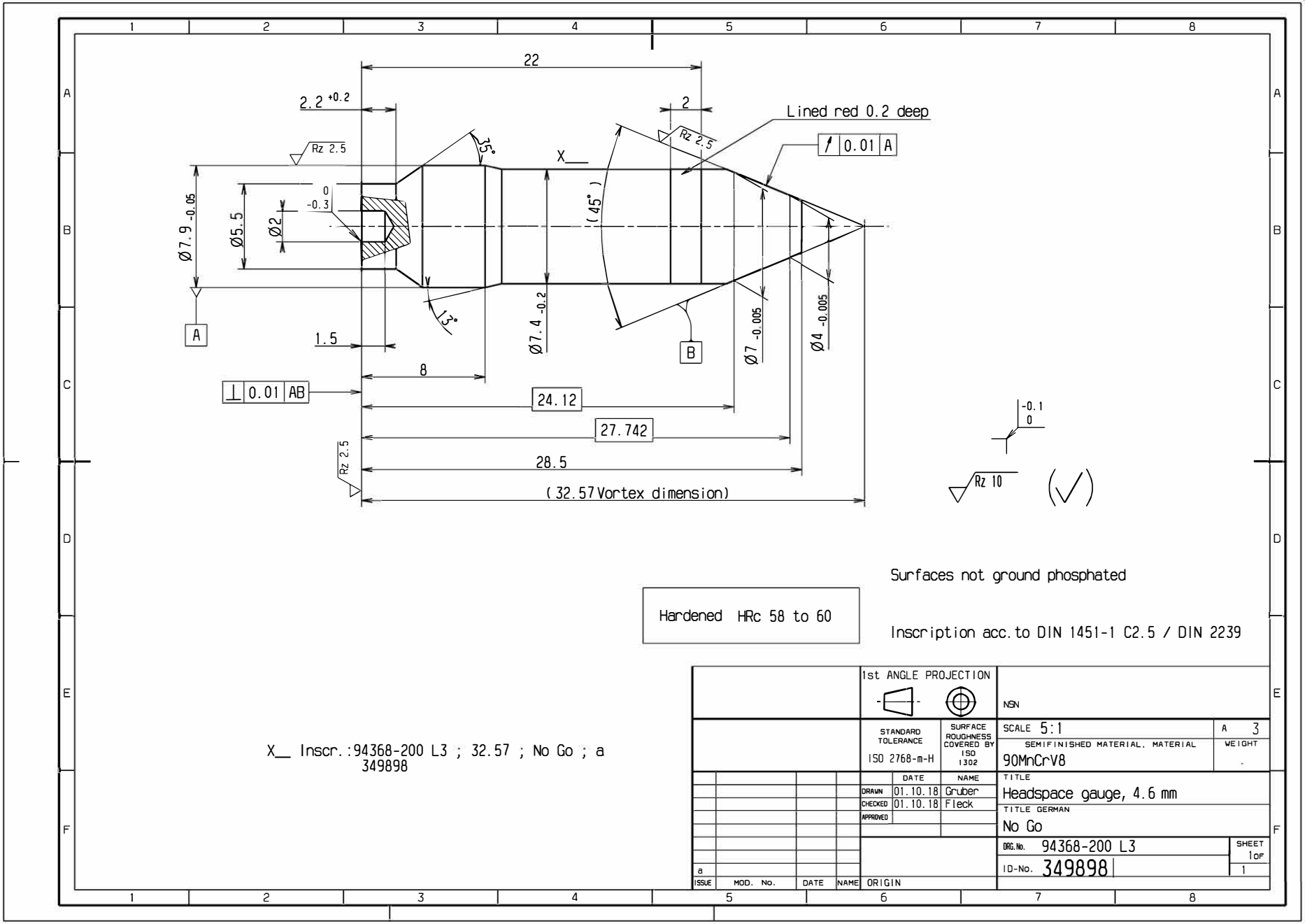
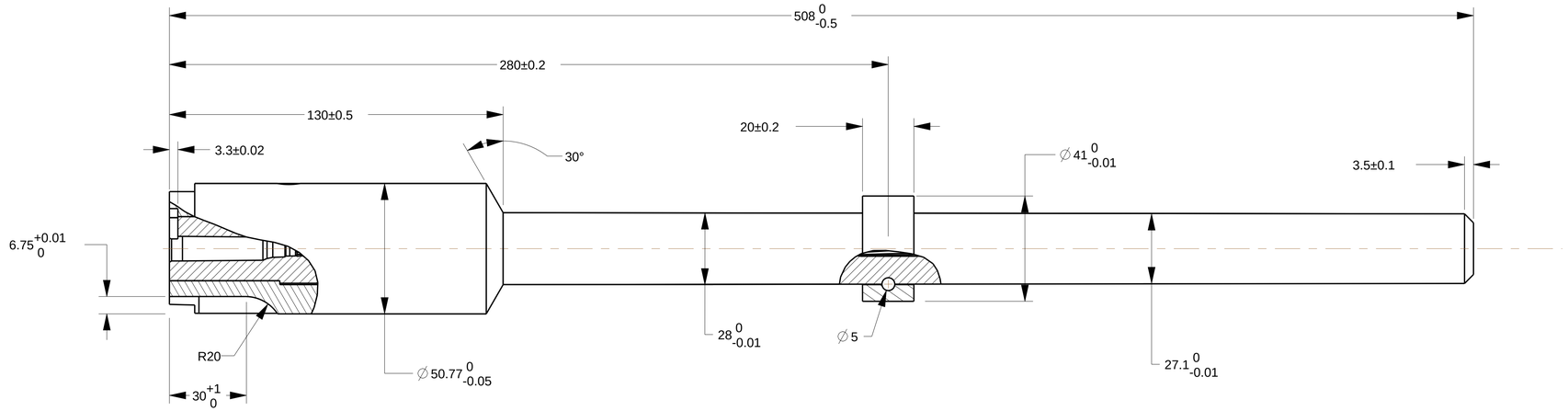
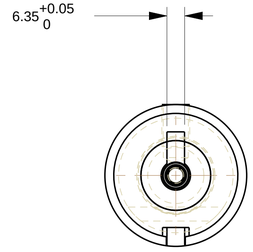

22
2.2 +0.2
2
Lined red 0.2 deep
Rz 2.5
0.01 A
35°
X__
Rz 2.5
(45°)
Ø7.9 -0.05
Ø5.5
Ø2
0 -0.3
13°
A
1.5
8
Ø7.4 -0.2
B
Ø7 -0.005
Ø4 -0.005
0.01 AB
24.12
27.742
28.5
Rz 2.5
(32.57 Vortex dimension)
-0.1 0
Rz 10
Surfaces not ground phosphated
Hardened HRc 58 to 60
Inscription acc. to DIN 1451-1 C2.5 / DIN 2239
X__ Inscr.: 94368-200 L3 ; 32.57 ; No Go ; a 349898
1st ANGLE PROJECTION
NSN
STANDARD TOLERANCE ISO 2768-m-H
SURFACE ROUGHNESS COVERED BY ISO 1302
SCALE 5:1
A 3
SEMIFINISHED MATERIAL, MATERIAL 90MnCrV8
WEIGHT
DATE NAME
DRAWN 01.10.18 Gruber
CHECKED 01.10.18 Fleck
APPROVED
TITLE Headspace gauge, 4.6 mm
TITLE GERMAN No Go
DRG.No. 94368-200 L3
SHEET 1 OF 1
ID-No. 349898
a
ISSUE MOD. No. DATE NAME ORIGIN

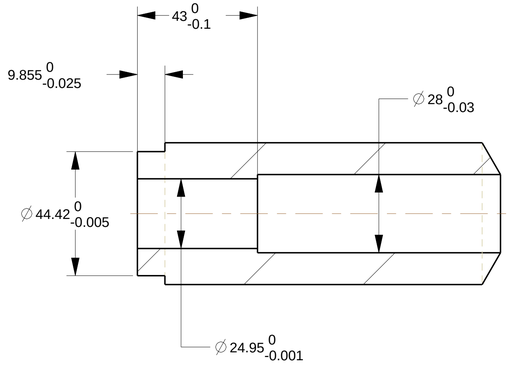
DRAWING SIZE D

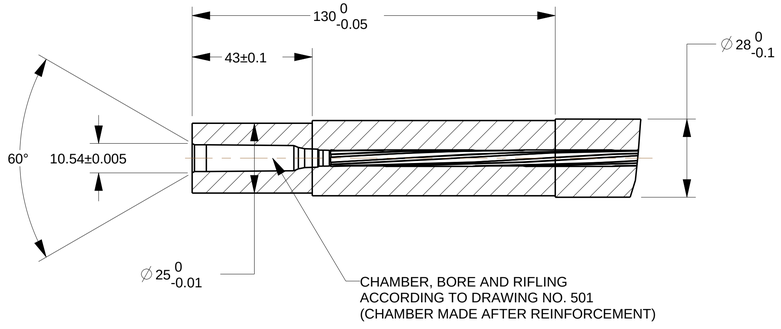
NOTES:
1. CR-MO-V STEEL FOR BARREL OR ALTERNATIVE.
2. FINISH 1.6 EXCEPT AS NOTED.
3. ALL EDGES SHALL BE BROKEN.

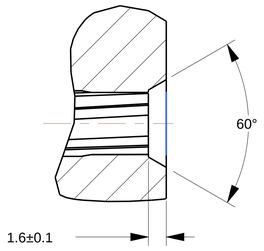


SECTION A-A
SCALE 1/1

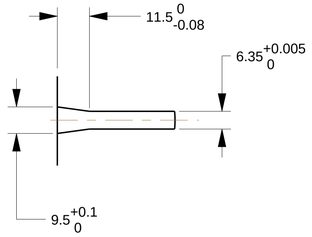








MUZZLE
SCALE: 4/1



METRIC

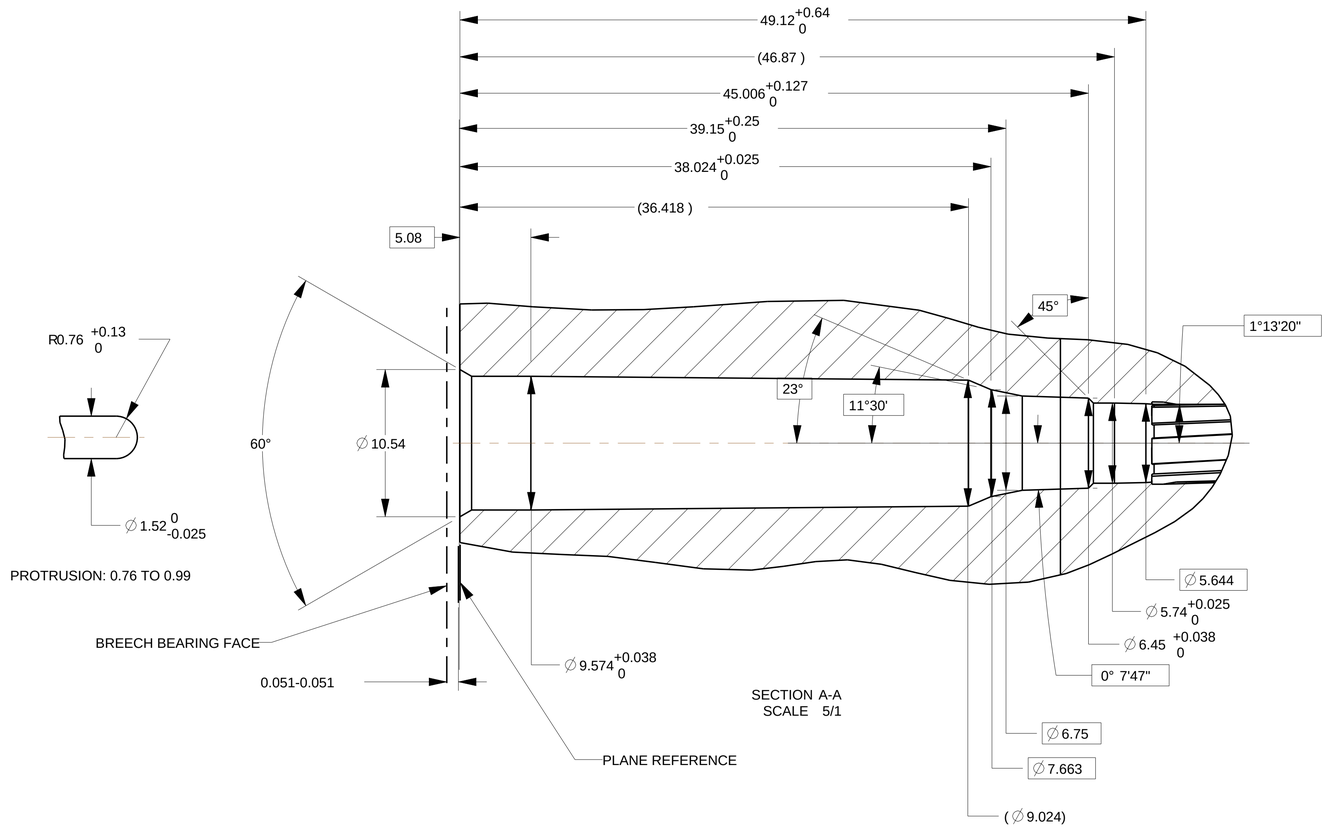
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY: AMW	DATE (YEAR-MO-DA): 2012-05-01

Barrel, Test, Velocity (EPVAT), 5.56mm

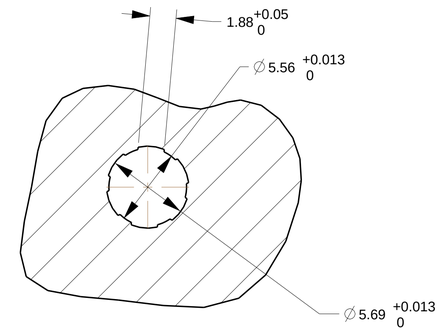
SIZE	DWG NO.	
D	12-(5.56mm)-1	
SCALE 1/1	UNIT WT	SHEET 2 OF 3

FORMAT: D_NATO_TESTEQUIP

DRAWING SIZE D



SECTION A-A
SCALE 5/1



DETAIL OF RIFLING
6 GROOVES RIGHT HAND TWIST
1 TURN IN 177.8 MM

METRIC

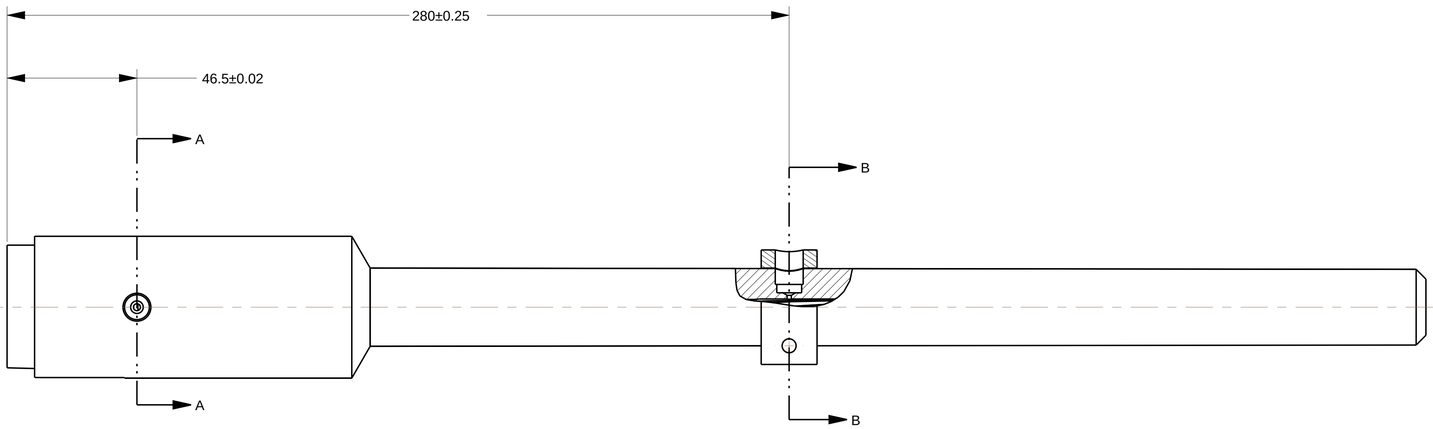
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY AMW	DATE (YEAR-MO-DA) 2012-05-01

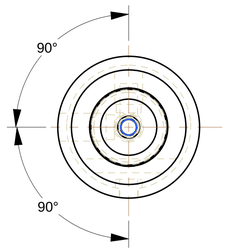
Barrel, Test, Chamber and Bore, 5.56mm

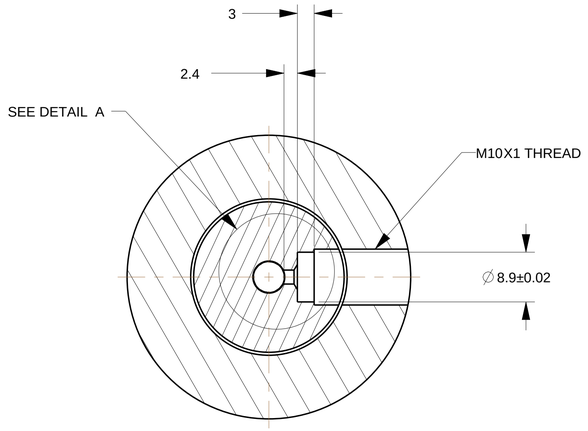
SIZE	DWG NO.	
D	12-(5.56mm)-2	
SCALE 1/1	UNIT WT	SHEET 1 OF 3

FORMAT: D_NATO_TESTEQUIP

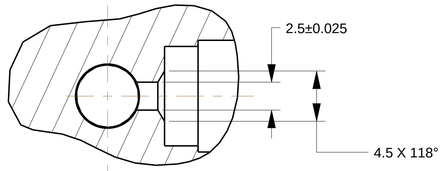
DRAWING SIZE D



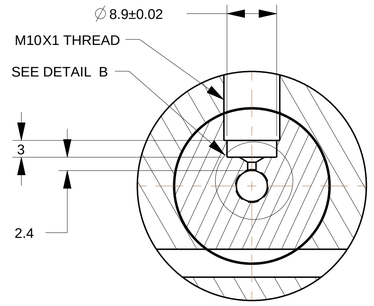




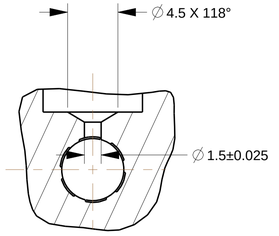
SECTION A-A
SCALE 2/1



DETAIL A
SCALE 4/1



SECTION B-B
SCALE 2/1



DETAIL B
SCALE 4/1

THE PORT PRESSURE OFFTAKE SHALL BE COMPLETELY CENTERED IN A GROOVE

METRIC

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY: AMW	DATE (YEAR-MO-DA): 2012-05-01

Barrel, Test, EPVAT, 6215 or HP6 Transducer, 5.56mm

SIZE	DWG NO.	
D	12-(5.56mm)-3	
SCALE 1/2	UNIT WT	SHEET 3 OF 3

FORMAT: D_NATO_TESTEQUIP

Drawing No. 12-(5.56mm)-4
Firing Pin, Universal Receiver, 5.56mm

is now replaced by

Drawing No. 12-(MC)-2
Firing Pin, Universal Receiver,
4.6mm, 5.56mm and 5.7mm

Drawing No. 12-(5.56mm)-5
Plate, Firing Pin, Universal Receiver, 5.56mm

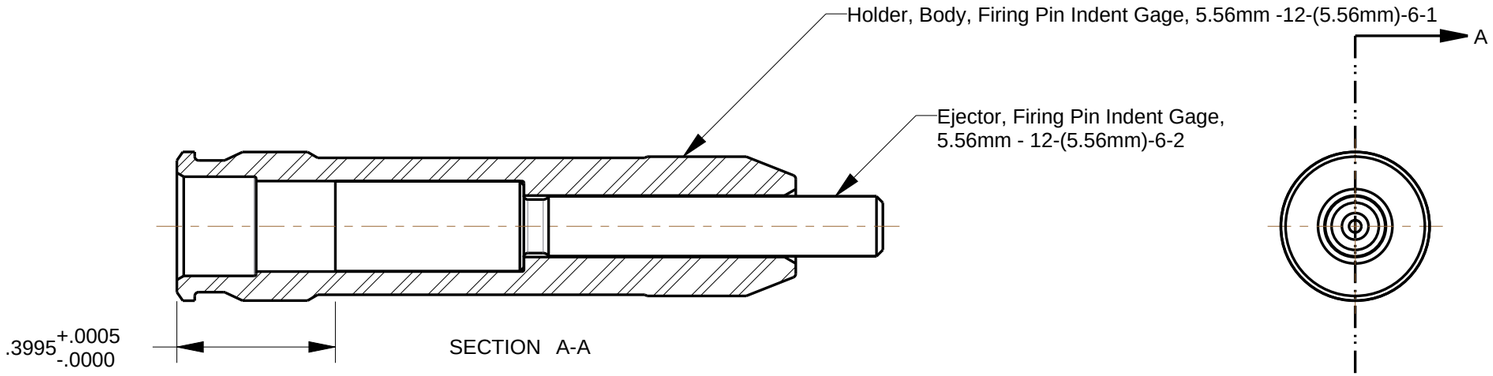
is now replaced by

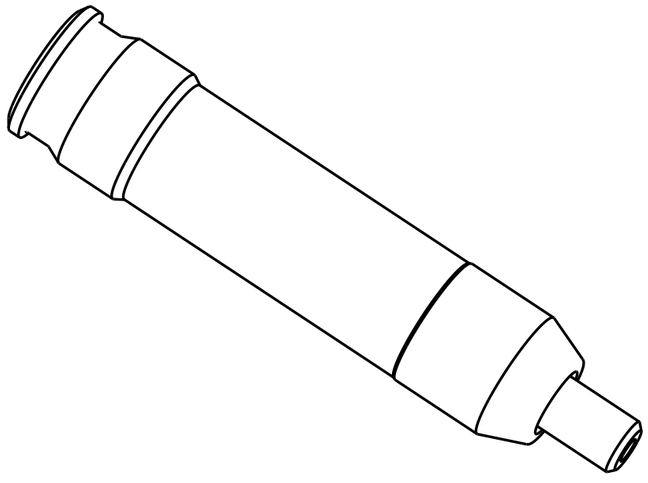
Drawing No. 12-(MC)-3
Plate, Firing Pin, Universal Receiver, 4.6mm,
5.56mm and 5.7mm

DRAWING SIZE B

NOTE:

1. USE COPPER COMPRESSION CYLINDER
   NATO DRAWING 26 FOR FIRING PIN INDENT.





PART NO. 12-(5.56mm)-6

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY JTD	DATE (YEAR-MO-DA) 2012-05-15

Gage, Firing Pin Indent, 5.56mm

SIZE	DWG NO.		
B	12-(5.56mm)-6		
SCALE 3/1	UNIT WT 0.000	SHEET 1 OF 1	

FORMAT: B_NATO_TESTEQUIP

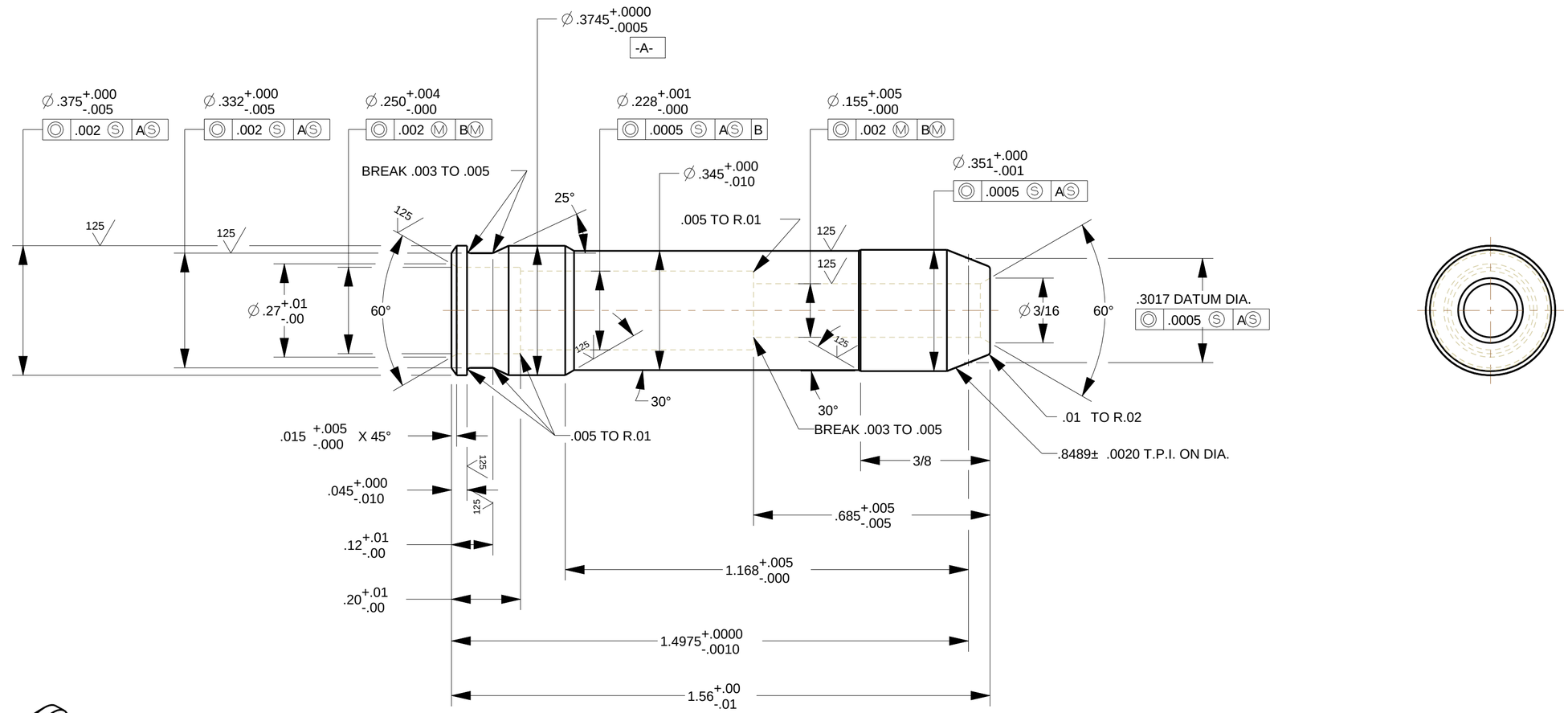
DRAWING SIZE C

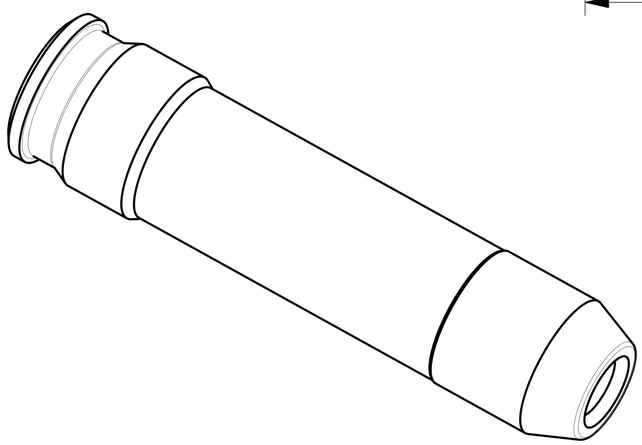
NOTES:

1. SPECIFICATIONS: MIL-STD-8 & MIL-STD-10 APPLY.

2. MATERIAL: STEEL FSO2 SPEC. QQ-T-570.

3. 63 FINISH EXCEPT AS NOTED.





DISTRIBUTION STATEMENT A.
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

PART NO. 12-(5.56mm)-6-1

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES

TOLERANCE ON ANGLES ± 1°
DECIMALS ±
FRACTIONS ± 1/64

DRAWN BY	DATE (YEAR-MO-DA)
J. DUEHRING	2012-05-09

Holder, Body, Firing Pin
Indent Gage, 5.56mm

SIZE	DWG NO.		
C	12-(5.56mm)-6-1		
SCALE 4/1	UNIT WT 0.000	SHEET 1 OF 1	

FORMAT: C_NATO_TESTEQUIP

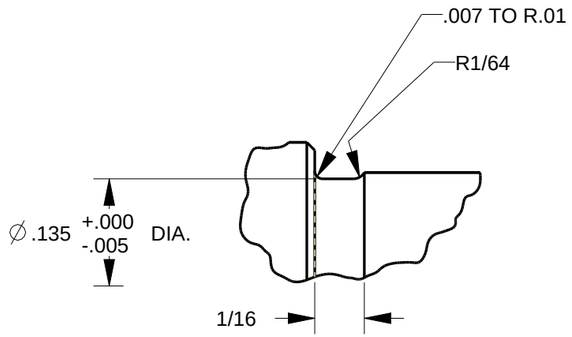
DRAWING SIZE B

NOTES:

1. SPECIFICATIONS: MIL-STD-8 & MIL-STD-10 APPLY.

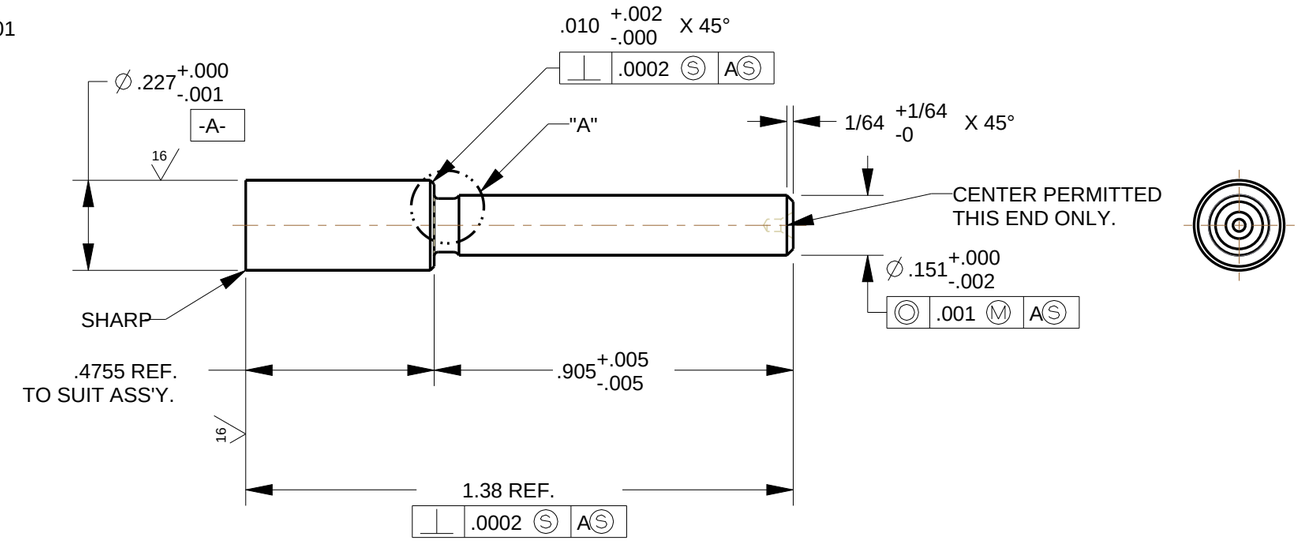
2. MATERIAL: STEEL FS02 SPEC. QQ-T-570.

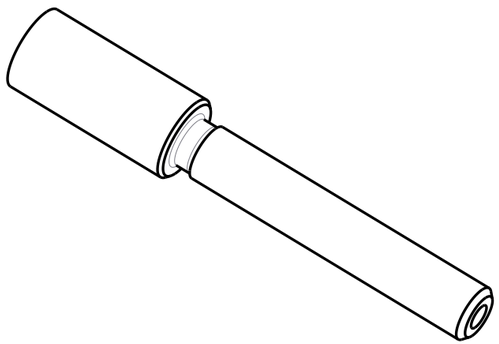
3. 63 FINISH EXCEPT AS NOTED.



ENLARGED VIEW
AT "A"

SCALE 6/1





DISTRIBUTION STATEMENT A.
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± °
DECIMALS ±
FRACTIONS ±

DRAWN BY	DATE (YEAR-MO-DA)
J. DUEHRING	2012-05-09

Ejector, Firing Pin
Indent Gage, 5.56mm

SIZE	DWG NO.		
B	12-(5.56mm)-6-2		
SCALE 3/1	UNIT WT 0.000	SHEET 1 OF 1	

FORMAT: B_NATO_TESTEQUIP

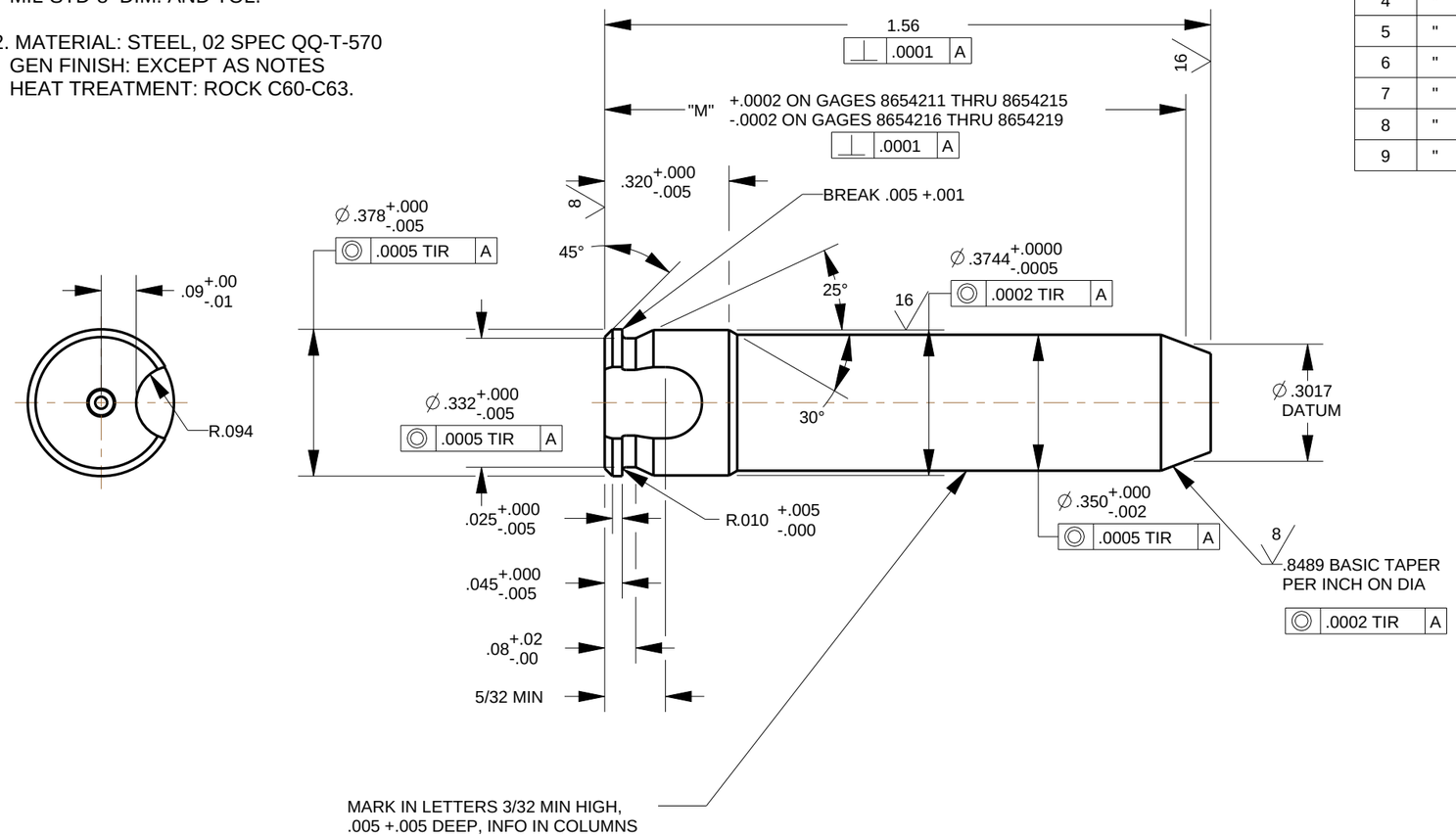
DRAWING SIZE B

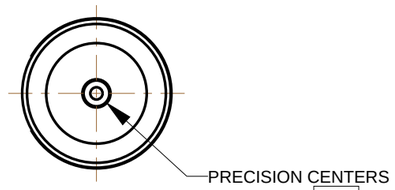
NOTES:

1. APPLICABLE SPECIFICATIONS:
   MIL-G-10944 GAGES, DIM. CONT.
   MIL-STD-8 DIM. AND TOL.

2. MATERIAL: STEEL, 02 SPEC QQ-T-570
   GEN FINISH: EXCEPT AS NOTES
   HEAT TREATMENT: ROCK C60-C63.

LINE NO.	LIST OF DRAWINGS "A"	PART NO. "B"	HEAD SPACE "M"
1	GAGE, HEADSPACE 5.56 MM	12-(5.56mm)-7-1	1.4960
2	" " "	12-(5.56mm)-7-2	1.4970
3	" " "	12-(5.56mm)-7-3	1.4980
4	" " "	12-(5.56mm)-7-4	1.4990
5	" " "	12-(5.56mm)-7-5	1.5000
6	" " "	12-(5.56mm)-7-6	1.5010
7	" " "	12-(5.56mm)-7-7	1.5020
8	" " "	12-(5.56mm)-7-8	1.5030
9	" " "	12-(5.56mm)-7-9	1.5040



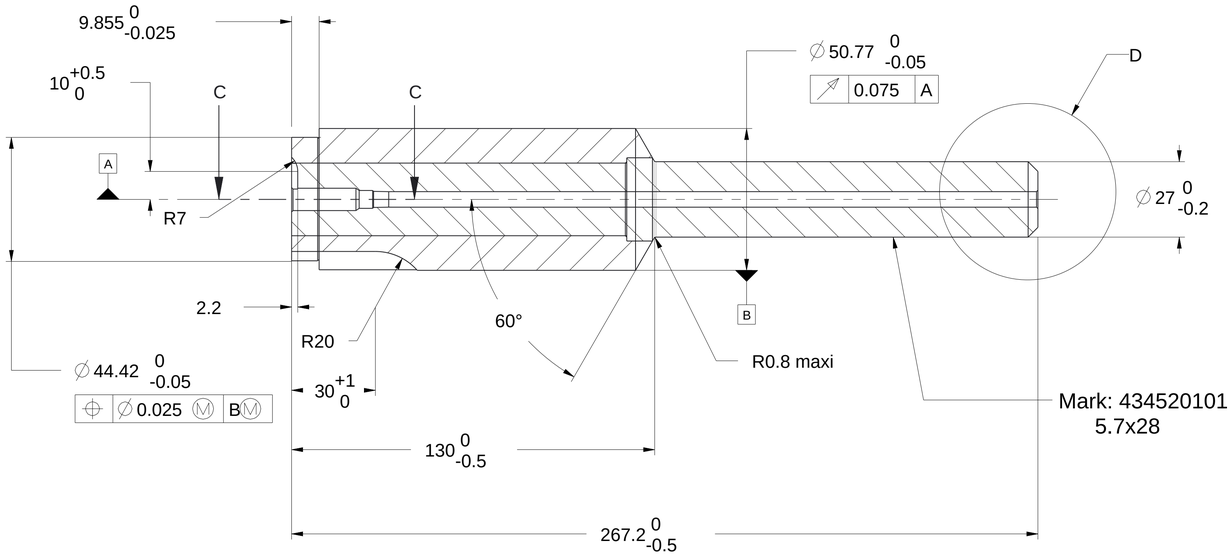


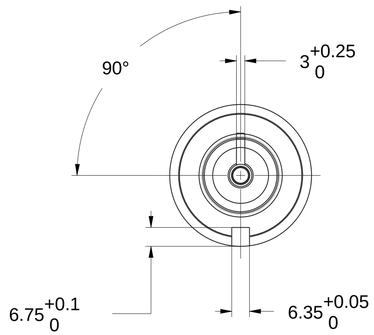
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± 5° DECIMALS ± .01 FRACTIONS ±	
DRAWN BY J. DUEHRING	DATE (YEAR-MO-DA) 2012-05-04

Gage, Headspace, 5.56mm

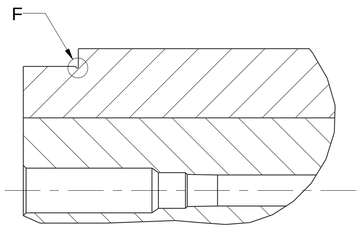
SIZE	DWG NO.		
B	12-(5.56mm)-7		
SCALE 3/1	UNIT WT 0.000	SHEET 1 OF 1	

FORMAT: B_NATO_TESTEQUIP

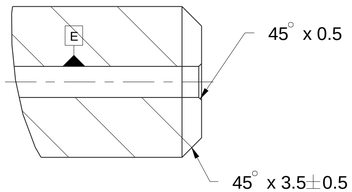


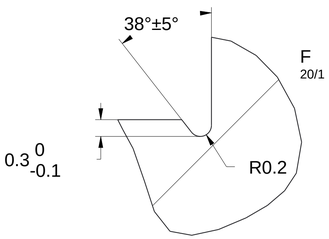


C-C
2/1



D
2/1





NOTES:

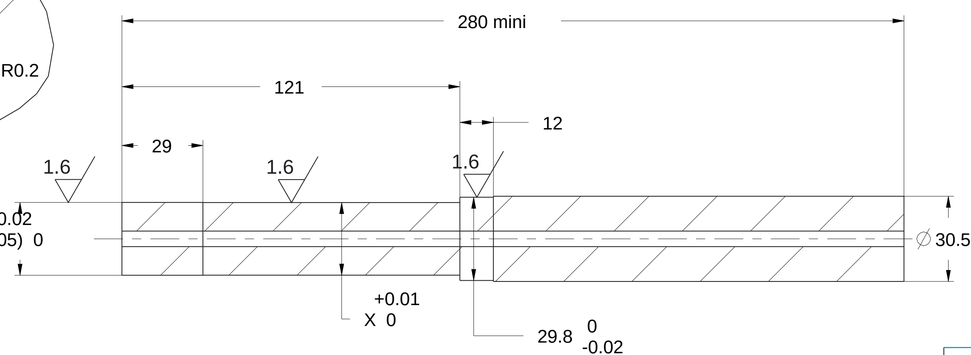
1. Break all exterior corners

2. The reference A is the axis which joins the centers of the chamber and bore ends

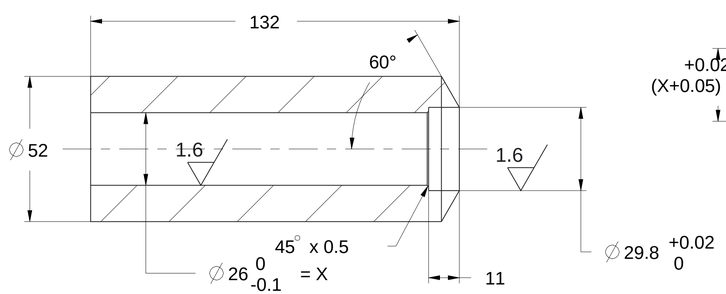
3. Phosphate coating on external surfaces only

4. Roughness: 3.2 1.6 0.1

ROUGH BARREL



ROUGH RING



21 CrMoV 5 11

Treated as supplied hardness 63 HRA

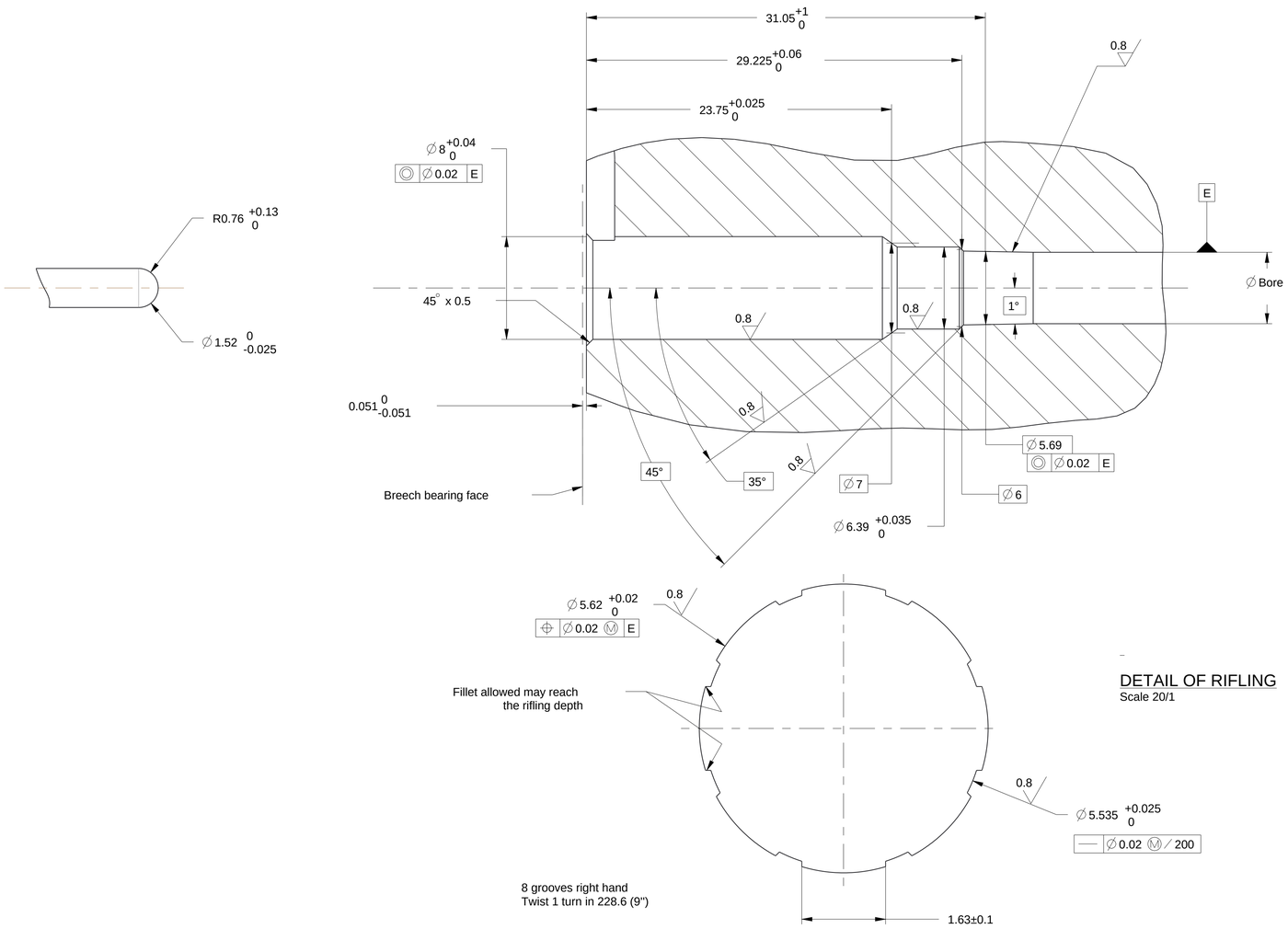
Phosphate coating oil treatment acc. to QST 87612

METRIC

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ±0° 30' DICIMALS ±.01 FRACTIONS ±1/64	
DRAWN BY: BEL	DATE (YEAR-MO-DA): 2018-09-25

Barrel, Test, Velocity (EPVAT), 5.7mm

SIZE: D	DWG NO: 12-(5.7mm)-1		
SCALE: 1/1	UNIT WT: 0.000	SHEET: 1 OF 1	



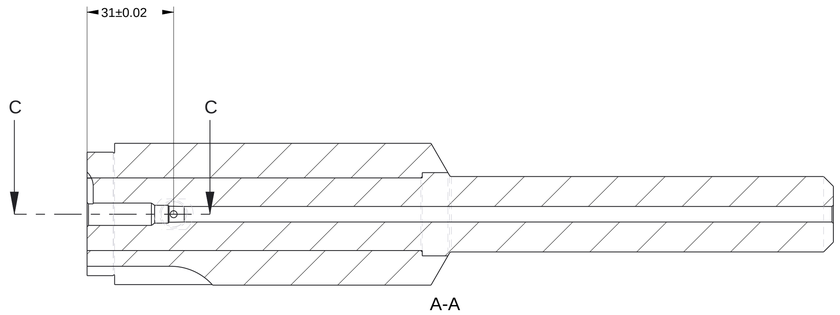
NOTE:

Edges of lands shall be sharp and free of burrs

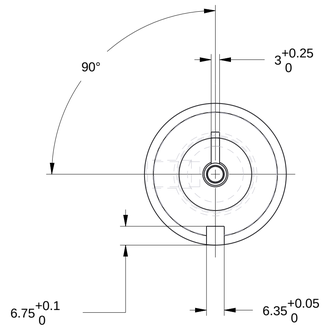
DETAIL OF RIFLING
Scale 20/1

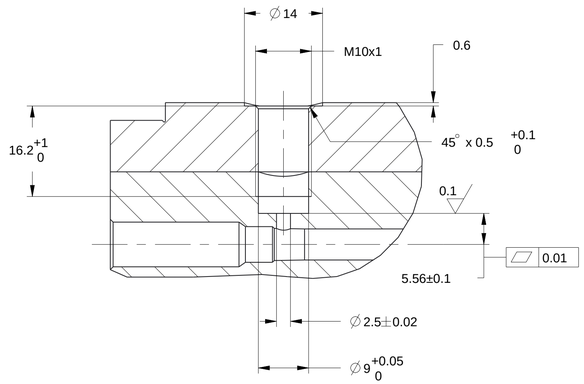
METRIC

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ±0° 30' DICIMALS ±.01 FRACTIONS ±1/64	Barrel, Test, Chamber and Bore, 5.7mm
DRAWN BY: BEL	DATE (YEAR-MO-DA): 2018-09-26
SIZE: D	DWG NO: 12-(5.7mm)-2
SCALE: 5/1	UNIT WT: 0.000
	SHEET: 1 OF 1



A-A





C-C
2/1

METRIC

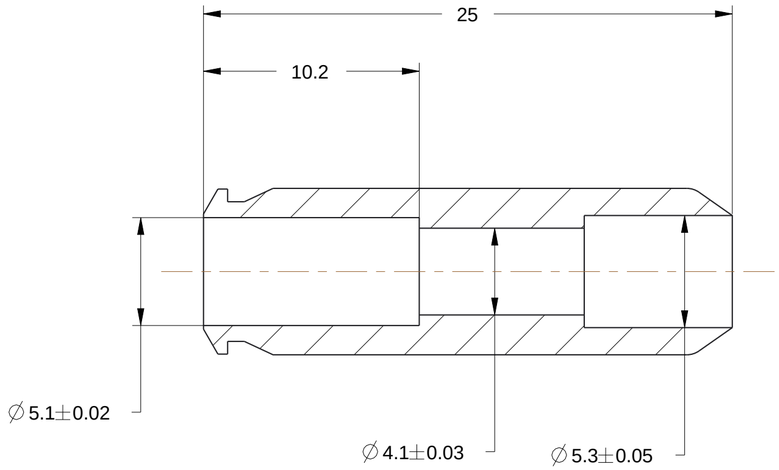
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ±0° 30' DICIMALS ±.01 FRACTIONS ±1/64	
DRAWN BY BEL	DATE (YEAR-MO-DA) 2018-09-25

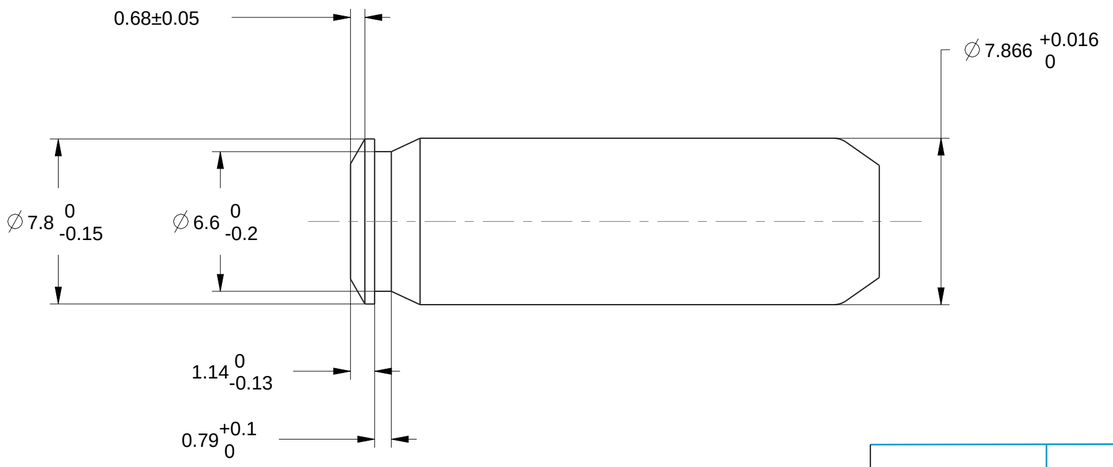
Barrel, Test, EPVAT ,
6215 or GP6 Transducer, 5.7mm

SIZE	DWG NO	
D	12-(5.7mm)-3	
SCALE 1/1	UNIT WT 0.000	SHEET 1 OF 1

Holder,Body Firing Pin Indent Gage 5.7

Steel 100 Cr6 60-63 HRC





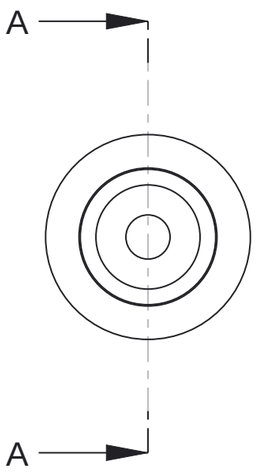
METRIC

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ±0° 30' DICIMALS ±.01 FRACTIONS ±1/64	
DRAWN BY BEL	DATE (YEAR-MO-DA) 2018-10-01

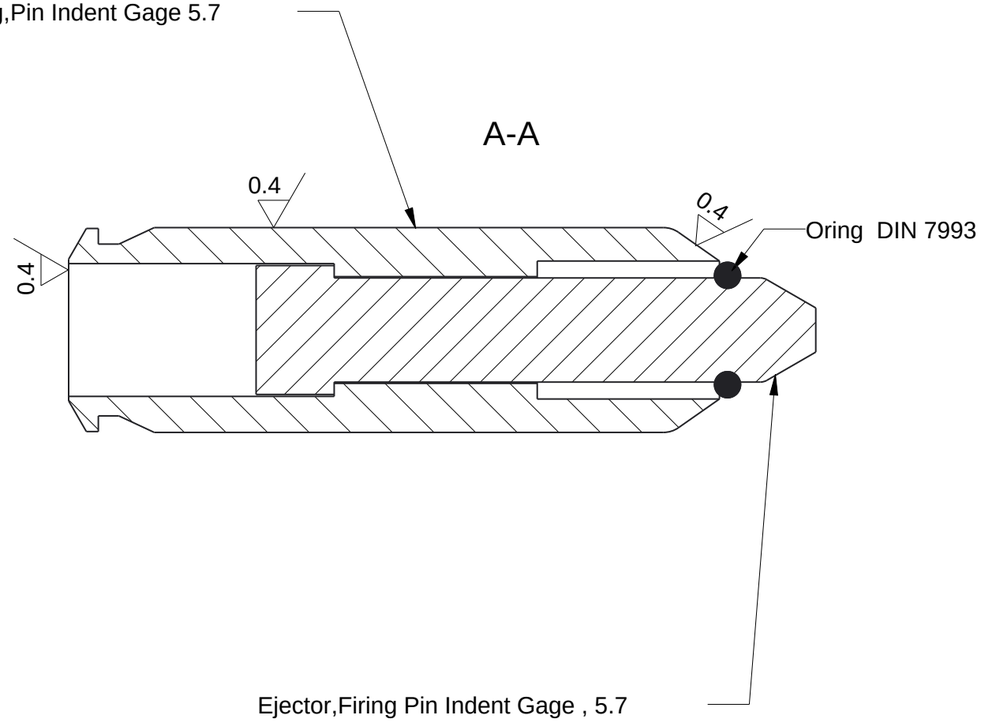
Gage ,Firing Pin Indent, 5.7mm

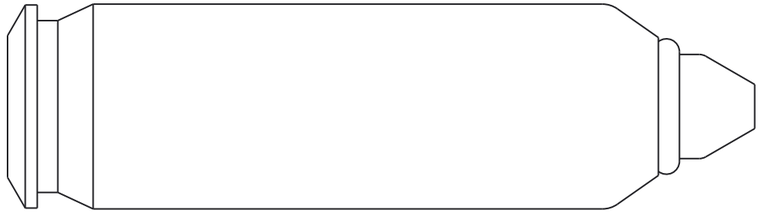
SIZE	DWG NO		
C	12-(5.7mm)-6		
SCALE	UNIT WT	SHEET	
5/1	0.000	1 OF 1	

Gage, Firing Pin indent, 5.7mm



Holder,Body,Firing,Pin Indent Gage 5.7





METRIC

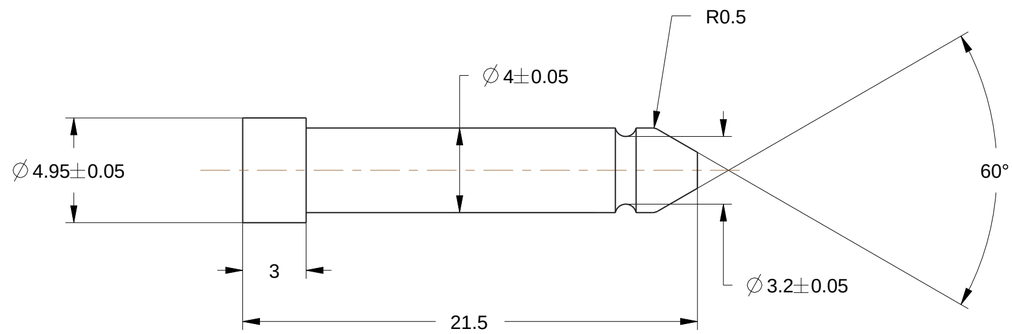
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ±0° 30' DICIMALS ±.01 FRACTIONS ±1/64	
DRAWN BY BEL	DATE (YEAR-MO-DA) 2018-10-01

Holder ,Firing Pin Indent Gage ,5.7mm

SIZE	DWG NO		
B	12-(5.7mm)-6-1		
SCALE 5/1	UNIT WT 0.000	SHEET 1 OF 1	

Ejector, Firing Pin Indent Gage 5.7

Steel 100 Cr6 60-63 HRC

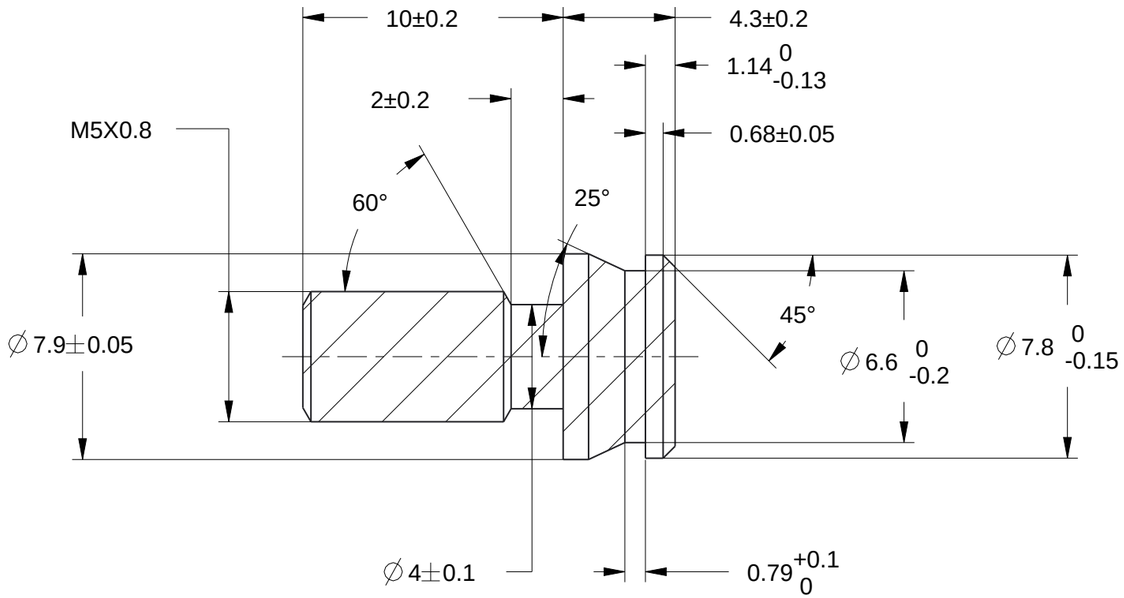


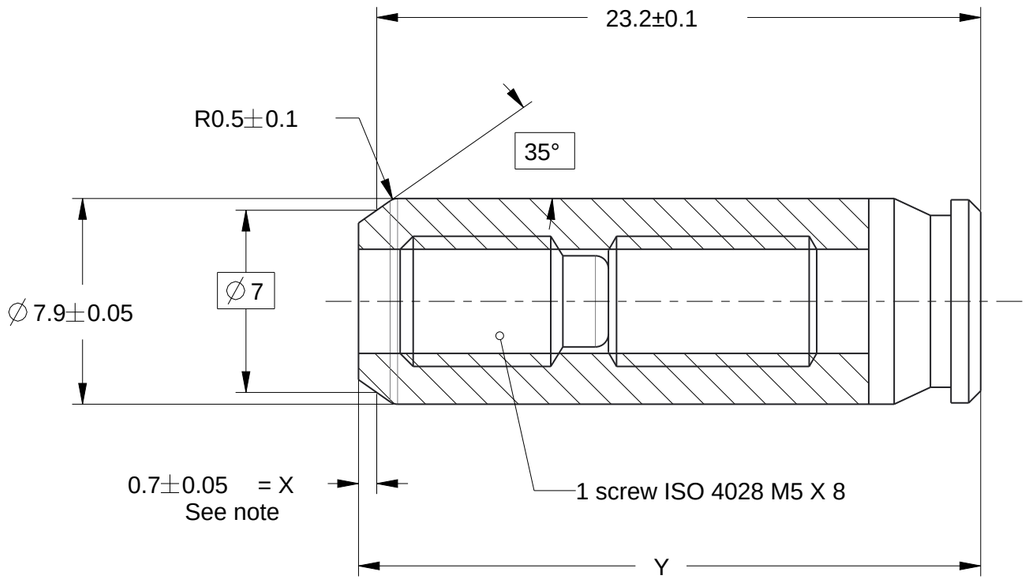
METRIC

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ±0° 30' DICIMALS ±.01 FRACTIONS ±1/64	
DRAWN BY BEL	DATE (YEAR-MO-DA) 2018-10-01

Ejector,Firing Pin Indent,
Gage ,5.7mm

SIZE	DWG NO		
C	12-(5.7mm)-6-2		
SCALE	UNIT WT	SHEET	
5/1	0.000	1 OF 1	





NOTES:

1. After completion the exact value of X will be measured and engraved on the gage.
2. Value of the headspace on mountel barrel = Y - X

Material :90 MnCrV 8

Treated for 62-64 HRC

METRIC

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ±0° 30' DICIMALS ±.01 FRACTIONS ±1/64	
DRAWN BY BEL	DATE (YEAR-MO-DA) 2018-10-01

Gage , Headspace
5.7mm

SIZE B	DWG NO 12-(5.7mm)-7	
SCALE 5/1	UNIT WT 0.000	SHEET 1 OF 1

DRAWING SIZE D

22-1/8 +1/16 -0 [562 +1,5 -0,0]

16-1/4 [412,8]

4-7/8 [123,8]

.250 +.005 -.000 [6,35 +0,13 -0,00]

.388 +.000 -.001 [9,855 +0,000 -0,025]

1/8 [3,2]

R.005 MAX [0,13]

R1/32 MAX [0,8]

R1/16 MAX [1,6]

1/8 X 45° [3,2]

3/4 [19,05]

∅1.748 +.000 -.002 [44,4 +0,00 -0,05]

R5/8 [15,9]

∅1.245 [31,62]

9/32 [7,1]

.250 +.002 -.000 [6,35 +0,05 -0,00]

R1-1/2 [38,1]

∅1.562 [39,67]

1-5/8 [41,28]

∅1.999 +.000 -.002 [50,77 +0,00 -0,05]

∅.400 REF [10,15]

.125 + .005R [3.18 + 0.13]

.455 +.002 -.000 [11,56 +0,05 -0,00]

∅.3445±.0010 [±0,0258,75]

R .015 ± .001 [0,38± 0,02]

.013 TAPER ON DIA

.300 [7,62]

60°

40°

80°

∅.60 +.01 -.00 [15,2 +0,2 -0,0]

R.030 [0,76] MAX

32

CHAMBER

.050 TAPER ON DIA

.005 TAPER ON DIA

1.552 REF [39,42]

1.628 +.002 -.000 [41,35 +0,05 -0,00]

2.025 +.005 -.000 [51,44 +0,13 -0,00]

2.273 +.020 -.000 [57,73 +0,5 -0,0]

2.373 REF [60,27]

∅.3000 +.0005 -.0000 [7,62 +0,013 -0,000]

(NOT TO SCALE)

.167

.002 R MAX [.03]

∅.3080 +.0005 -.0000 [7,823 +0,012 -0,000]

∅.35 +.02 -.00 [8,9 +0,5 -0,0]

60°

MUZZLE

RIFLING
4 GROOVES
RIGHT HAND TWIST
ONE TURN IN 12.000 ±.25 [304.8 ±6.35]

NOTES:

1. FINISH 63 EXCEPT AS NOTED
2. ALL EDGES SHALL BE BROKEN .005+.015R [.13+0.38] OR 45° CHAMFER EXCEPT AS NOTED.
3. EDGES OF LANDS SHALL BE SHARP AND FREE FROM BURRS.
4. DIMENSION IN [ ] ARE IN MILLLIMETERS.
5. THIRD ANGLE PROJECTION.
6. MATERIAL: STEEL, GUN BARREL QUALITY. QUENCH AND TEMPER.

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY A. WALKER	DATE (YEAR-MO-DA) 2012-05-08

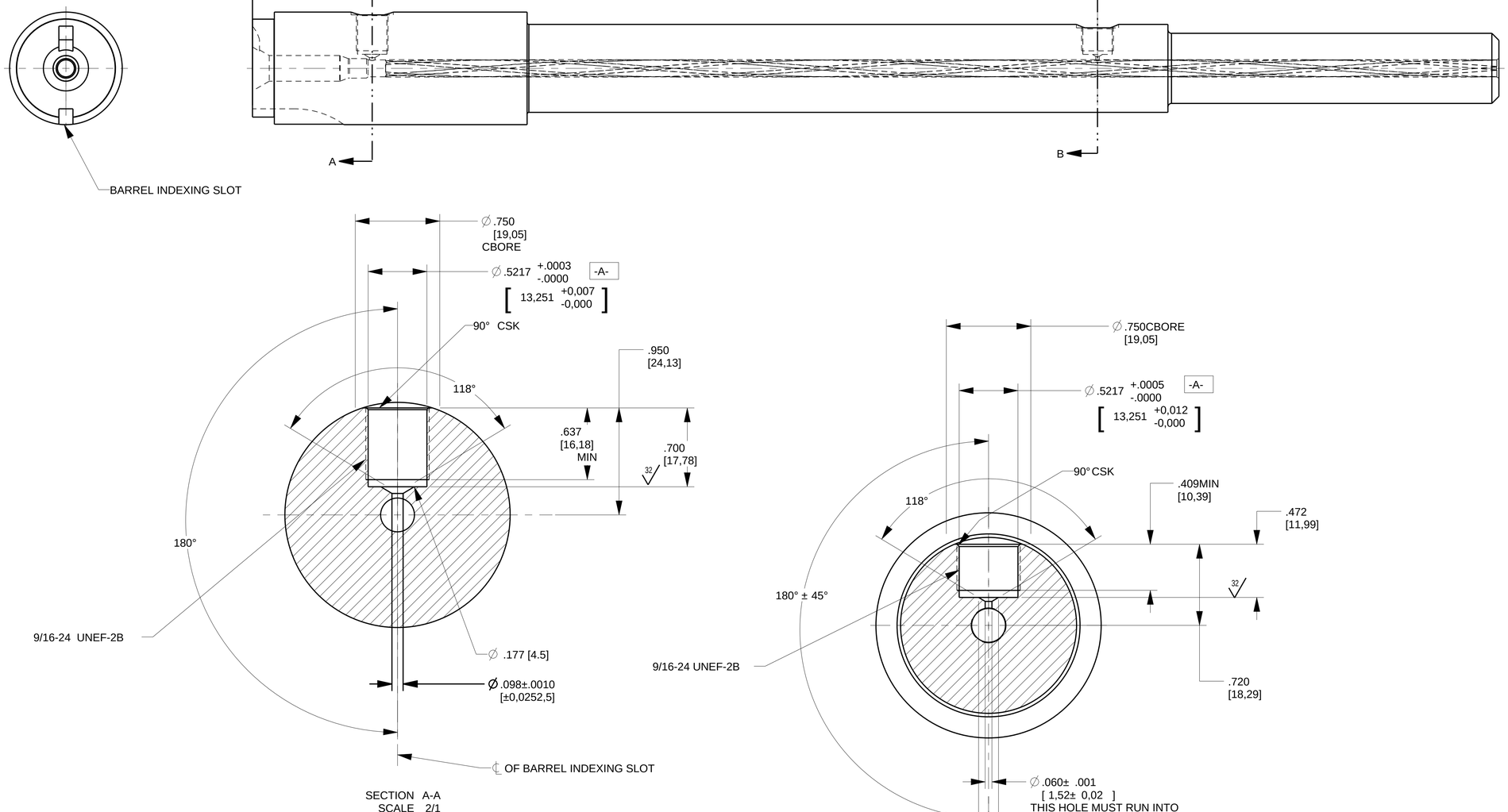
Barrel, Test, Velocity (EPVAT), 7.62mm

SIZE	DWG NO.
D	12-(7.62mm)-1

SCALE	UNIT WT	SHEET
1/1	0.000	1 OF 2

FORMAT: D_NATO_TESTEQUIP

DRAWING SIZE D



NOTES:

1. ALTER VELOCITY TEST BARREL, DRAWING NO. 102 REV A, AS SHOWN.
2. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
3. THIRD ANGLE PROJECTION.

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY A. WALKER	DATE (YEAR-MO-DA) 2012-03-20

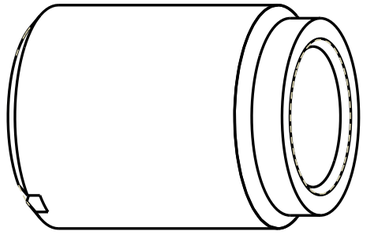
Barrel, Test, EPVAT, 7.62mm

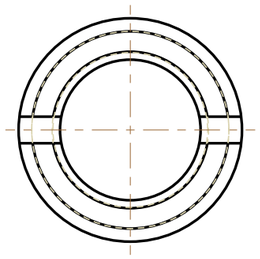
SIZE	DWG NO.
D	12-(7.62mm)-2

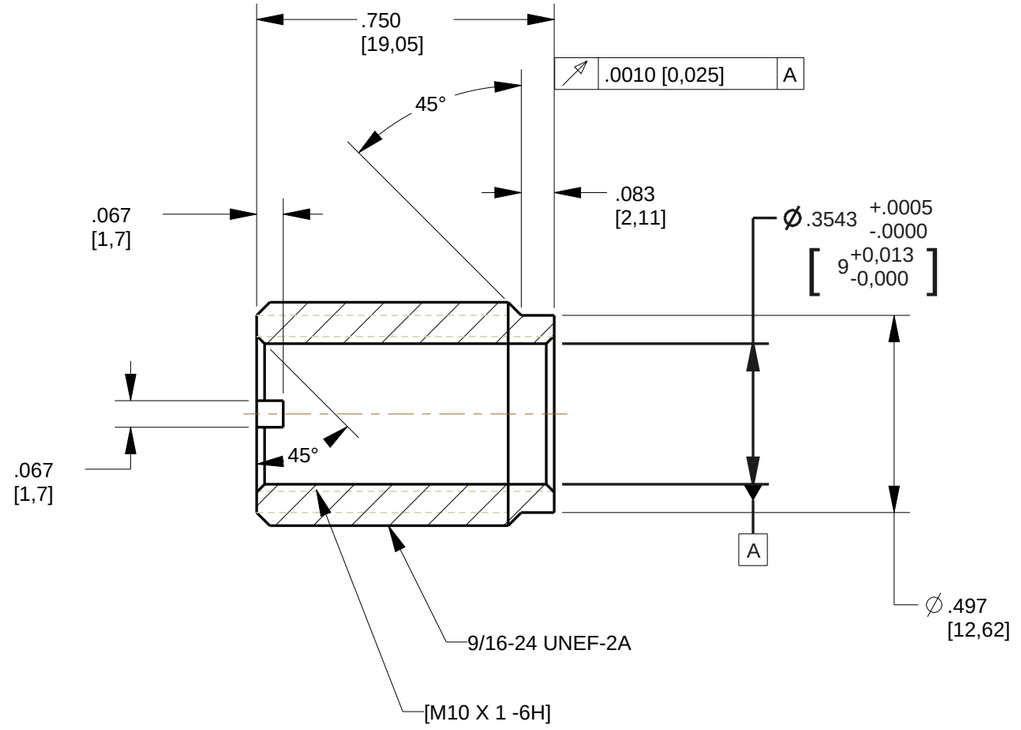
SCALE	UNIT WT	SHEET
1/1	0.000	2 OF 2

FORMAT: D_NATO_TESTEQUIP

DRAWING SIZE B







NOTES:

1. FINISH √63
2. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
3. MATERIAL - STEEL, ANSI-4150.
4. HEAT TREAT AS REQ'D.

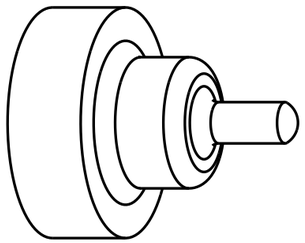
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ± .005[0.13]	
DRAWN BY A.WALKER	DATE (YEAR-MO-DA) 2012-02-01

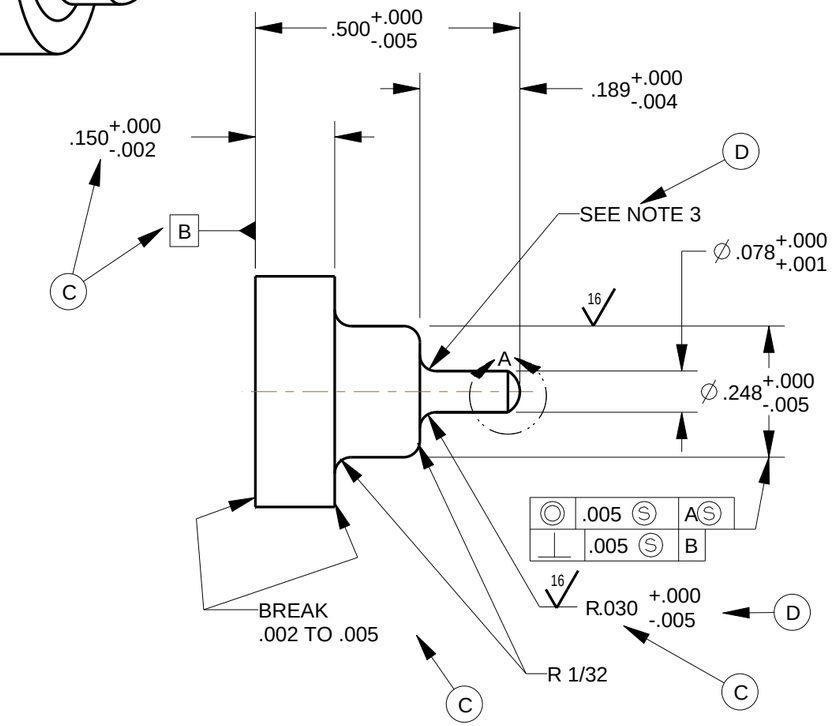
Adapter, EPVAT Barrel, 6215 or GP6, Transducer, 7.62mm

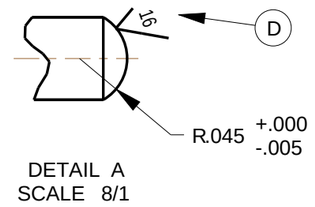
SIZE	DWG NO.		
B	12-(7.62mm)-3		
SCALE 3/1	UNIT WT 0.000	SHEET 1 OF 1	

FORMAT: B_NATO_TESTEQUIP

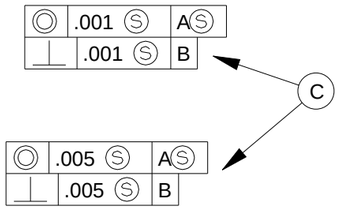
DRAWING SIZE B

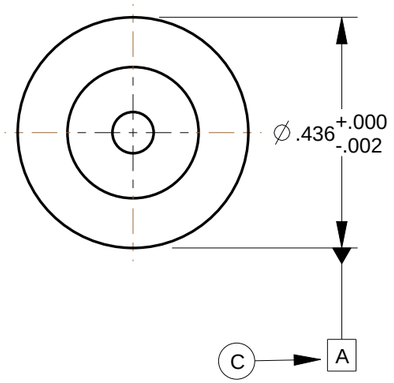






DETAIL A
SCALE 8/1





NOTES:

1. SPEC ANSI Y14.5 AND ANSI B46.1 APPLY.
2. FINISH 63 EXCEPT AS NOTED.
3. RADIUS MUST BLEND SMOOTHLY WITH DIAMETER.
4. COATING - BLACK OXIDE, SPEC MIL- C-13924.
5. MATERIAL: STEEL ANSI 4140 ASTM A304 ASTM A322 ASTM A331.
6. HEAT TREATMENT: HARDEN.

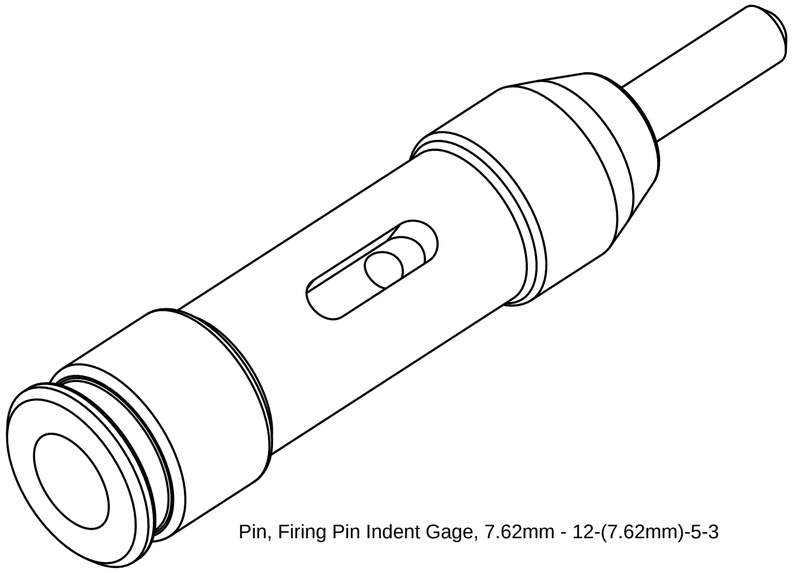
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY AMW	DATE (YEAR-MO-DA) 2012-03-03

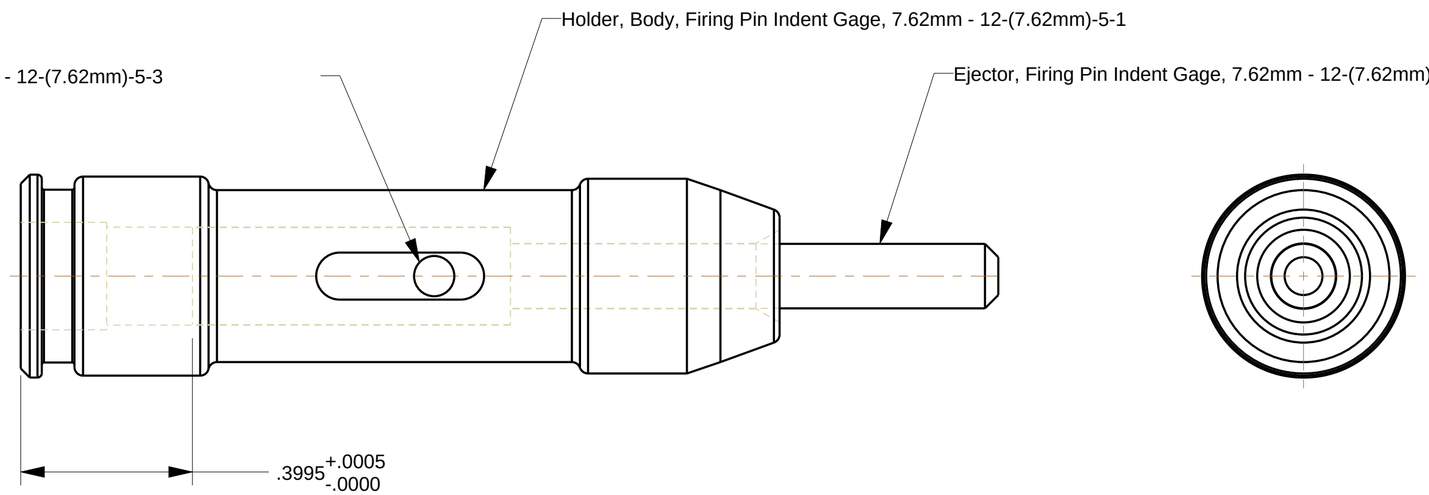
Firing Pin, Universal Receiver, 7.62mm

SIZE	DWG NO.	
B	12-(7.62mm)-4	
SCALE 4/1	UNIT WT 0.000	SHEET 1 OF 1

FORMAT: B_NATO_TESTEQUIP

DRAWING SIZE C





NOTES:

1. USE COPPER COMPRESSION CYLINDER DWG NO. NATO DRAWING 26 FOR FIRING PIN INDENT.

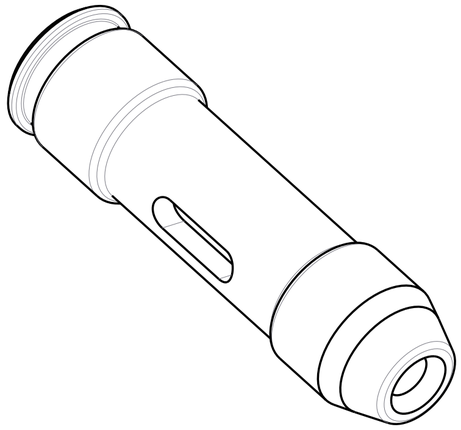
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY AMW	DATE (YEAR-MO-DA) 2012-03-09

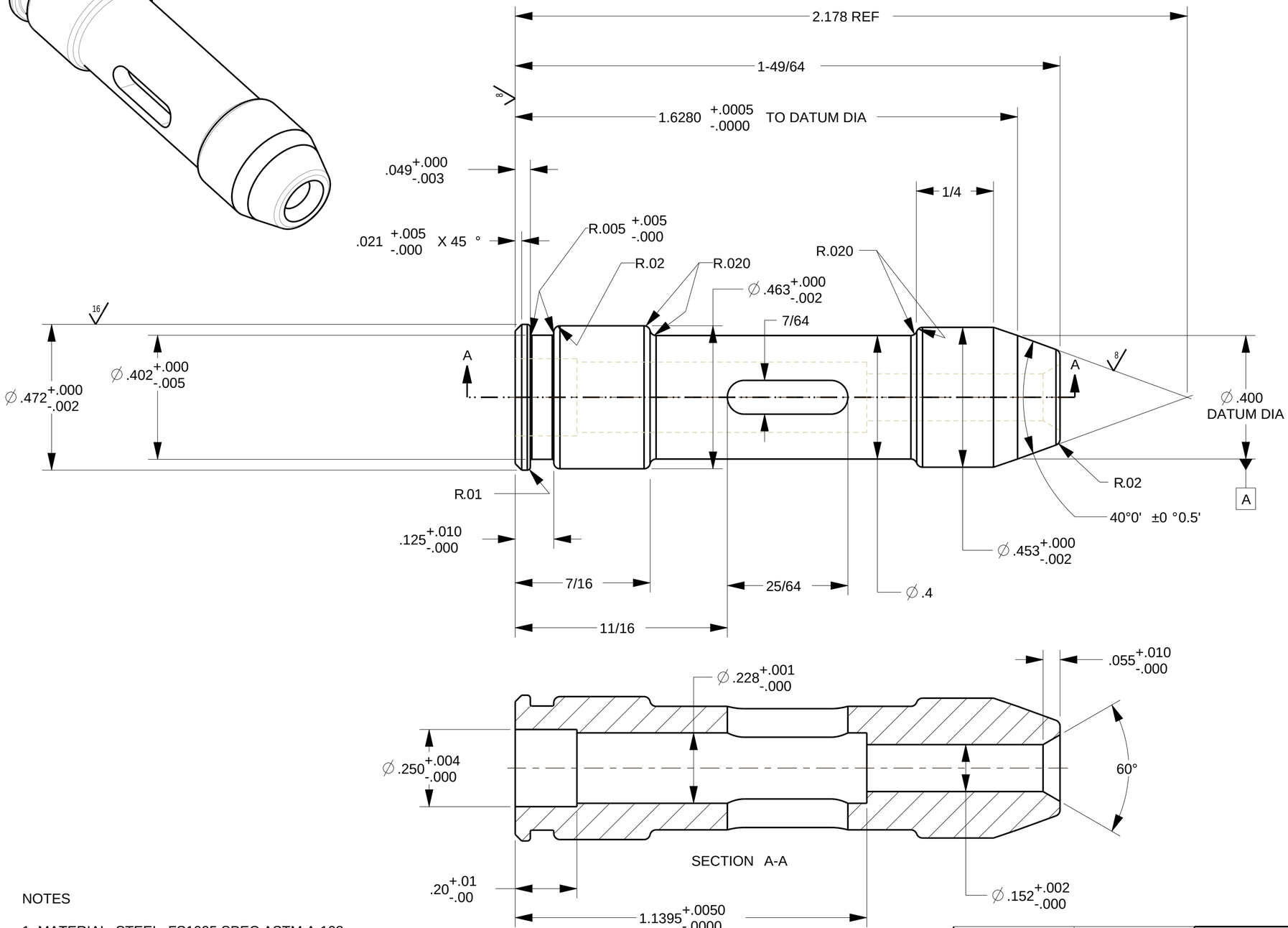
Gage, Firing Pin Indent 7.62mm

SIZE	DWG NO.		
C	12-(7.62mm)-5		
SCALE 4/1	UNIT WT 0.000	SHEET 1 OF 1	

FORMAT: C_NATO_TESTEQUIP

DRAWING SIZE C





NOTES

1. MATERIAL: STEEL, FS1095 SPEC ASTM A-108.
   HARDNESS: ROCKWELL C60 TO C63
2. REMOVE ALL BURRS AND BREAK SHARP EDGES.
3. SURFACE FINISH 63 EXCEPT AS NOTED.

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± 0° 30' DECIMALS ± .01 FRACTIONS ± 1/64	
DRAWN BY AMW	DATE (YEAR-MO-DA) 2012-03-07

Holder, Body, Firing Pin Indent Gage, 7.62mm

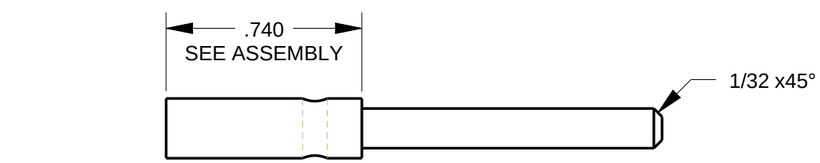
SIZE	DWG NO.		
C	12.-(7.62mm)-5-1		
SCALE 4/1	UNIT WT 0.000	SHEET 1 OF 1	

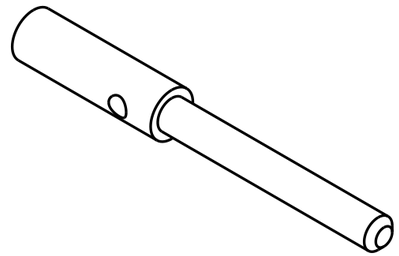
FORMAT: C_NATO_TESTEQUIP

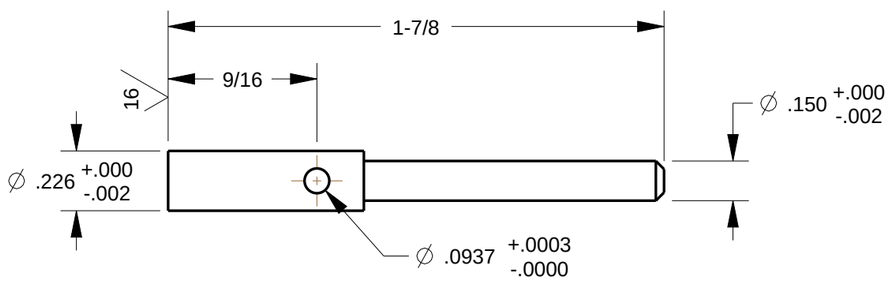
DRAWING SIZE B

NOTES:

1. REMOVE ALL SHARP EDGES
2. FINISH 63 EXCEPT AS NOTED







C8596162	FIXTURE, HOLDING, 7.62 MM, FIRING PIN INDENT
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± 1°
DECIMALS ± .001
FRACTIONS ± 1/64

DRAWN BY J. DUEHRING	DATE (YEAR-MO-DA) 2012-03-09

Ejector, Firing Pin Indent Gage, 7.62mm

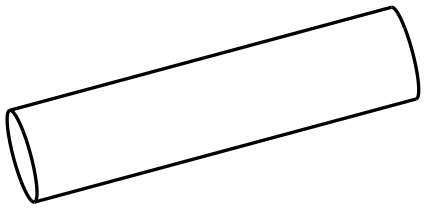
SIZE B	DWG NO. 12-(7.62mm)-5-2		
SCALE 2/1	UNIT WT 0.000	SHEET 1 OF 1	

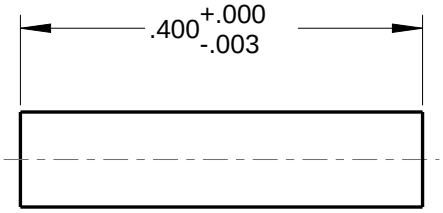
FORMAT: B_NATO_TESTEQUIP

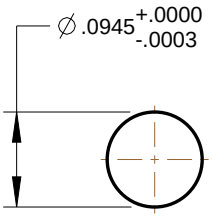
NOTE:-

FINISH ALL OVER 63

MATERIAL: TOOL, CARBON STEEL, ASTM A686







UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES

TOLERANCE ON ANGLES ± °
DECIMALS ±
FRACTIONS ±

APPLICATION	
NEXT ASSY	USED ON
C8596162	FIXTURE, HOLDING, 7.62MM
DRAWN BY J. DUEHRING	DATE (YEAR-MO-DA) 2012-03-13

Pin, Firing Pin
Indent Gage, 7.62mm

SIZE	DWG NO.	
A	12-(7.62mm)-5-3	
SCALE 6/1	UNIT WT. 0.000	SHEET 1 OF 1

DRAWING SIZE D

NOTES

1. APPLICABLE SPECS/STANDARDS:
   A. ASME Y14.5M 1994
   B. ASME Y14.100-2000
   C. MIL-G-10944 APPLIES

2. MATERIAL: STEEL, FS1095 SPEC ASTM A-108.
   HARDNESS: ROCKWELL C60 TO C65

3. REMOVE ALL BURRS AND BREAK SHARP EDGES.

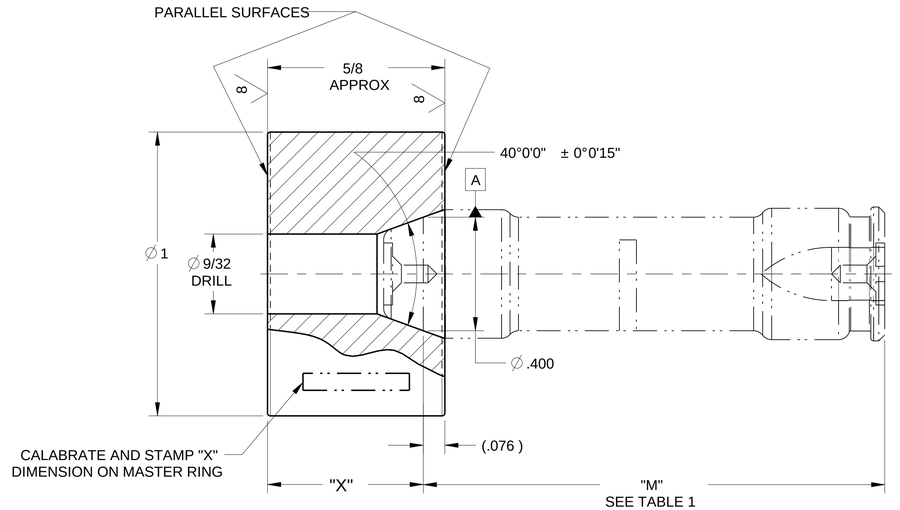
4. SURFACE FINISH $\sqrt{63}$ EXCEPT AS NOTED.

5. DRAW RIM TO ROCKWELL C50 TO C55
   BEFORE FINISHING GRINDING TO LENGTH.

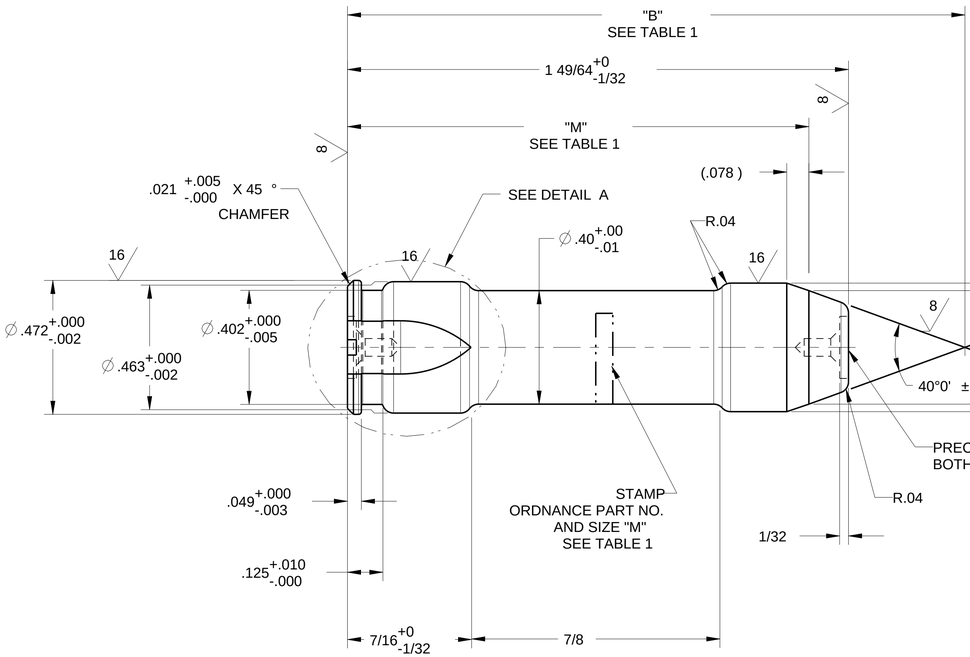
   OPTIONAL METHOD:
   DRAW HEAD TO ROCKWELL C50 TO C55,
   FLASH CHROMIUM PLATE .0002 TO .0003
   AFTER GRINDING.

TABLE 1

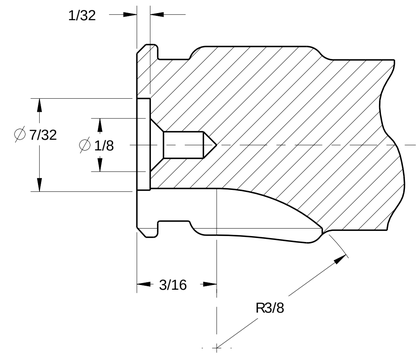
LINE NO.	LIST OF DRAWINGS	PART NUMBER	DIM "B" BREECHING SPACE	DIM "M" HEADSPACE LENGTH
1	GAGE, HEADSPACE 7.62 MM	12-(7.62mm)-6-1	2.176	1.6260 +.0002 -.0000
2		12-(7.62mm)-6-2	2.177	1.6270 +.0002 -.0000
3		12-(7.62mm)-6-3	2.178 MIN	1.6280 +.0002 -.0000
4		12-(7.62mm)-6-4	2.179	1.6290 +.0002 -.0000
5		12-(7.62mm)-6-5	2.180	1.6300 +.0002 -.0000
6		12-(7.62mm)-6-6	2.181 MAX	1.6310 +.0002 -.0000
7		12-(7.62mm)-6-7	2.182	1.6320 +.0002 -.0000
8		12-(7.62mm)-6-8	2.183	1.6330 +.0002 -.0000
9		12-(7.62mm)-6-9	2.184	1.6340 +.0002 -.0000
10		12-(7.62mm)-6-10	2.185	1.6350 +.0000 -.0002
11		12-(7.62mm)-6-11	2.186	1.6360 +.0000 -.0002
12		12-(7.62mm)-6-12	2.187	1.6370 +.0000 -.0002
13		12-(7.62mm)-6-13	2.188	1.6380 +.0000 -.0002
14		12-(7.62mm)-6-14	2.189	1.6390 +.0000 -.0002
15		12-(7.62mm)-6-15	2.190	1.6400 +.0000 -.0002
16		12-(7.62mm)-6-16	2.191	1.6410 +.0000 -.0002



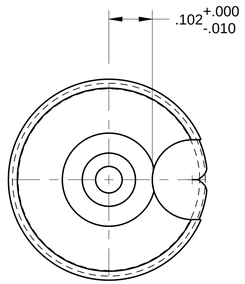
GAGE, HEADSPACE 7.62

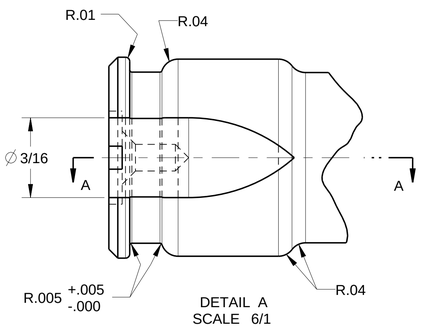


GAGE, HEADSPACE



SECTION A-A





DETAIL A
SCALE 6/1

DISTRIBUTION STATEMENT A.
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± °
DECIMALS ±
FRACTIONS ±

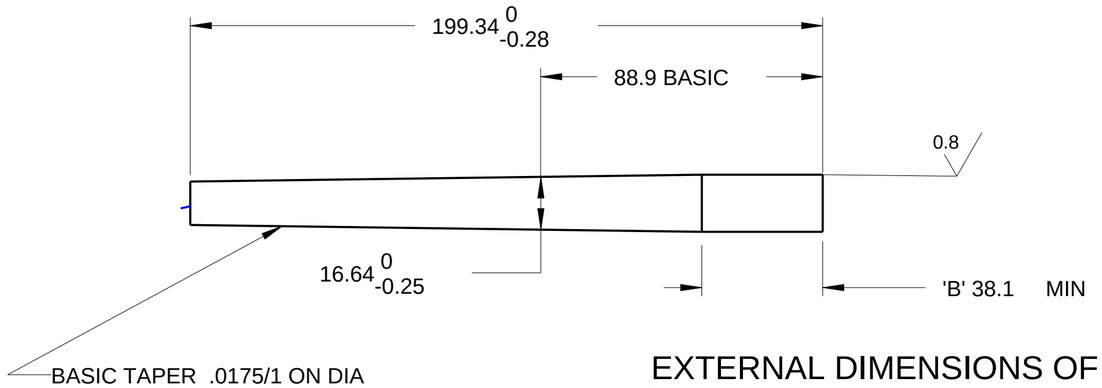
DRAWN BY AMW	DATE (YEAR-MO-DA) YEAR-MM-DD

Gage, Headspace, 7.62mm

SIZE	DWG NO.	
D	12-(7.62mm)-6	
SCALE 4/1	UNIT WT 0.000	SHEET 1 OF 1

FORMAT: D_NATO_TESTEQUIP

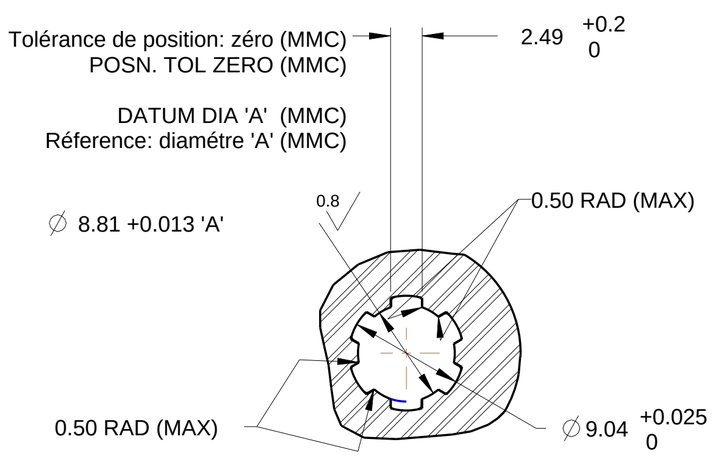
DRAWING SIZE C



EXTERNAL DIMENSIONS OF BARREL
COTES EXTERNES DU TUBE

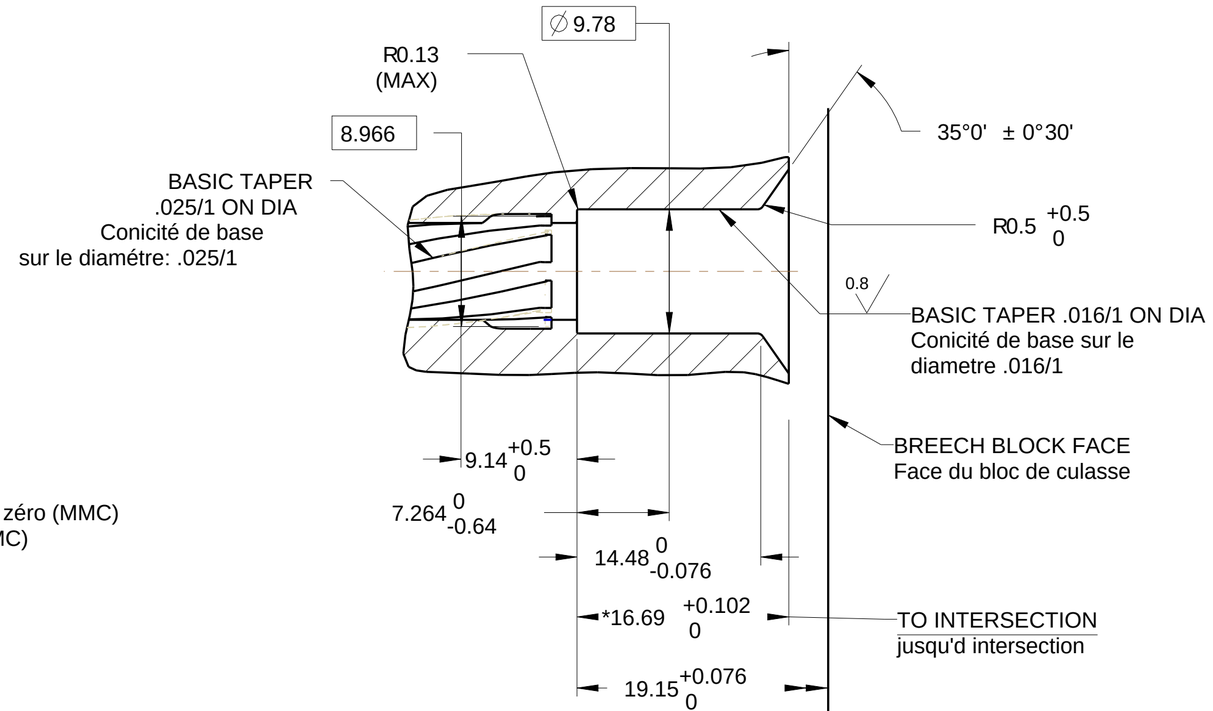
Extrémité de la culasse au usinée diamétre de 17.27-0.051
Pour la langueur B. tolérance de concentricite -0.051
Sur le diamétre. Reference: axe du tube et de la chambre.

BREECH END MACHINED TO 17.27-0.051 DIA
FOR LENGTH 'B' CONC TOL -0.051 DIA.
DATUM AXIS OF BARREL AND CHAMBER



SECTION C-C
SCALE 3/1

Diamétre 9.04 +0.025/ -0
Tolérance de concentricite: zéro (MMC)
Reference diamétre 'A' (MMC)



DETAILS OF RIFLE
DETAILS DES RAYURES

METRIC

RIFLING - 6 GROOVES EQUALLY SPACED 1 TURN IN 250MM R.H.
MMC EQUALS MAXIMUM METAL CONDITION
Rayures: 6 rayures également espacées - 1 tour â draite en 250mm
MMC = condition maximum du métal

DIMENSION IN MM
Les cotes sont en mm

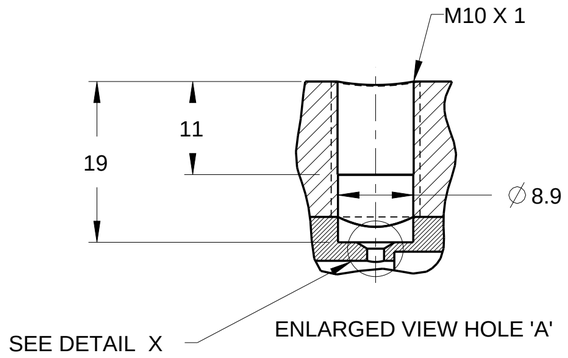
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY AMW	DATE (YEAR-MO-DA) 2012-05-10

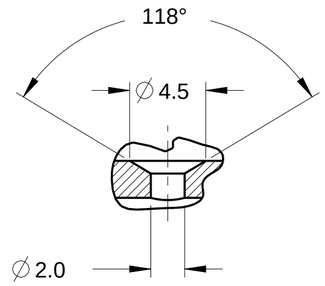
Barrel, Test,
Velocity (EPVAT), 9mm

SIZE	DWG NO.	
C	12-(9mm)-1	
SCALE 1/4	UNIT WT 0.000	SHEET 1 OF 3

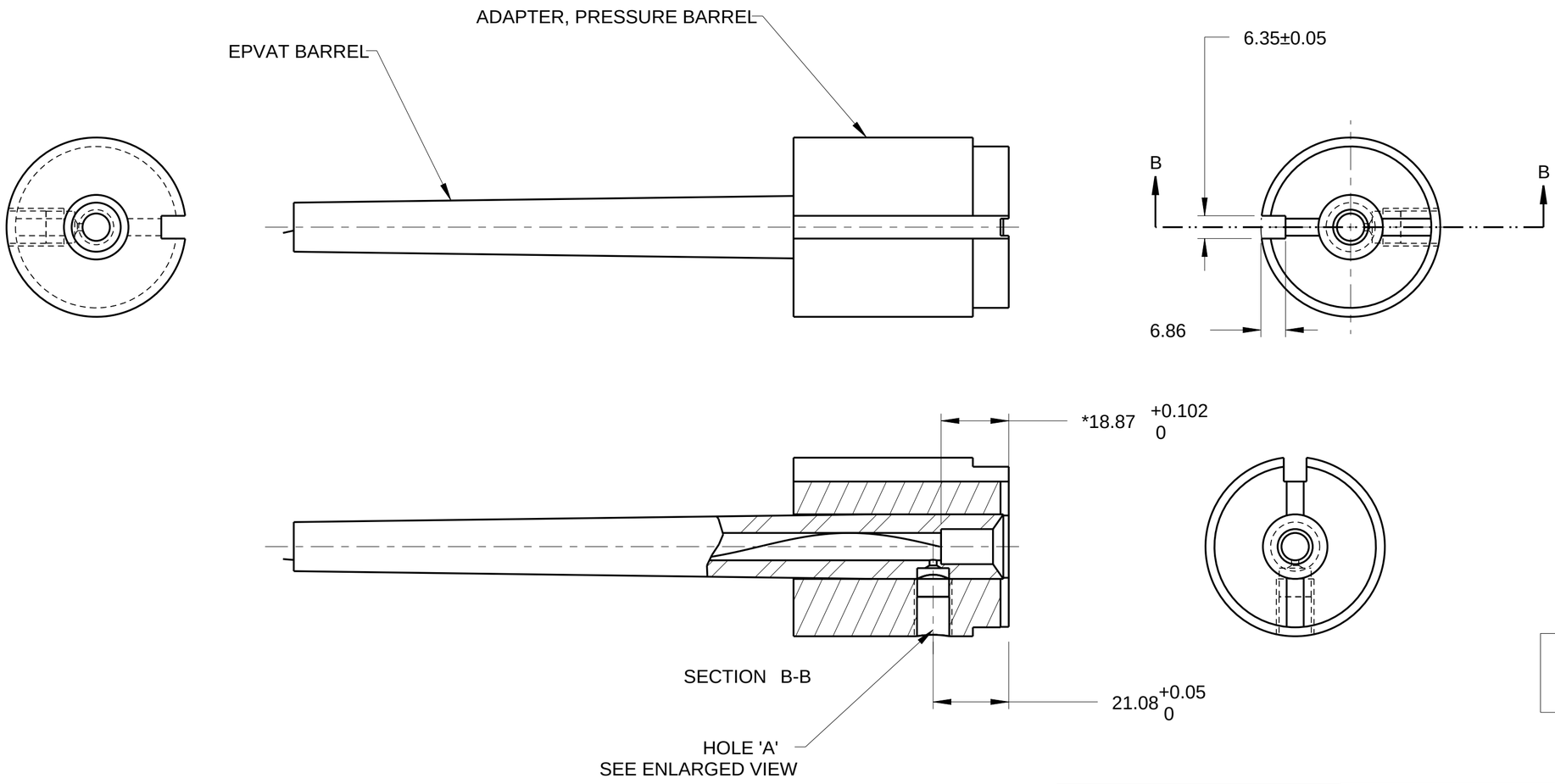
FORMAT: C_NATO_TESTEQUIP

DRAWING SIZE C





DETAIL X
ENLARGED VIEW AT 'X'
SCALE 4/1



METRIC

* THIS DIMENSION TO BE OBTAINED BY FACING OFF BACK OF THE ADAPTOR AFTER ASSEMBLY

DIMENSIONS IN mm
Les cotes sont en mm

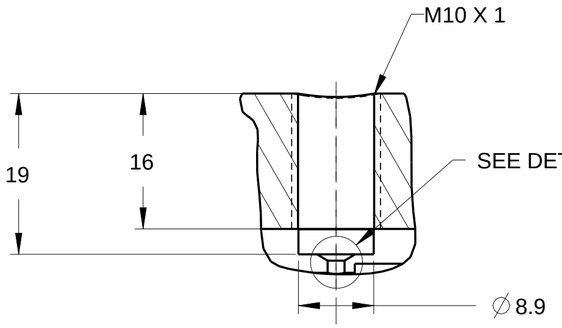
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY AMW	DATE (YEAR-MO-DA) 2012-09-14

Barrel, Test, EPVAT, 6203 Transducer, 9mm

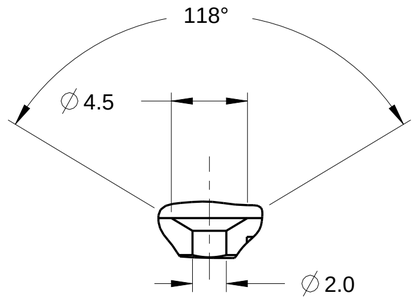
SIZE	DWG NO.		
C	12-(9mm)-2		
SCALE 1/2	UNIT WT 0.000	SHEET 3 OF 3	

FORMAT: C_NATO_TESTEQUIP

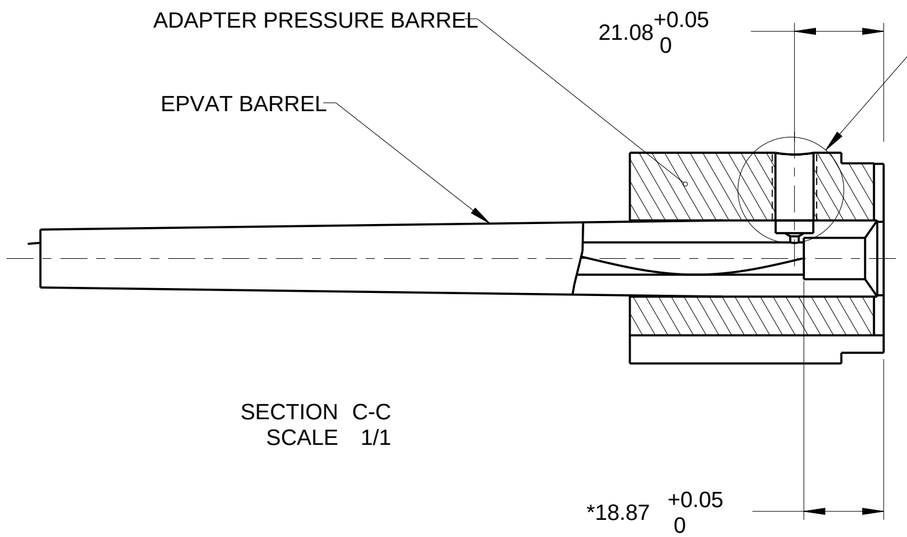
DRAWING SIZE C



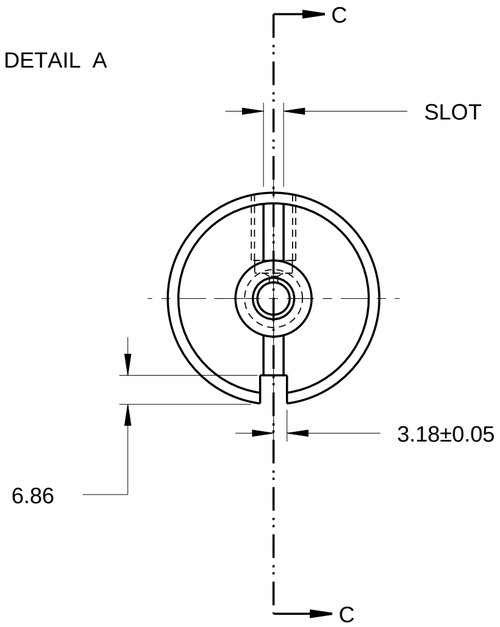
DETAIL A
ENLARGED VIEW HOLE "A"
SCALE 2/1



DETAIL B
ENLARGED VIEW 'B'
SCALE 4/1



SECTION C-C
SCALE 1/1



METRIC

* THIS DIMENSION TO BE OBTAINED BY FACING OFF BACK OF THE ADAPTER AFTER ASEMBLY

DIMENSIONS IN mm
Les cotes sont en mm

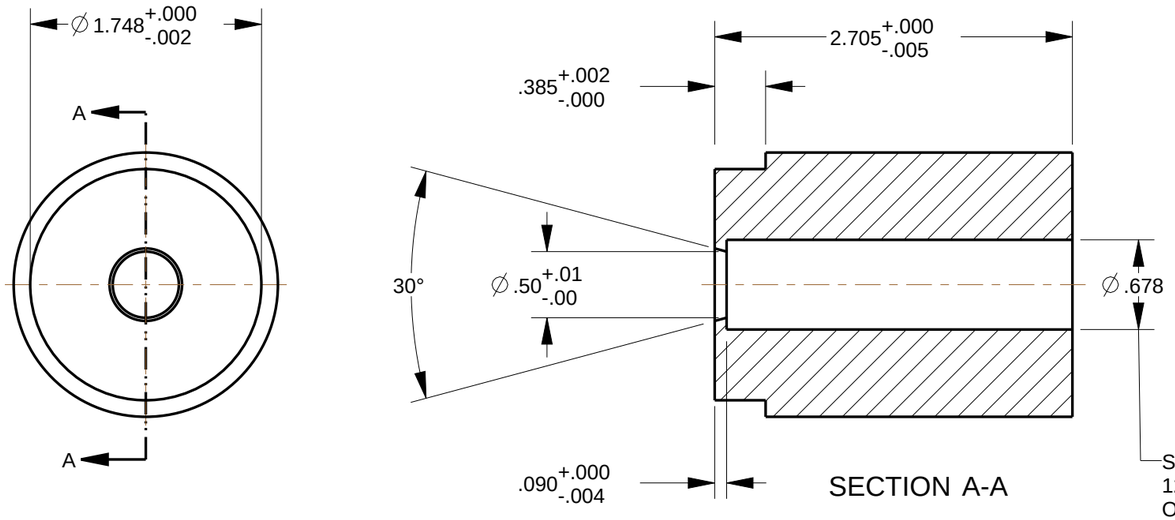
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY AMW	DATE (YEAR-MO-DA) 2012-09-14

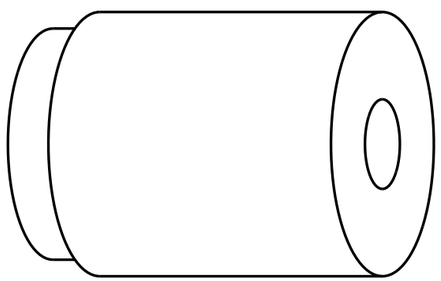
Barrel, Test, EPVAT, 6215 or GP6 Transducer, 9mm

SIZE C	DWG NO. 12-(9mm)-3		
SCALE 1/2	UNIT WT 0.000	SHEET 2 OF 3	

FORMAT: C_NATO_TESTEQUIP

DRAWING SIZE B





	PF7203GA
	PF8036A
	AR-827-52744
NEXT ASSY	USED ON
APPLICATION	

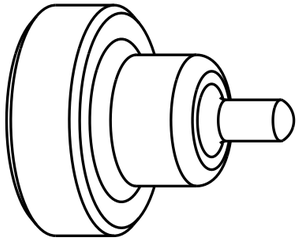
UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± °
DECIMALS ±
FRACTIONS ±

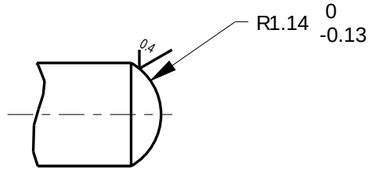
Adapter, Barrel, Test, EPVAT, 9mm

DRAWN BY	DATE (YEAR-MO-DA)	SIZE	DWG NO.	
A. WALKER	2012-11-05	B	12-(9mm)-4	
SCALE 1/1	UNIT WT 0.000	SHEET 1 OF 1		

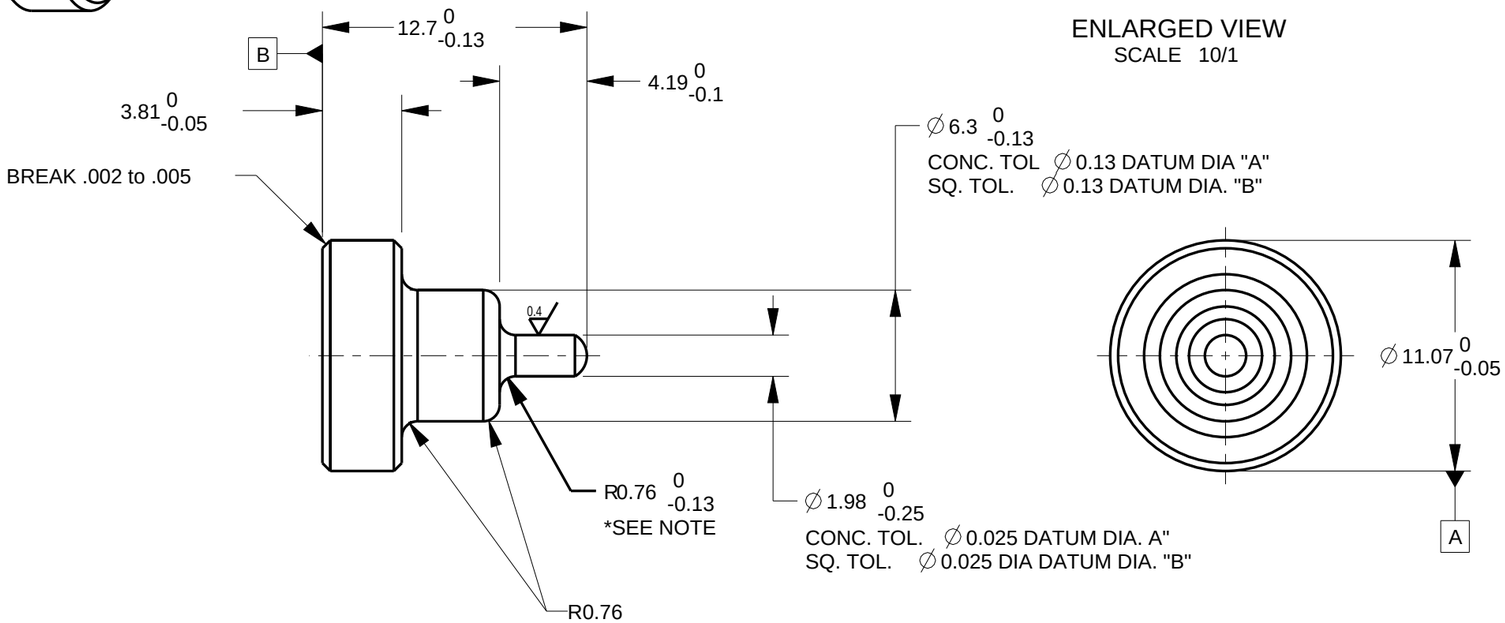
FORMAT: B_NATO_TESTEQUIP

DRAWING SIZE B





ENLARGED VIEW
SCALE 10/1



*RADIUS MUST BLEND SMOOTHLY WITH DIAMETER.

HARDEN AND TEMPER TO AHV OF
450-550 INCREASING TO 600 AT POINT

PROTECTIVE FINISH - PHOSPHATE TO DEF STAN 03-11/1 CL 1
CPC PX-4 TO DEF STAN 80-34

MATERIAL - STEEL TO B.S.970 PT. 2 826 M 31

DIMENSIONS IN MM
les cotes sont en mm

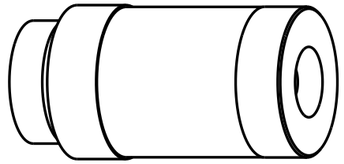
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY AMW	DATE (YEAR-MO-DA) 1959-10-20

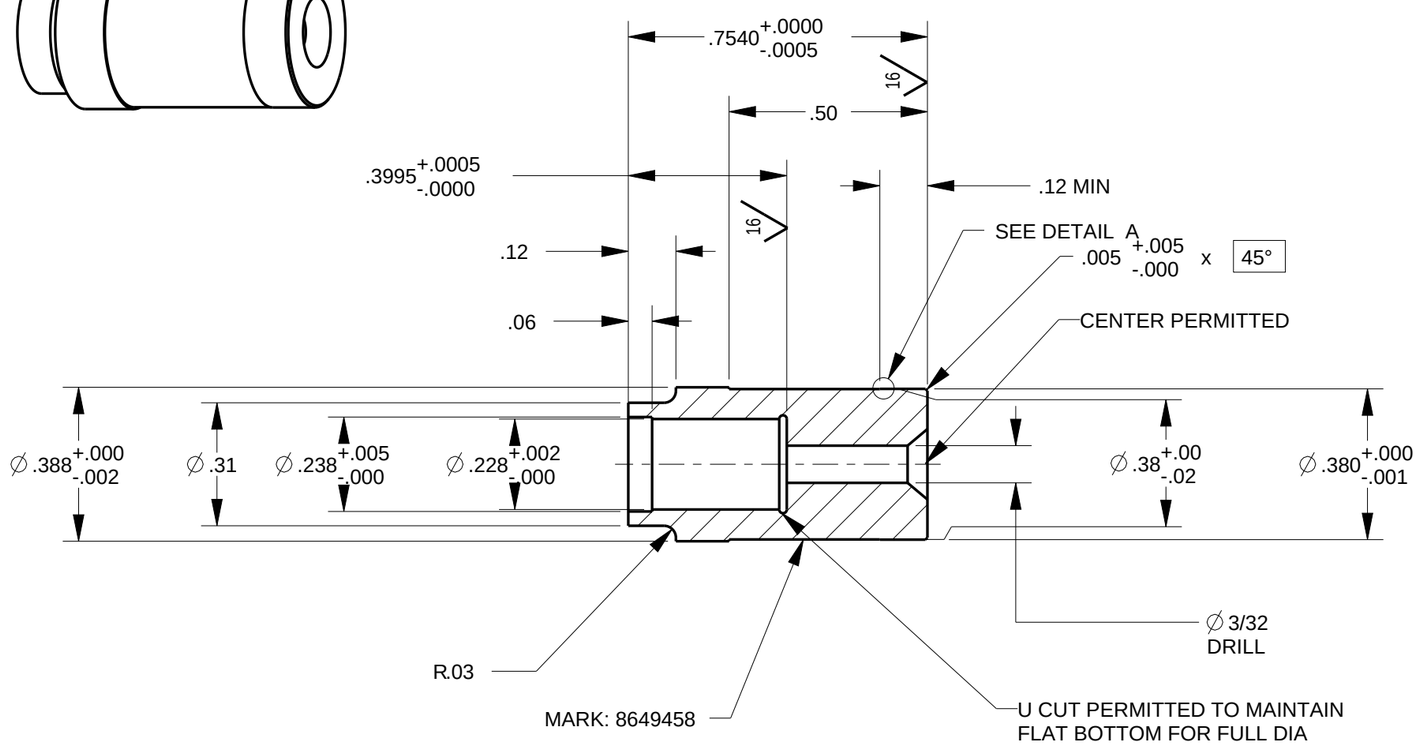
Firing Pin, Universal Receiver, 9mm

SIZE	DWG NO.		
B	12-(9mm)-5		
SCALE 4/1	UNIT WT 0.000	SHEET 1 OF 1	

FORMAT: B_NATO_TESTEQUIP

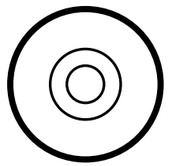
DRAWING SIZE B





SECTION A-A

DETAIL A
SCALE 20/1



NOTES:

1. SPEC MIL-G-10944, ANSI Y14.5 AND ANSI B46.1 APPLY.
2. MATERIAL - TOOL STEEL.
3. QUENCH AND TEMPER.
4. HDN TO ROCK C50-55.
5. $\sqrt{63}$ ALL OVER, EXEPT AS NOTED.

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY A. WALKER	DATE (YEAR-MO-DA) 2012-02-21

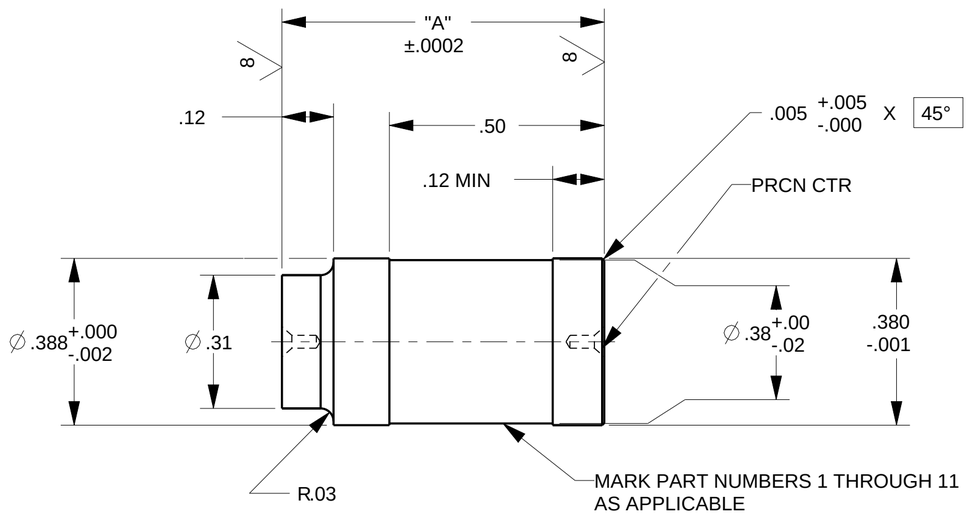
Gage, Firing Pin Indent, 9mm

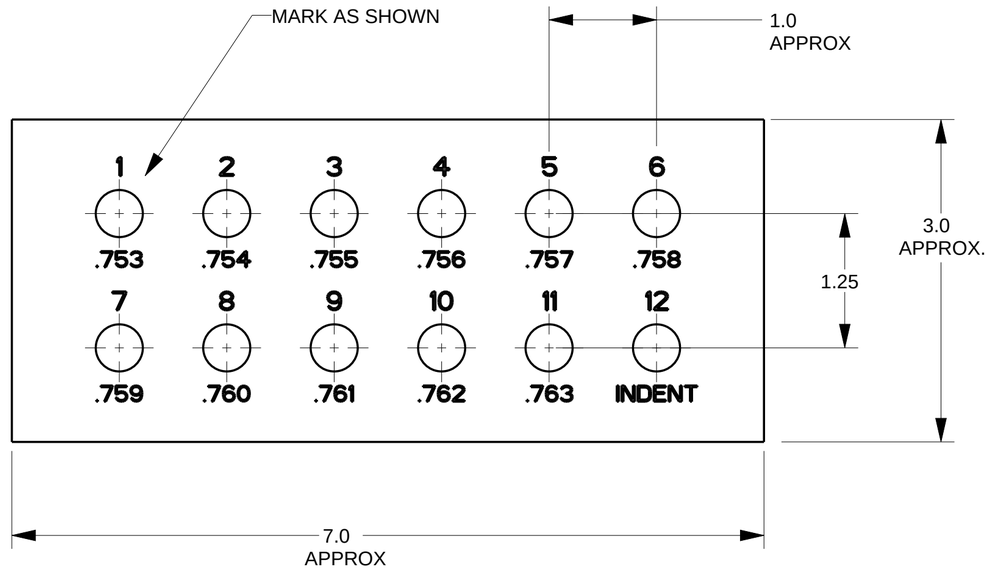
SIZE	DWG NO.		
B	12-(9mm)-6		
SCALE 3/1	UNIT WT 0.000	SHEET 1 OF 1	

FORMAT: B_NATO_TESTEQUIP

DRAWING SIZE C

NOTES:
1-SPEC MIL-G-10944, ANSI Y14.5 & ANSI B46.1 APPLY.

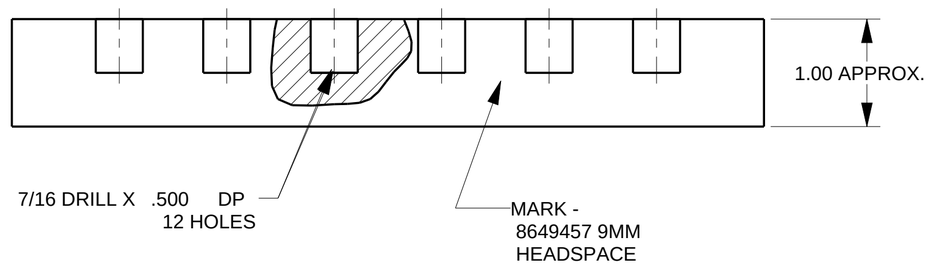




PART NO.	LENGTH "A"
12-(9mm)-7-1	.7530
12-(9mm)-7-2	.7540
12-(9mm)-7-3	.7550
12-(9mm)-7-4	.7560
12-(9mm)-7-5	.7570
12-(9mm)-7-6	.7580
12-(9mm)-7-7	.7590
12-(9mm)-7-8	.7600
12-(9mm)-7-9	.7610
12-(9mm)-7-10	.7620
12-(9mm)-7-11	.7630

GAGE, HEADSPACE
ELEVEN REQD
MATL - TOOL STEEL
QUENCH AMD TEMPER
HDN TO ROCK C60-63

63 ALL OVER, EXCEPT AS NOTED



BLOCK, GAGE, HOLDER
ONE REQD
MATL - WOOD
PROT FNSH
TYPE OPTIONAL

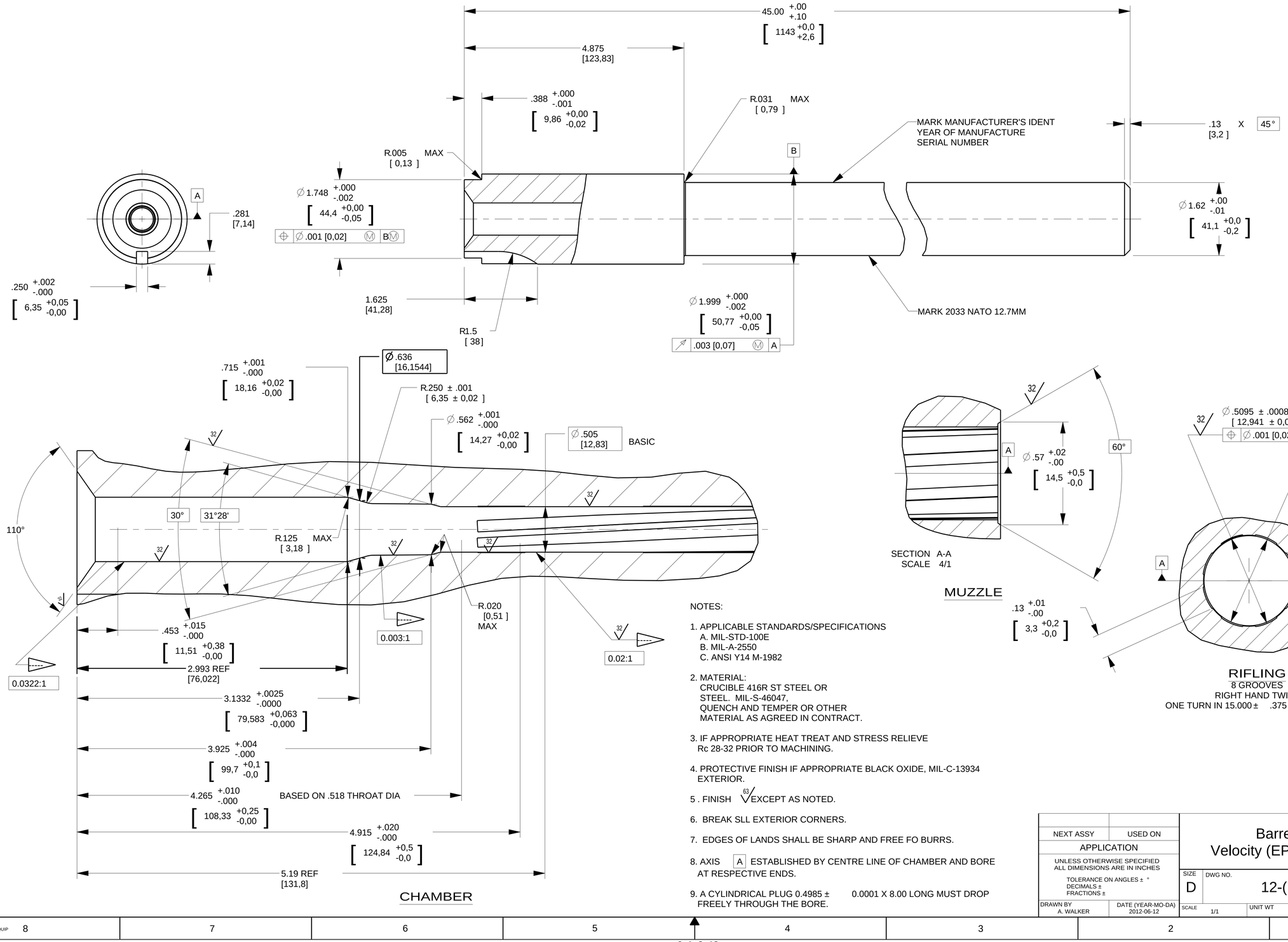
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY AMW	DATE (YEAR-MO-DA) 2012-02-22

Gage, Headspace, 9mm

SIZE	DWG NO.		
C	12-(9mm)-7		
SCALE 1/1	UNIT WT 0.000	SHEET 1 OF 1	

FORMAT: C_NATO_TESTEQUIP

DRAWING SIZE D



NOTES:

1. APPLICABLE STANDARDS/SPECIFICATIONS
   A. MIL-STD-100E
   B. MIL-A-2550
   C. ANSI Y14 M-1982

2. MATERIAL:
   CRUCIBLE 416R ST STEEL OR
   STEEL. MIL-S-46047,
   QUENCH AND TEMPER OR OTHER
   MATERIAL AS AGREED IN CONTRACT.

3. IF APPROPRIATE HEAT TREAT AND STRESS RELIEVE
   Rc 28-32 PRIOR TO MACHINING.

4. PROTECTIVE FINISH IF APPROPRIATE BLACK OXIDE, MIL-C-13934
   EXTERIOR.

5 . FINISH 63 EXCEPT AS NOTED.

6. BREAK SLL EXTERIOR CORNERS.

7. EDGES OF LANDS SHALL BE SHARP AND FREE FO BURRS.

8. AXIS A ESTABLISHED BY CENTRE LINE OF CHAMBER AND BORE
   AT RESPECTIVE ENDS.

9. A CYLINDRICAL PLUG 0.4985 ± 0.0001 X 8.00 LONG MUST DROP
   FREELY THROUGH THE BORE.

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± °
DECIMALS ±
FRACTIONS ±

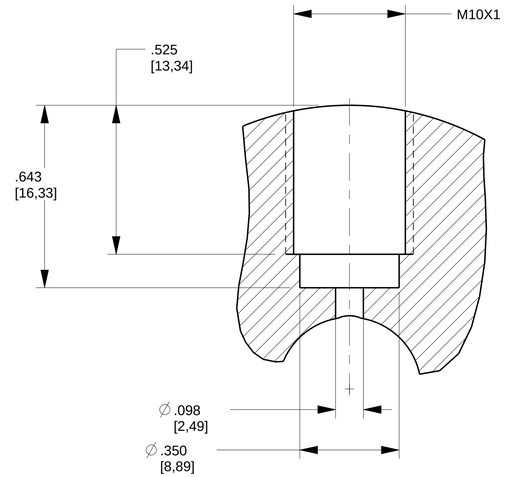
DRAWN BY	DATE (YEAR-MO-DA)
A. WALKER	2012-06-12

Barrel, Test, Velocity (EPVAT), 12.7mm

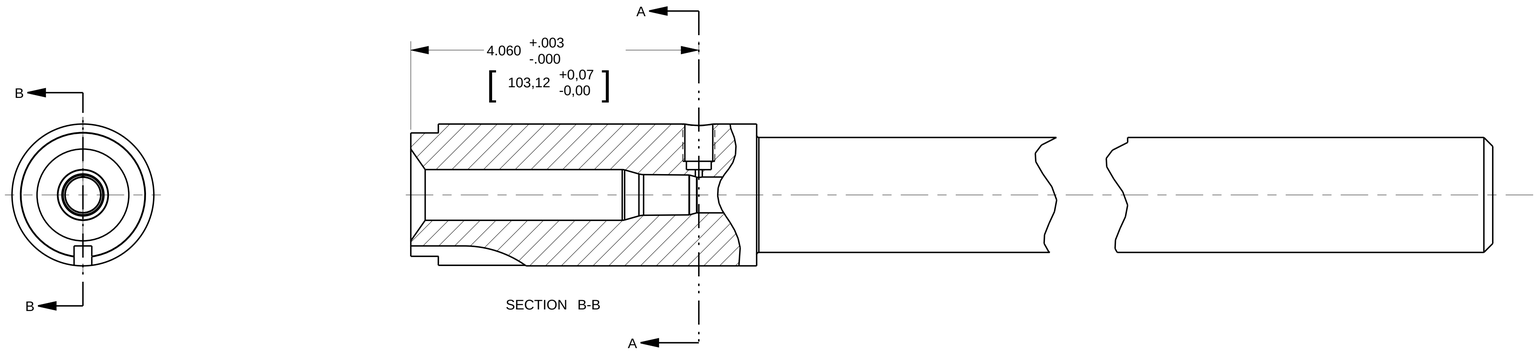
SIZE	DWG NO.	
D	12-(12.7mm)-1	
SCALE 1/1	UNIT WT 0.000	SHEET 1 OF 2

FORMAT: D_NATO_TESTEQUIP

DRAWING SIZE D



SECTION A-A
SCALE 4/1



SECTION B-B

NOTES:

1. MODIFY VELOCITY (EPVAT) TEST BARREL, DWG NO. 12-(12.7mm)-1 AS SHOWN.

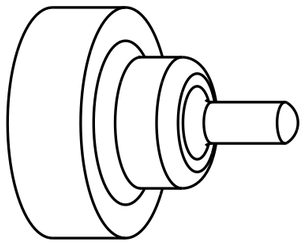
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY A. WALKER	DATE (YEAR-MO-DA) 2012-03-20

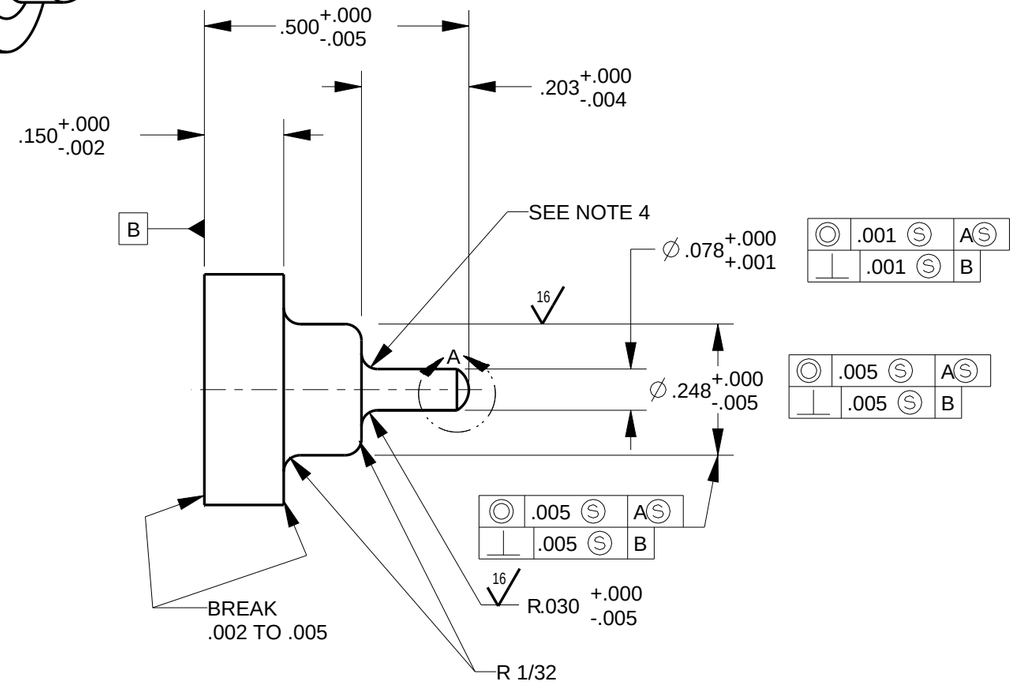
Barrel, Test, EPVAT 6215 or GP6 Transducer, 12.7mm

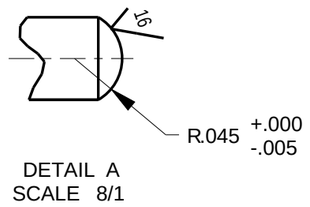
SIZE	DWG NO.	
D	12-(12.7mm)-2	
SCALE 1/1	UNIT WT 0.000	SHEET 2 OF 2

FORMAT: D_NATO_TESTEQUIP

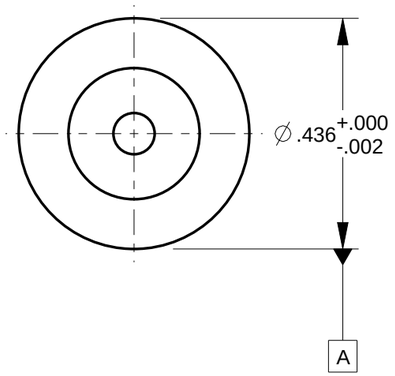
DRAWING SIZE B







DETAIL A
SCALE 8/1



NOTES:

1. SPEC ANSI Y14.5 AND ANSI B46.1 APPLY.
2. COATING - BLACK OXIDE, SPEC MIL- C-13924.
3. FINISH 63 EXCEPT AS NOTED.
4. RADIUS MUST BLEND SMOOTHLY WITH DIAMETER.
5. MATERIAL: STEEL ANSI 4140 ASTM A304 ASTM A322 ASTM A331.
6. HEAT TREATMENT: HARDEN.

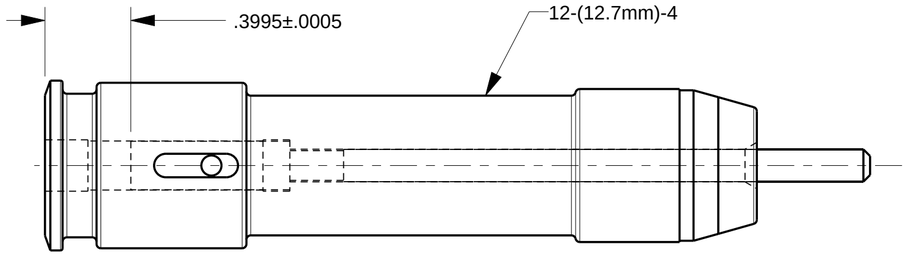
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±1/64	
DRAWN BY AMW	DATE (YEAR-MO-DA) 2012-03-03

Firing Pin, Universal Receiver, 12.7mm

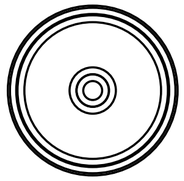
SIZE B	DWG NO. 12-(12.7mm)-3		
SCALE 4/1	UNIT WT 0.000	SHEET 1 OF 1	

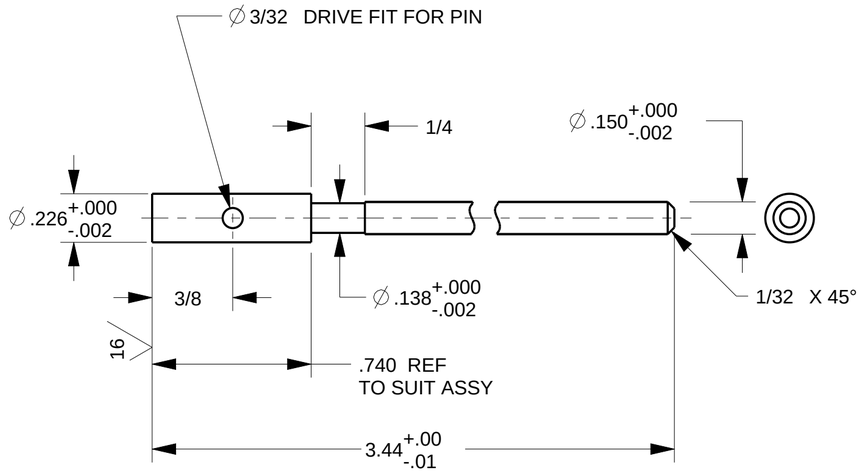
FORMAT: B_NATO_TESTEQUIP

DRAWING SIZE C

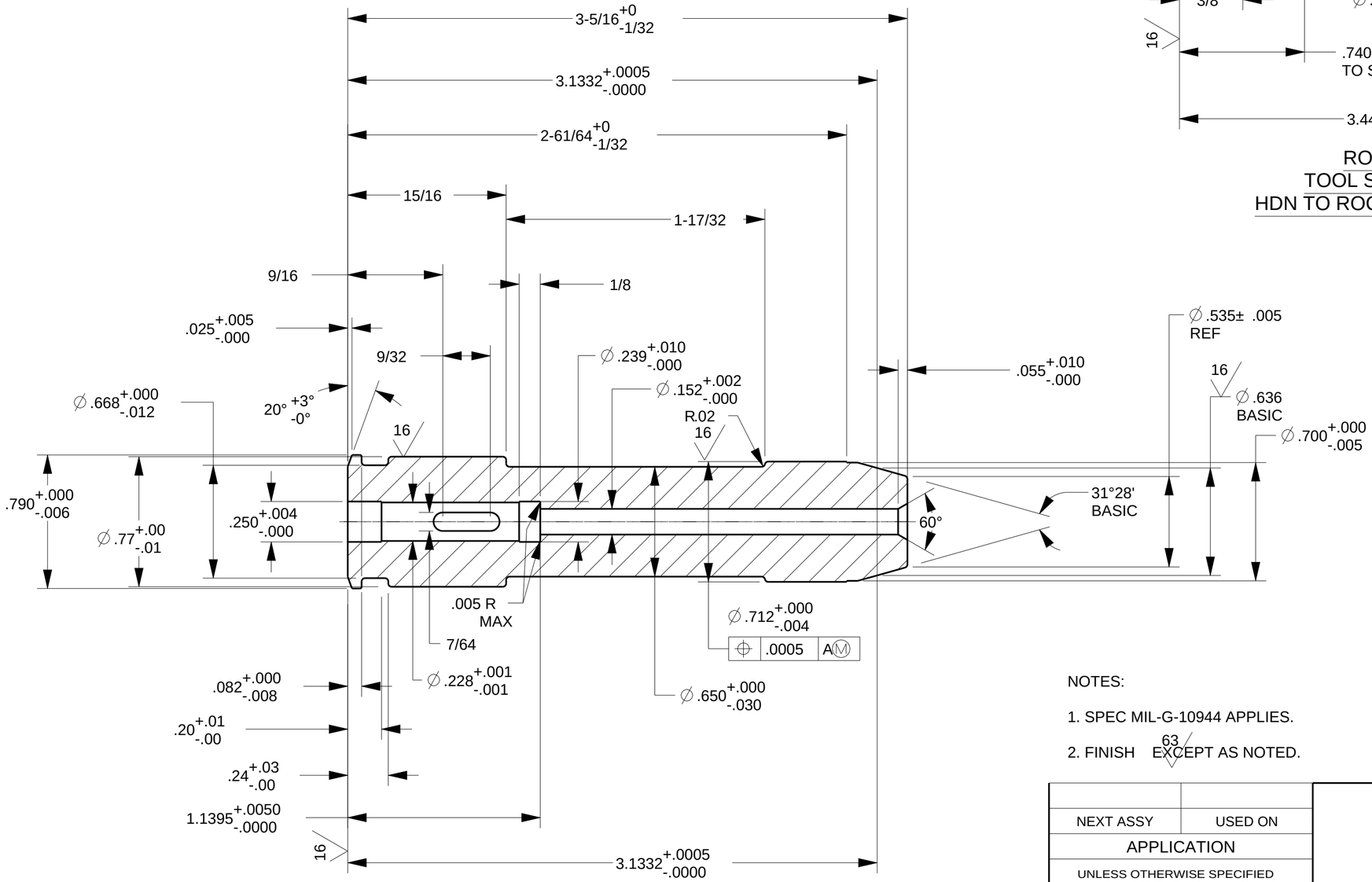


ASSEMBLY

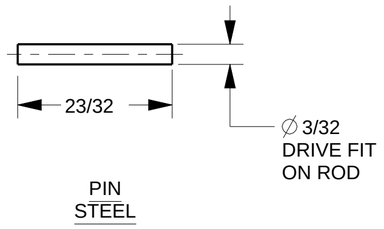




ROD
TOOL STEEL
HDN TO ROCK. G 60-63



BODY
TOOL STEEL
HDN TO ROCK C63-66



PIN
STEEL

NOTES:

1. SPEC MIL-G-10944 APPLIES.
2. FINISH 63 EXCEPT AS NOTED.

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± °
DECIMALS ±
FRACTIONS ±

DRAWN BY	DATE (YEAR-MO-DA)
AMW	2012-05-05

Gage, Firing Pin Indent, 12.7mm

SIZE	DWG NO.	
C	12-(12.7mm)-4	
SCALE 2/1	UNIT WT 0.000	SHEET 1 OF 1

FORMAT: C_NATO_TESTEQUIP

DRAWING SIZE D

NOTES

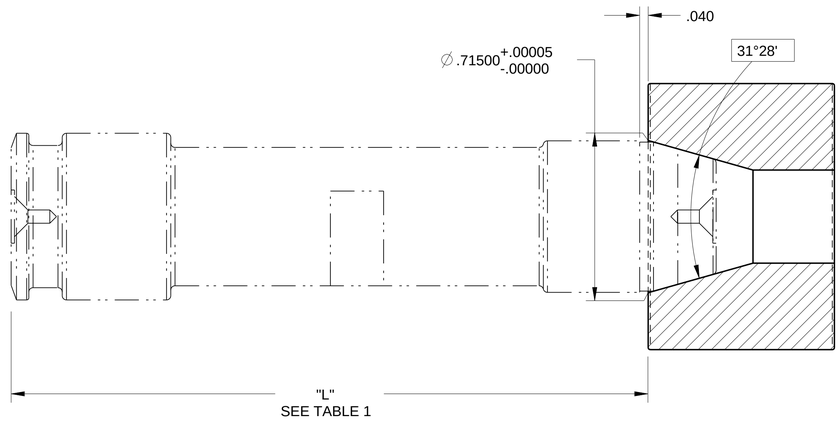
1. APPLICABLE SPECS/STANDARDS:
   A. ASME Y14.5M 1994
   B. ASME Y14.100-2000
   C. MIL-G-10944 APPLIES

2. MATERIAL: STEEL, FS1095 SPEC ASTM A-108.
   HARDEN AND TEMPER TO ROCKWELL C64 TO C65
   THEN DRAW .783-.004 DIA. SECTION TO R C55-C58.

3. REMOVE ALL BURRS AND BREAK SHARP EDGES.

4. SURFACE FINISH 63 EXCEPT AS NOTED.

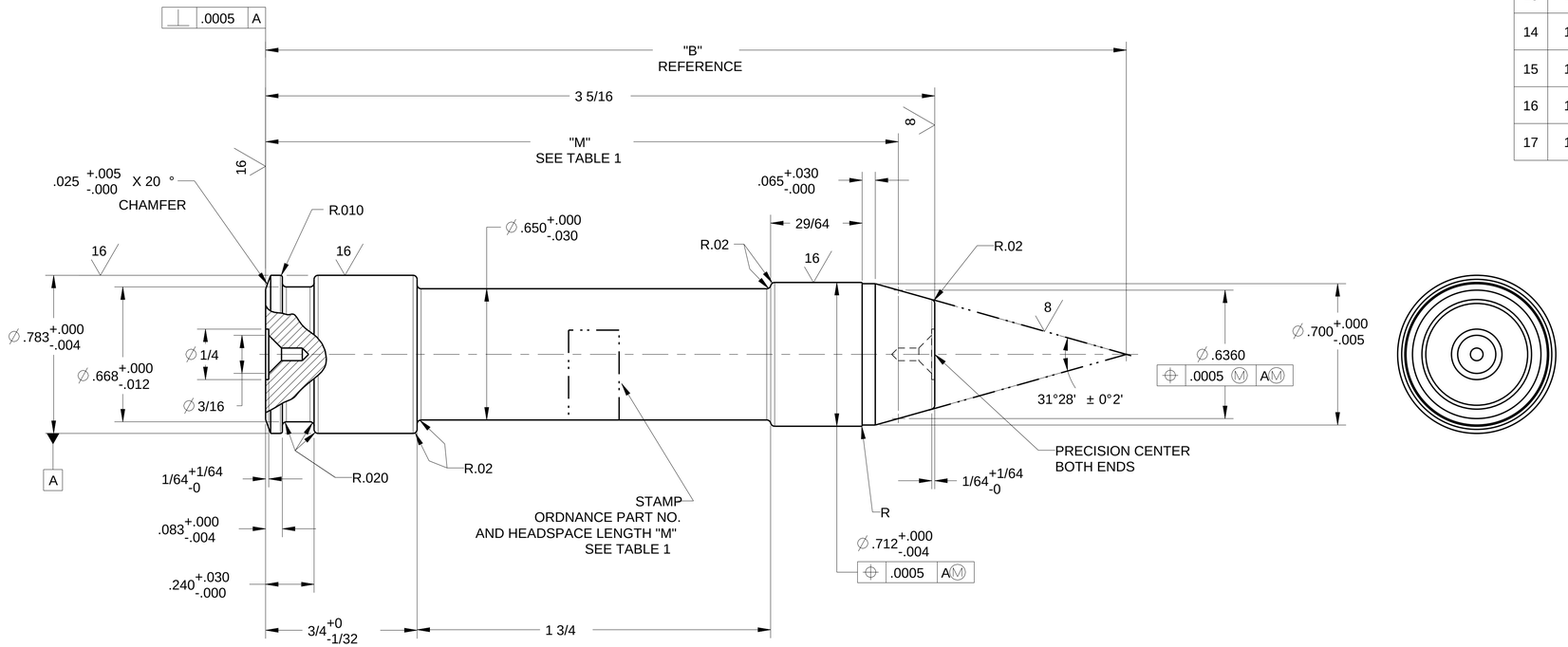
5. GAGE WITH HEADSPACE LENGTH 3.1332 TO BE STAMPED MINIMUM.
   GAGE WITH HEADSPACE LENGTH 3.1432 TO BE STAMPED MAXIMUM.



MASTER RING SET UP FOR PRODUCING "L"

TABLE 1

LINE NO.	ORDNANCE PART NUMBER	DIM "B" BREECHING SPACE	DIM "L" LENGTH	DIM "M" HEADSPACE LENGTH
1	12-(12.7mm)-5-1	4.261	2.992	3.1322 +.0005 -.0000
2	12-(12.7mm)-5-2	4.262	2.993	3.1332 +.0005 -.0000 MIN
3	12-(12.7mm)-5-3	4.263	2.994	3.1342 +.0005 -.0000
4	12-(12.7mm)-5-4	4.264	2.995	3.1352 +.0005 -.0000
5	12-(12.7mm)-5-5	4.265	2.996	3.1362 +.0005 -.0000
6	12-(12.7mm)-5-6	4.266	2.997	3.1372 +.0005 -.0000
7	12-(12.7mm)-5-7	4.267	2.998	3.1382 +.0000 -.0005
8	12-(12.7mm)-5-8	4.268	2.999	3.1392 +.0000 -.0005
9	12-(12.7mm)-5-9	4.269	3.000	3.1402 +.0000 -.0005
10	12-(12.7mm)-5-10	4.270	3.001	3.1412 +.0000 -.0005
11	12-(12.7mm)-5-11	4.271	3.002	3.1422 +.0000 -.0005
12	12-(12.7mm)-5-12	4.272	3.003	3.1432 +.0000 -.0005 MAX
13	12-(12.7mm)-5-13	4.273	3.004	3.1442 +.0000 -.0005
14	12-(12.7mm)-5-14	4.274	3.005	3.1452 +.0000 -.0005
15	12-(12.7mm)-5-15	4.275	3.006	3.1462 +.0000 -.0005
16	12-(12.7mm)-5-16	4.276	3.007	3.1472 +.0000 -.0005
17	12-(12.7mm)-5-17	4.277	3.008	3.1482 +.0000 -.0005



GAGE, HEADSPACE

DISTRIBUTION STATEMENT A.
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ±1°
DECIMALS ±.005
FRACTIONS ±1/64

DRAWN BY GK | DATE (YEAR-MO-DA) 1958-01-06

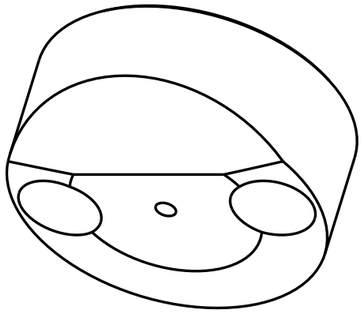
Gage, Headspace, 12.7mm

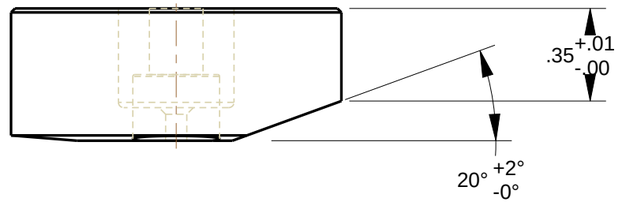
SIZE D | DWG NO. 12-(12.7mm)-5

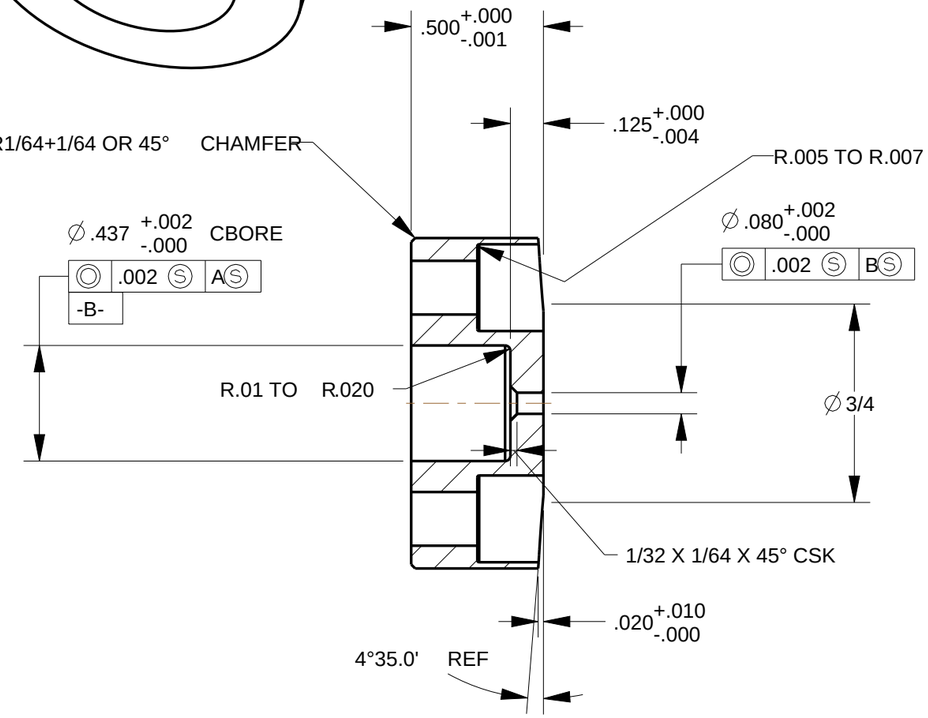
SCALE 3/1 | UNIT WT 0.000 | SHEET 1 OF 1

FORMAT: D_NATO_TESTEQUIP

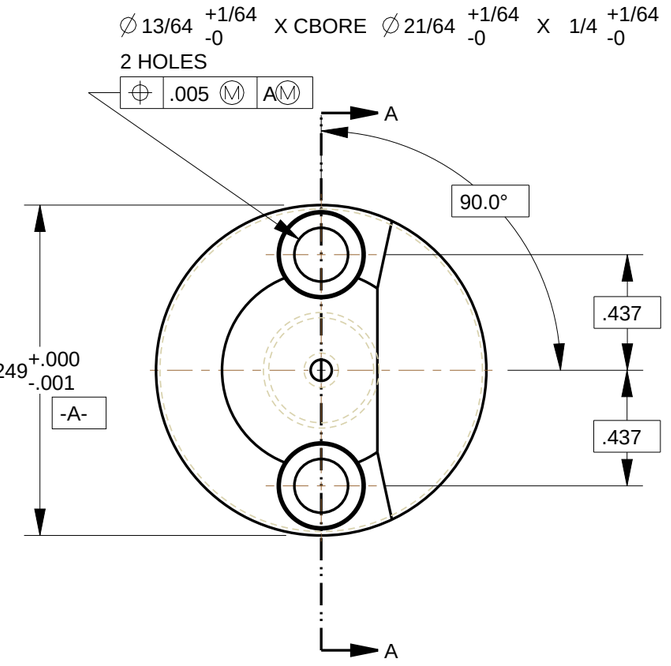
DRAWING SIZE B







SECTION A-A



NOTES:
1. SPEC ANSI Y14.5 AND ANSI B46.1 APPLY.
2. COATING- BLACK OXIDE, SPEC MIL-C-13924.
3. FINISH 63 EXCEPT AS NOTED.
4. MATERIAL: STEEL - FS02, SPEC 00-T-570.
5. HEAT TREATMENT: HARDEN

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± 1° DECIMALS ±.005 FRACTIONS ±1/64	
DRAWN BY AMW	DATE (YEAR-MO-DA) 2012-02-21

Plate, Firing Pin, Universal Receiver, 7.62mm, 9mm and 12.7mm

SIZE	DWG NO.	
B	12-(MC)-1	
SCALE 2/1	UNIT WT	SHEET 1 OF 1

FORMAT: B_NATO_TESTEQUIP

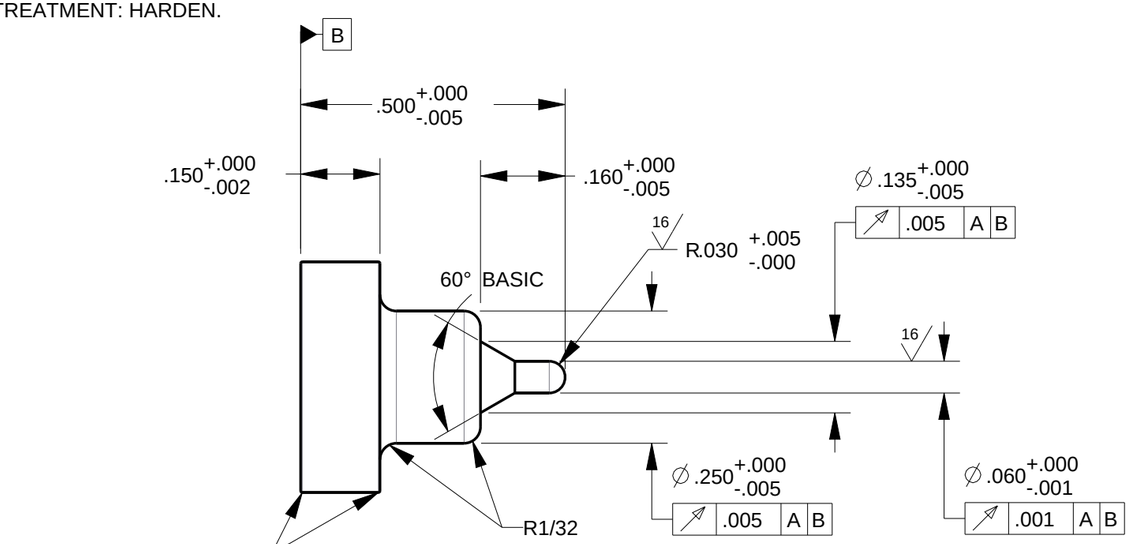
DRAWING SIZE B

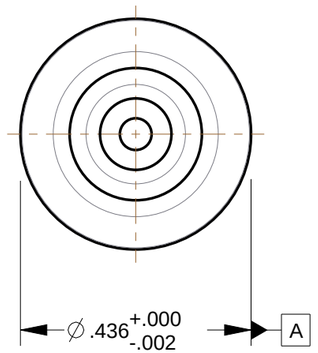
NOTE:

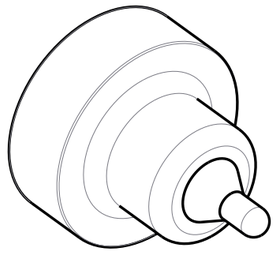
1. FINISH $\sqrt{63}$ EXCEPT AS NOTED.

2. MATERIAL: STEEL ANSI 4140 ASTM A304 ASTM A322 ASTM A331.

3. HEAT TREATMENT: HARDEN.







PART NO. 12-(MC)-2

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± °
DECIMALS ±
FRACTIONS ± 1/54

DRAWN BY	DATE (YEAR-MO-DA)
J. DUEHRING	2012-04-05

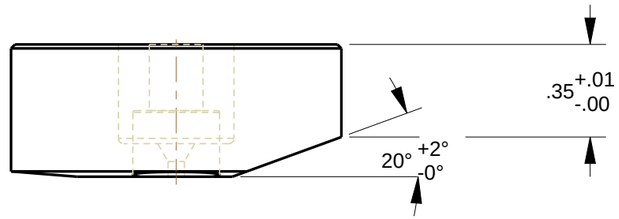
Firing Pin,
Universal Receiver,
4.6mm, 5.56mm and 5.7mm

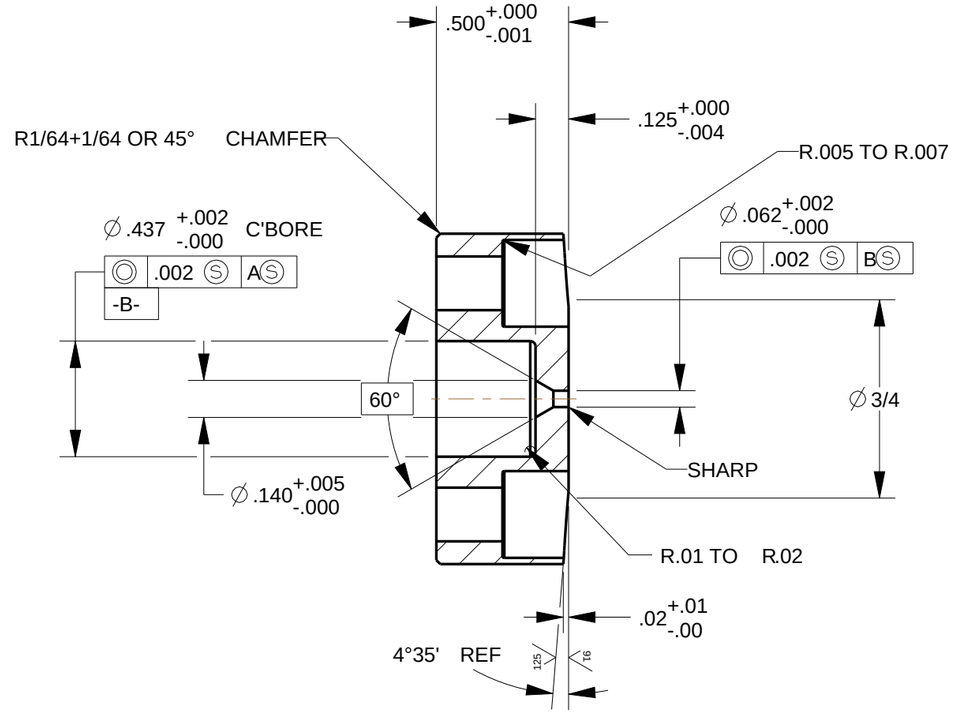
SIZE	DWG NO.		
B	12-(MC)-2		
SCALE 4/1	UNIT WT 0.000	SHEET 1 OF 1	

FORMAT: B_NATO_TESTEQUIP

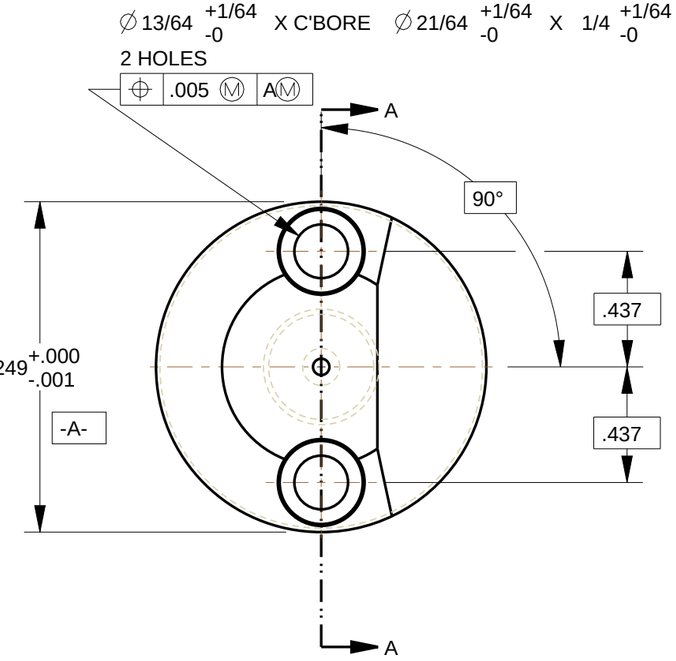
DRAWING SIZE B

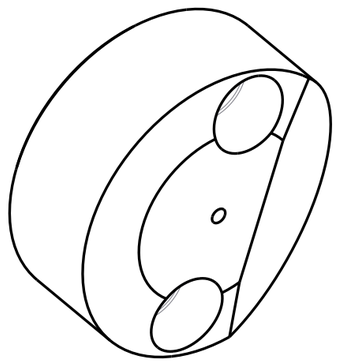
NOTES:
1- SPECIFICATIONS: MIL-STD-8 AND MIL-STD-10 APPLY.
2- MATERIAL:-STEEL C02 SPEC. QQ-T-570.
3- COATING BLACK OXIDE, SPEC MIL-C-13924.
4- FINISH 63 EXCEPT AS NOTED.





SECTION A-A





PART NO. 12-(MC)-3

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± 1°
DECIMALS ± .005
FRACTIONS ± 1/64

DRAWN BY	DATE (YEAR-MO-DA)
J DUEHRING	2012-05-04

Plate, Firing Pin,
Universal Receiver,
4.6mm, 5.56mm and 5.7mm

SIZE	DWG NO.	
B	12-(MC)-3	
SCALE 2/1	UNIT WT	SHEET 1 OF 1

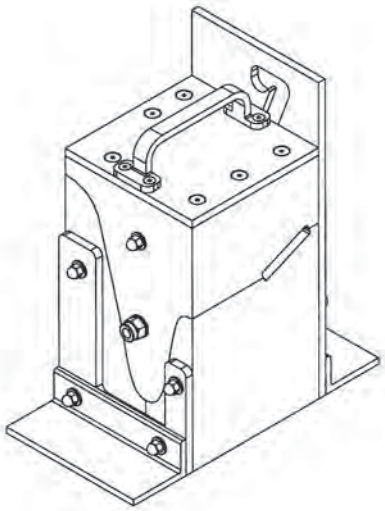
FORMAT: B_NATO_TESTEQUIP

6.A.2 AEP-97, VOLUME 14 – FUNCTION AND CASUALTY TEST PROCEDURE

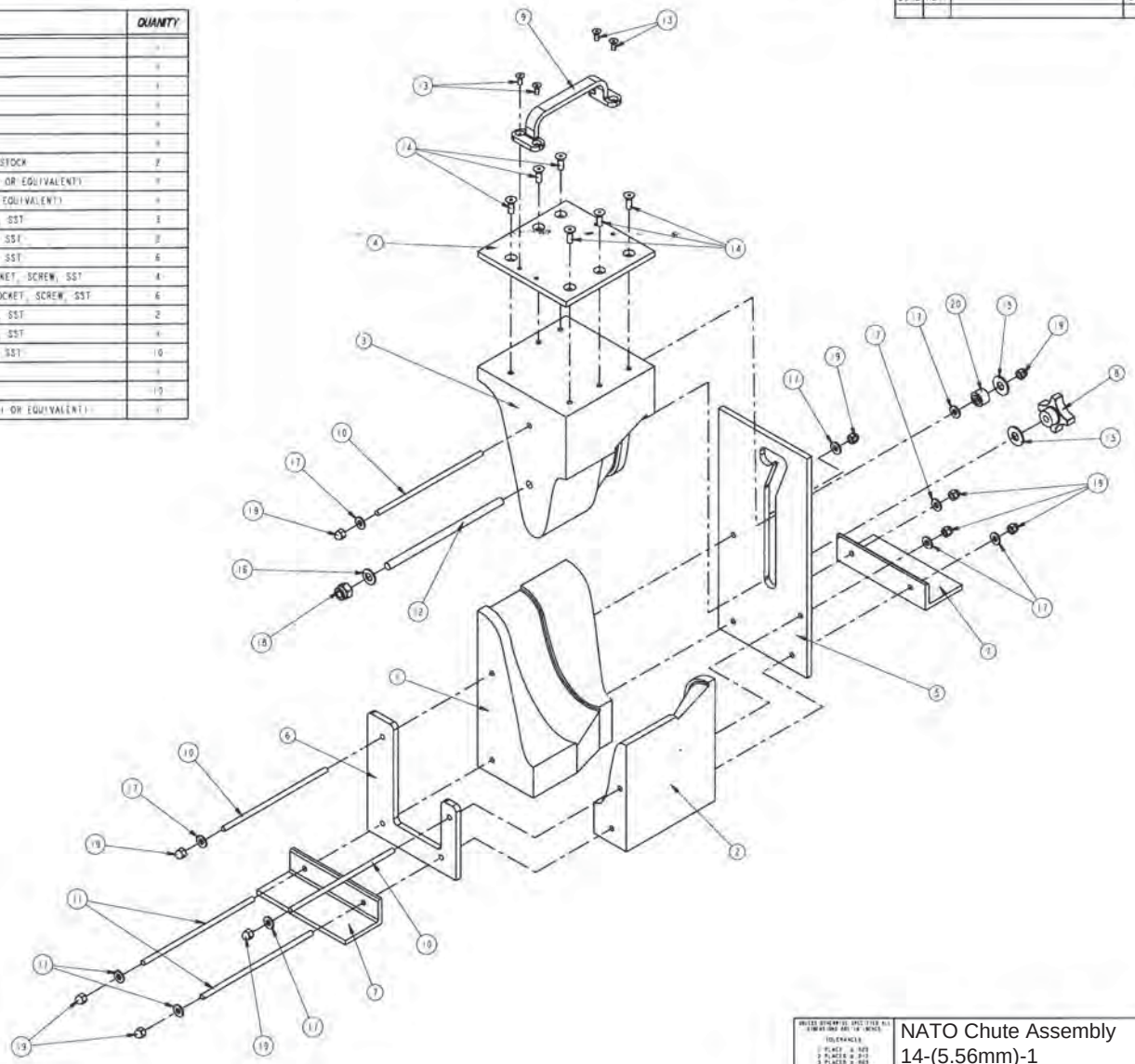
DRAWING NUMBER	DRAWING TITLE
14-(5.56mm)-1	NATO Chute Assembly
14-(5.56mm)-1-1A	NATO Block A1 (Detail)
14-(5.56mm)-1-1B	NATO Block A1 (Sections)
14-(5.56mm)-1-2A	NATO Block A2 (Detail)
14-(5.56mm)-1-2B	NATO Block A2 (Sections)
14-(5.56mm)-1-3A	NATO Block B (Detail)
14-(5.56mm)-1-3B	NATO Block B (Sections)
14-(5.56mm)-1-4	Plate, Top
14-(5.56mm)-1-5	Side Plate, Guide
14-(5.56mm)-1-6	Side Plate, U
14-(5.56mm)-1-7	Bracket, Angle
14-(MC)-1	NATO 1980 Mark 2 Weapon Mount (Sketch)
14-(MC)-2	Apparatus, Mounting, Pistol (Sketch)

***Note: Unless annotated otherwise (METRIC) presume all drawings are in English units.**

ITEM	PART NAME	DESCRIPTION	QUANTY
1	NATO BLOCK A1	TOP CHUTE	1
2	NATO BLOCK A2	BOTTOM LEFT CHUTE	1
3	NATO BLOCK B	BOTTOM RIGHT CHUTE	1
4	PLATE, TOP	5/16 ALUMINUM PLATE	1
5	SIDE PLATE, GUIDE	5/16 ALUMINUM PLATE	1
6	SIDE PLATE, U	5/16 ALUMINUM PLATE	1
7	BRACKET ANGLE	2 1/2 X 1 1/2 X 1/4 ALUMINUM ANGLE STOCK	2
8	KNOB, ADJUSTMENT	3/8-16 4-PRONG ADJUSTMENT KNOB, (MSC48613S3K13 OR EQUIVALENT)	1
9	HANDLE, RECTANGULAR	CAST TYPE 304 SST HANDLE (MSC48122S5A15 OR EQUIVALENT)	1
10	THREADED ROD, 1/4 X 7 1/8" LONG	1/4/-20 X 7 1/8" LONG THREADED ROD, SST	3
11	THREADED ROD, 1/4 X 7 1/2" LONG	1/4-20 X 7 1/2" LONG THREADED ROD, SST	2
12	THREADED ROD, 3/8 X 7 3/4" LONG	3/8-16 X 7 3/4" LONG THREADED ROD, SST	6
13	SCREW, CAPTIVE NO.10 X .50 LONG	NO.10-32 X .50 LONG FLAT HEAD CAPTIVE, HEX SOCKET, SCREW, SST	4
14	SCREW, CAPTIVE 1/4 X .75 LONG	1/4-20 X .75 LONG FLAT HEAD CAPTIVE, HEX SOCKET, SCREW, SST	6
15	WASHER, 7/16	TYPE A PLAIN 7/16" SERIES N WASHER, SST	2
16	WASHER, 3/8	TYPE A PLAIN 3/8" SERIES N WEASHER, SST	4
17	WASHER, 1/4	TYPE A PLAIN 1/4" SERIES N WASHER, SST	10
18	NUT, LOCK	3/8-16 NYLON LOCK NUT, SST	4
19	NUT, 1/4 ACORN	1/4-20 ACORN NUT, SST	10
20	TRACK ROLLER	1/4ID X 3/4OD X 9/16W TRACK ROLLER (MSC48831K11 OR EQUIVALENT)	6



ASSEMBLED ISO VIEW

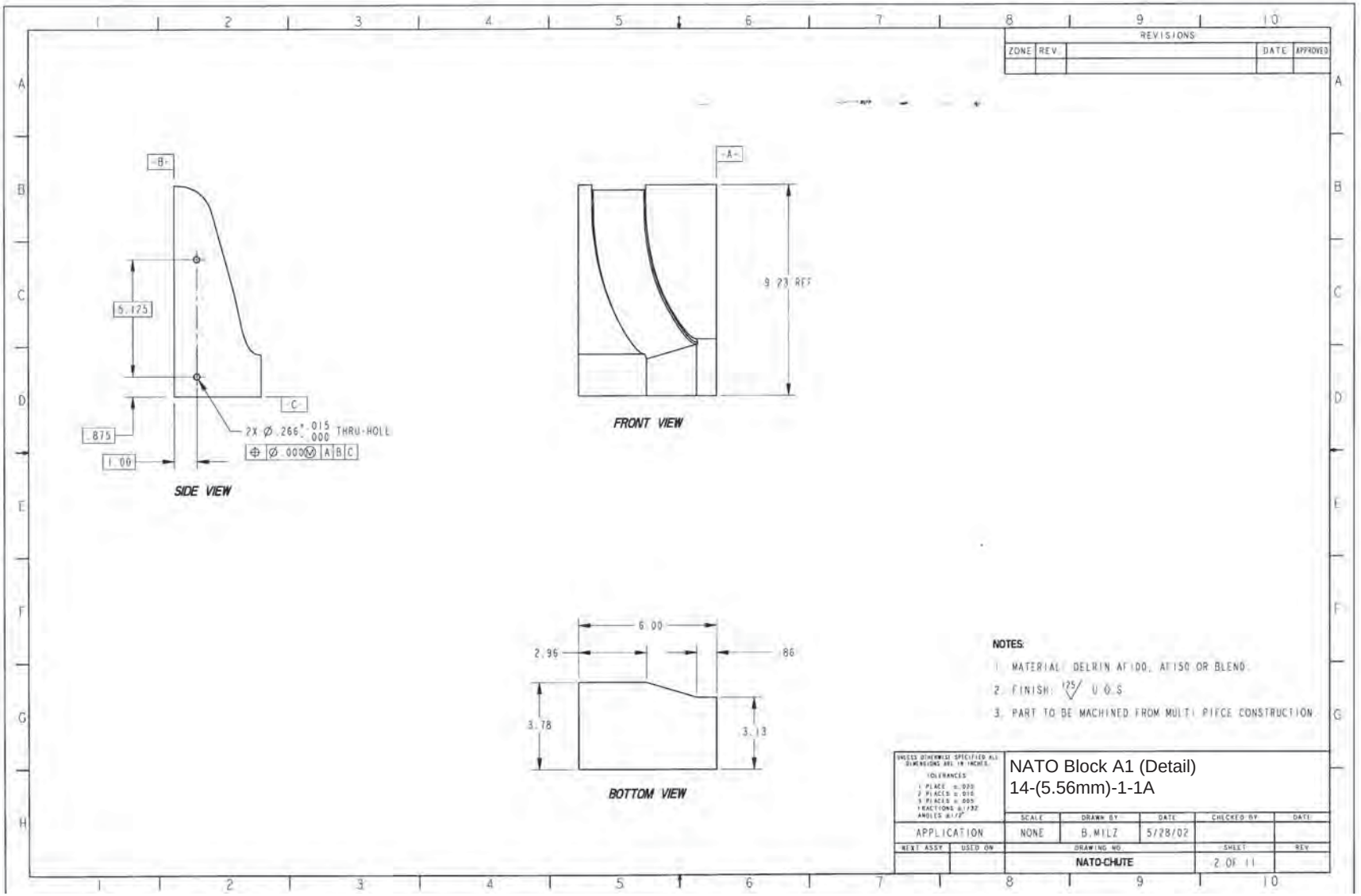


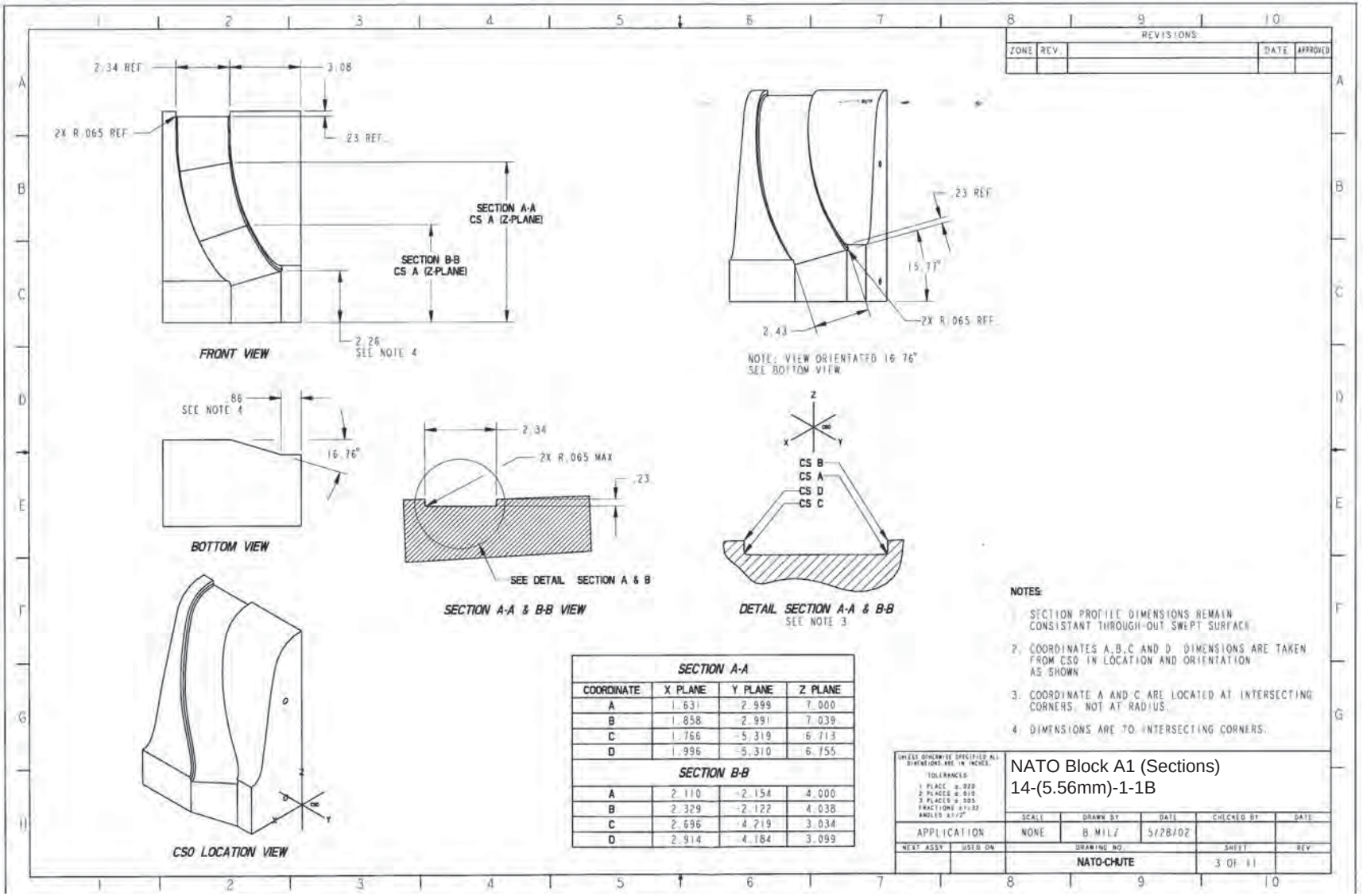
REVISIONS

ZONE	REV.		DATE	APPROVED

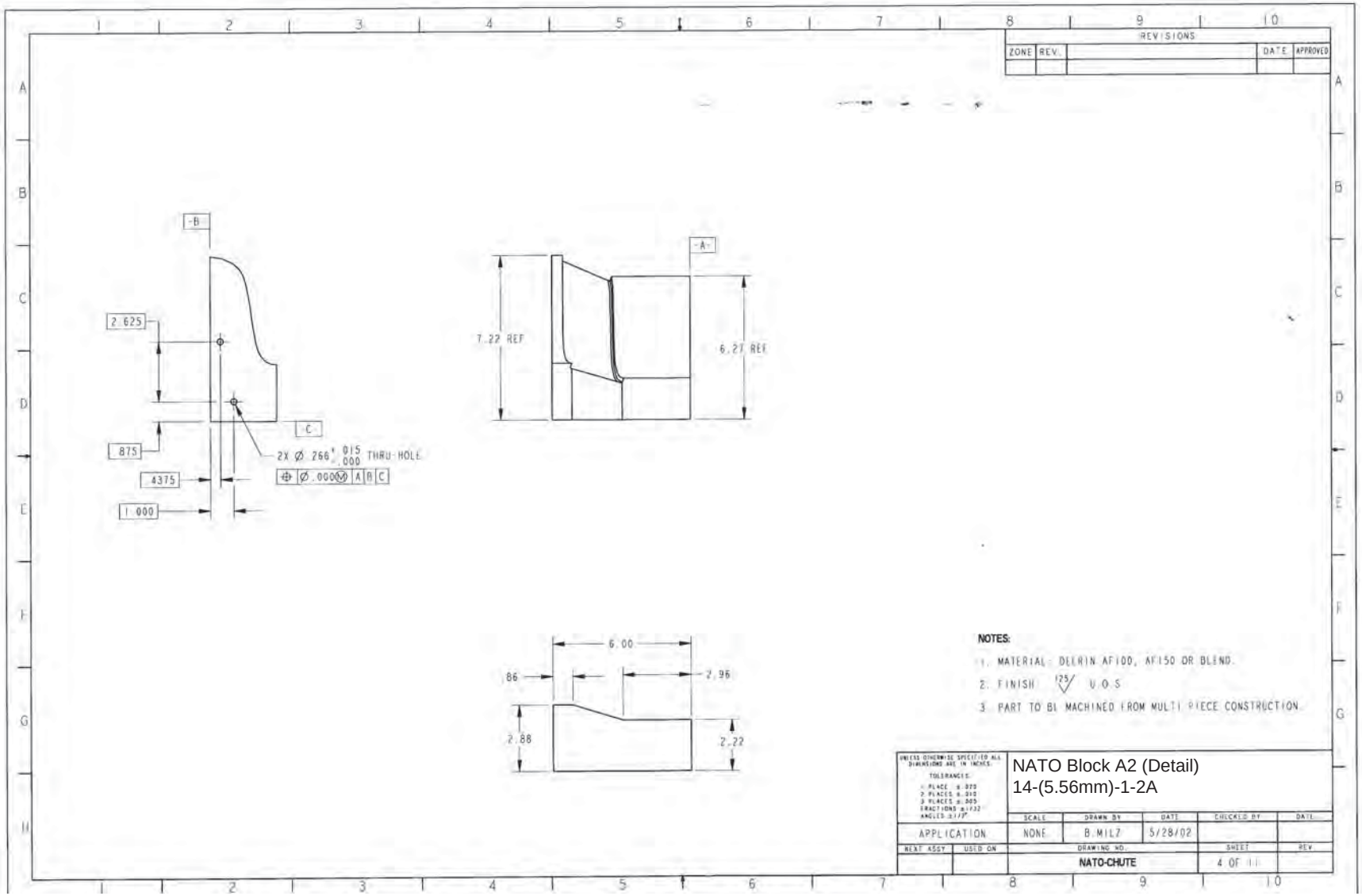
NATO Chute Assembly
14-(5.56mm)-1

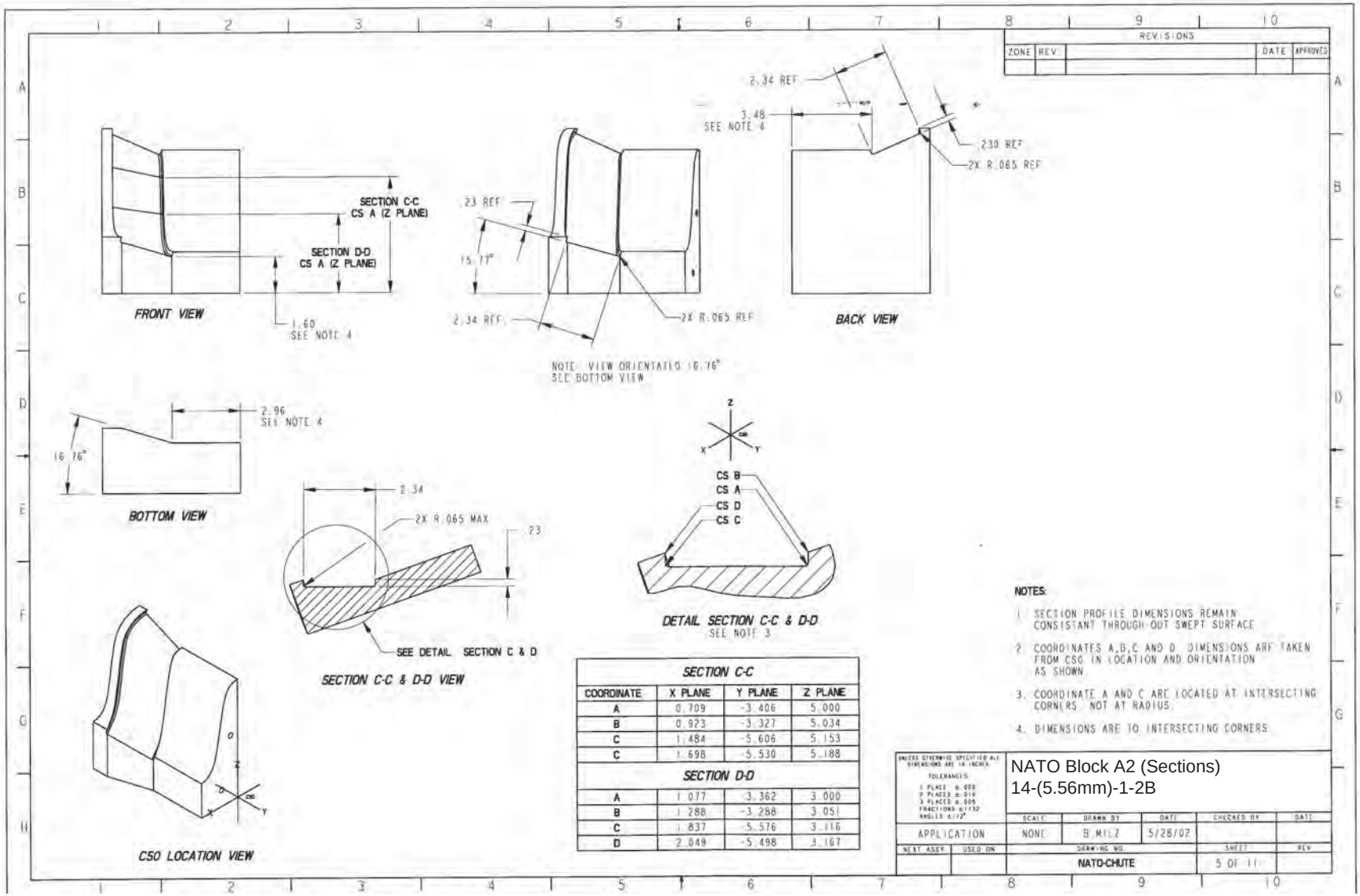
APPLICATION	SCALE: NONE	DRAWN BY: B.MILE	DATE: 5/29/02	CHECKED BY:	DATE:
NEXT ASSY	USED ON	DRAWING NO.: NATO-CHUTE	SHEET: 1 OF 11	REV:	


REVISIONS
ZONE
REV.
DATE
APPROVED
-B-
5.175
.875
1.00
-C-
2X Ø.266 +.015 -.000 THRU HOLL
Ø.000 M A B C
SIDE VIEW
-A-
9.23 REF
FRONT VIEW
6.00
2.96
.86
3.78
3.13
BOTTOM VIEW
NOTES:
1. MATERIAL: DELRIN AF100, AF150 OR BLEND.
2. FINISH: 125 U.O.S.
3. PART TO BE MACHINED FROM MULTI PIECE CONSTRUCTION.
NATO Block A1 (Detail)
14-(5.56mm)-1-1A
SCALE
DRAWN BY
DATE
CHECKED BY
DATE
APPLICATION
NONE
B.MILZ
5/28/02
NEXT ASSY
USED ON
DRAWING NO.
NATO-CHUTE
SHEET
2 OF 11
REV

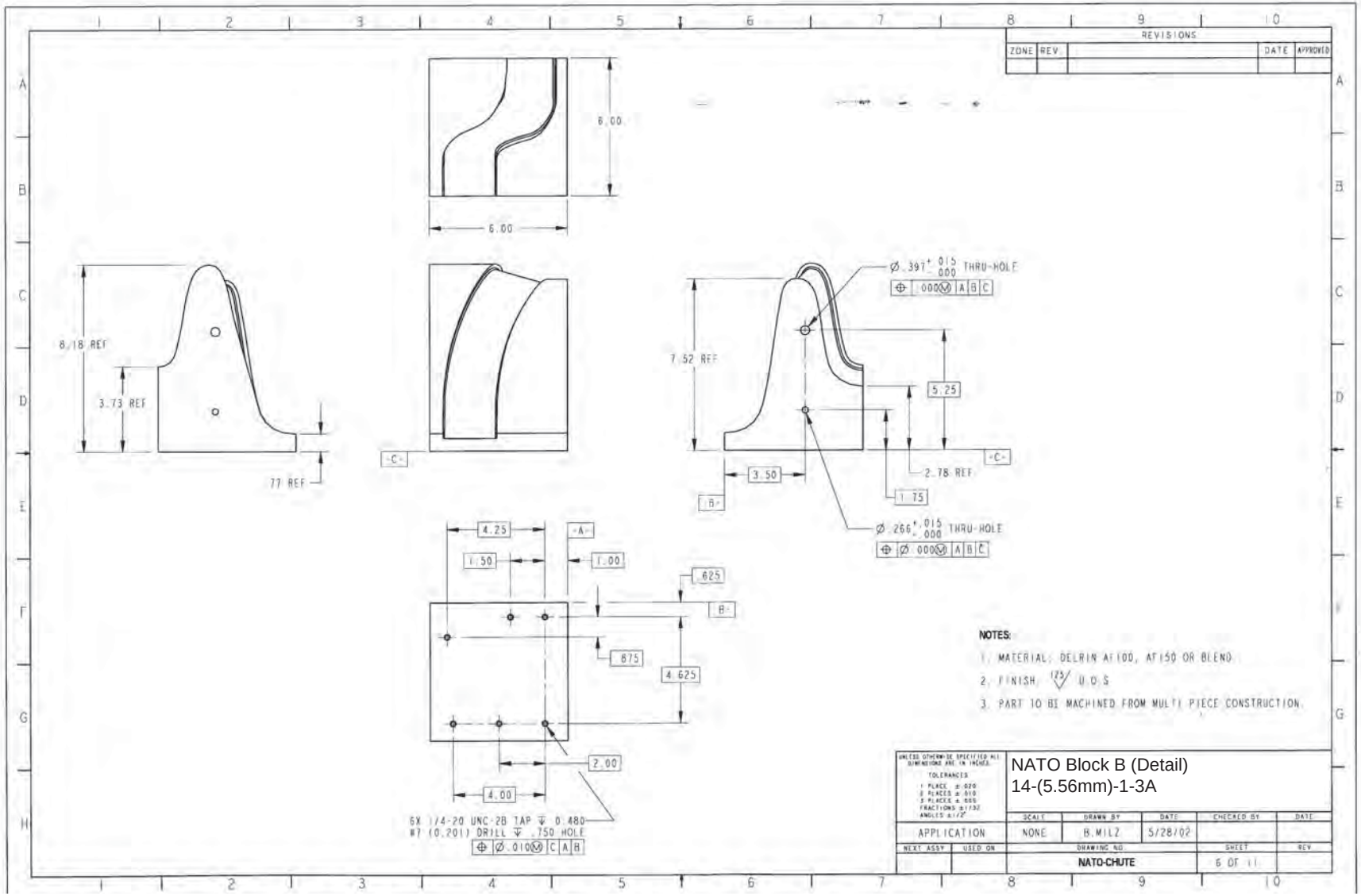


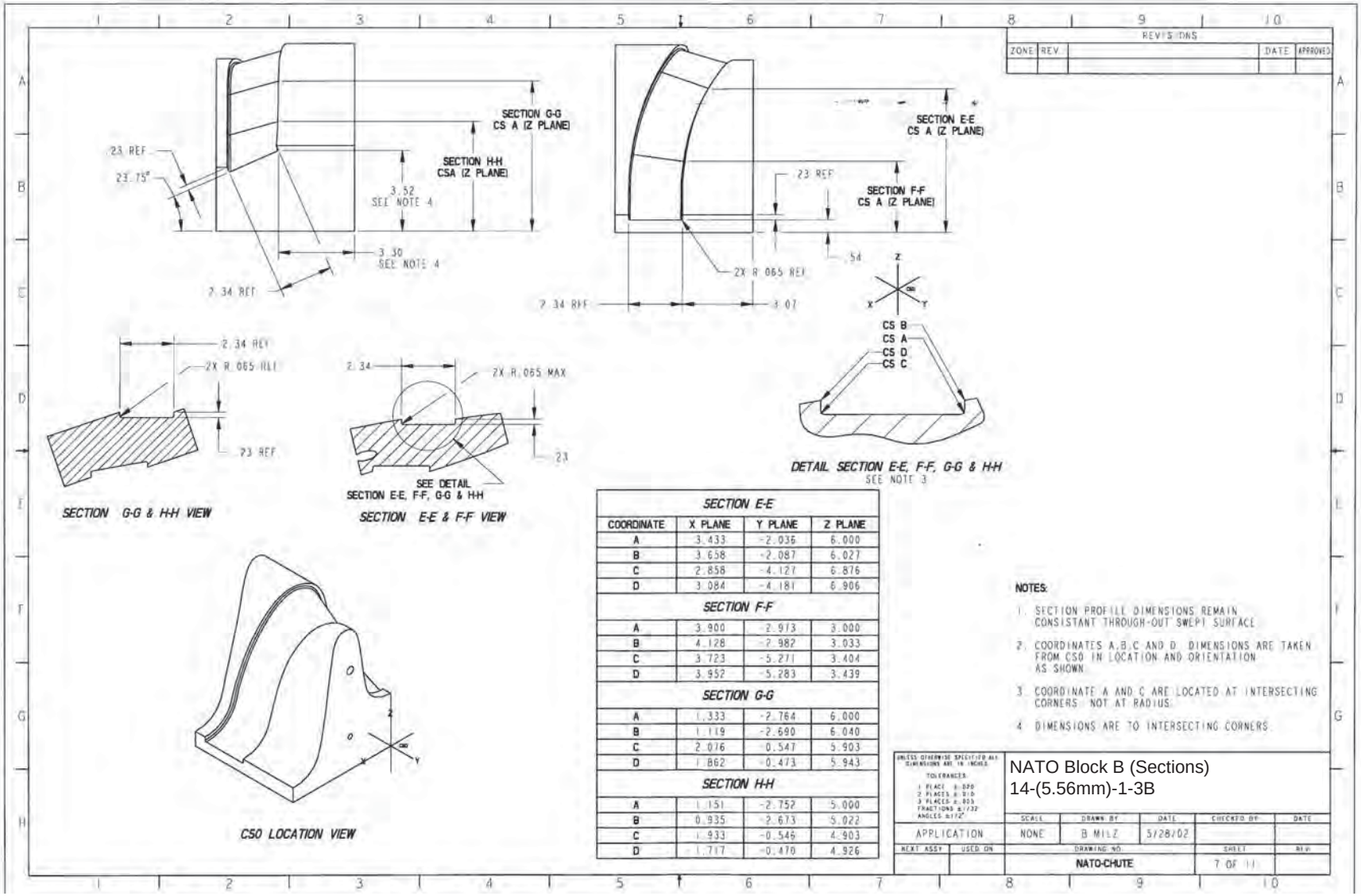
SECTION A-A			
COORDINATE	X PLANE	Y PLANE	Z PLANE
A	1.631	-2.999	7.000
B	1.858	-2.991	7.039
C	1.766	-5.319	6.713
D	1.996	-5.310	6.755
SECTION B-B			
A	2.110	-2.154	4.000
B	2.329	-2.122	4.038
C	2.696	-4.219	3.034
D	2.914	-4.184	3.099


REVISIONS
ZONE REV. DATE APPROVED
-B
2.625
.875
.4375
1.000
-C
2X Ø .266 +.015 -.000 THRU HOLE
Ø.000 M A B C
-A-
7.22 REF
6.27 REF
6.00
.86
2.96
2.88
2.22
NOTES:
1. MATERIAL: DELRIN AF100, AF150 OR BLEND.
2. FINISH: 125 U.O.S.
3. PART TO BE MACHINED FROM MULTI PIECE CONSTRUCTION.
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
TOLERANCES:
NATO Block A2 (Detail)
14-(5.56mm)-1-2A
SCALE DRAWN BY DATE CHECKED BY DATE
APPLICATION NONE B.MILZ 5/28/02
NEXT ASSY USED ON
DRAWING NO.
NATO-CHUTE
SHEET 4 OF 11
REV.

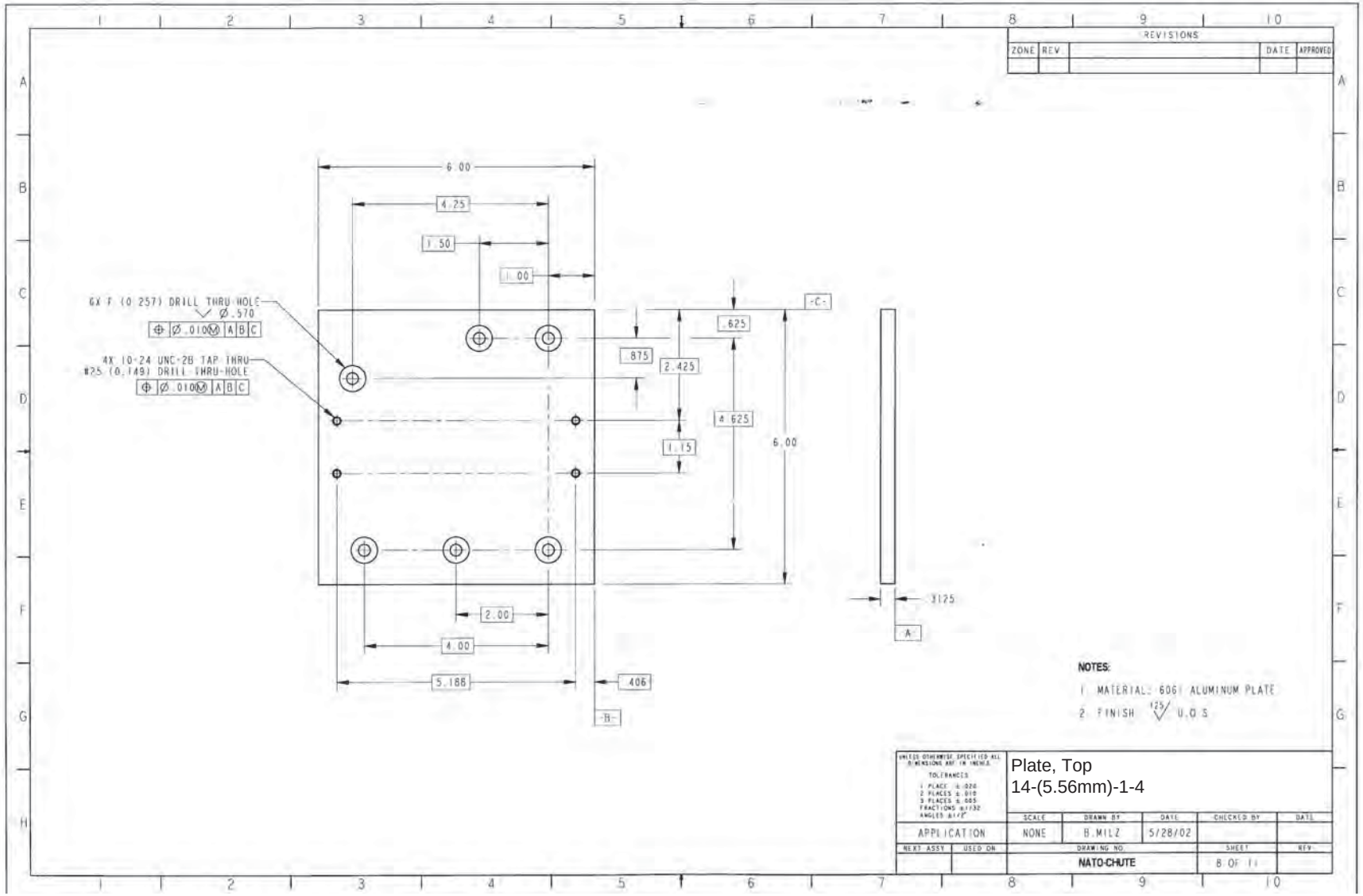


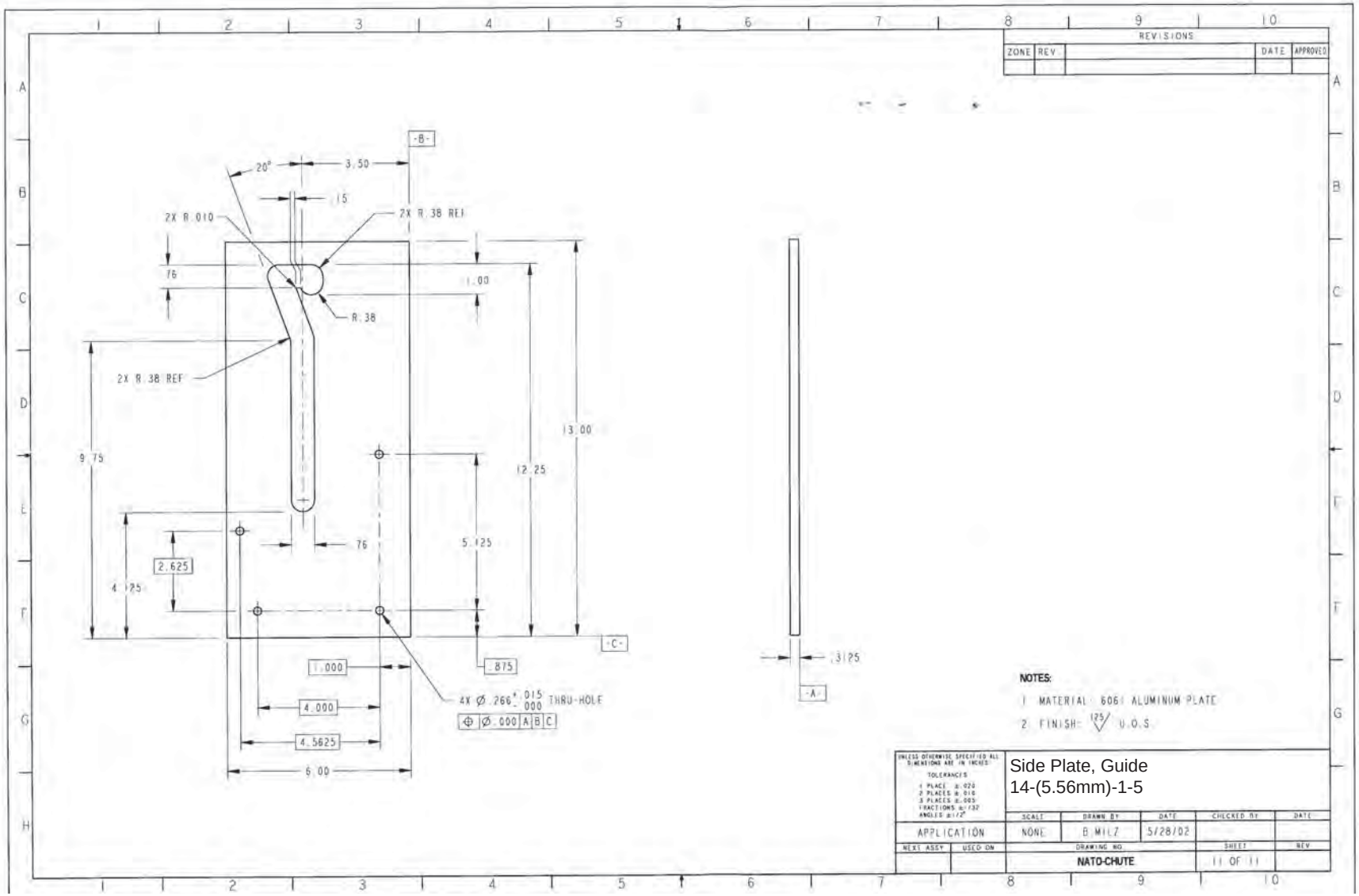
SECTION C-C			
COORDINATE	X PLANE	Y PLANE	Z PLANE
A	0.709	-3.406	5.000
B	0.923	-3.327	5.034
C	1.484	-5.606	5.153
C	1.698	-5.530	5.188
SECTION D-D			
A	1.077	-3.362	3.000
B	1.288	-3.288	3.051
C	1.837	-5.576	3.116
D	2.049	-5.498	3.167

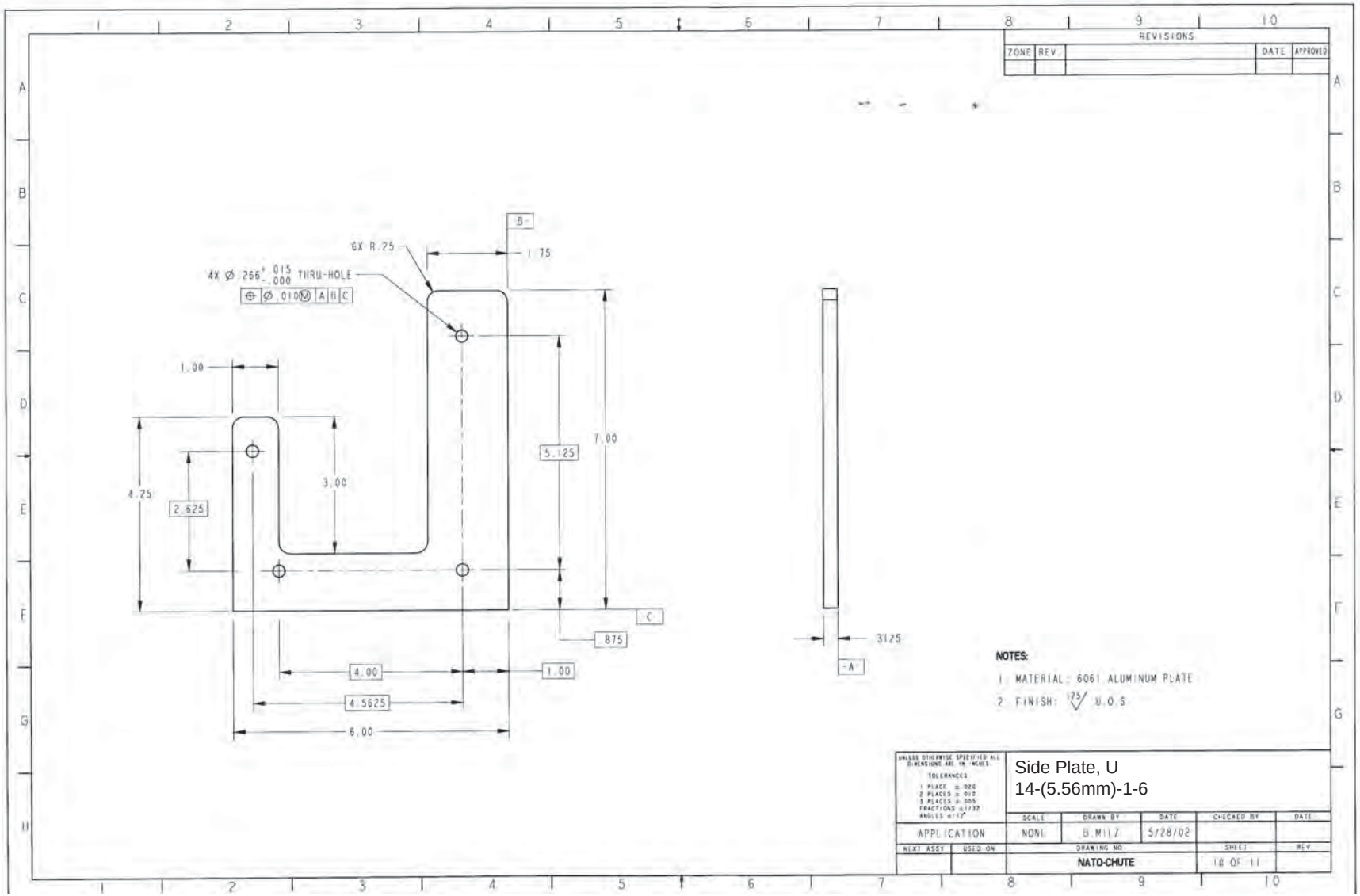

REVISIONS
ZONE REV. DATE APPROVED
6.00
6.00
8.18 REF
3.73 REF
.77 REF
-C-
Ø.397 +.015 -.000 THRU-HOLE
.000 M A B C
7.52 REF
5.25
3.50
2.78 REF
1.75
-B-
-C-
Ø.266 +.015 -.000 THRU-HOLE
Ø .000 M A B C
4.25
1.50
-A-
1.00
.625
-B-
.875
4.625
2.00
4.00
6X 1/4-20 UNC-2B TAP ↧ 0.480
#7 (0.201) DRILL ↧ .750 HOLE
Ø.010 M C A B
NOTES:
1. MATERIAL: DELRIN AF100, AF150 OR BLEND
2. FINISH: 125 U.O.S
3. PART TO BE MACHINED FROM MULTI PIECE CONSTRUCTION.
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
TOLERANCES
1 PLACE ± .020
2 PLACES ± .010
3 PLACES ± .005
FRACTIONS ± 1/32
ANGLES ± 1/2°
NATO Block B (Detail)
14-(5.56mm)-1-3A
APPLICATION
SCALE NONE
DRAWN BY B.MILZ
DATE 5/28/02
CHECKED BY
DATE
NEXT ASSY
USED ON
DRAWING NO. NATO-CHUTE
SHEET 6 OF 11
REV.

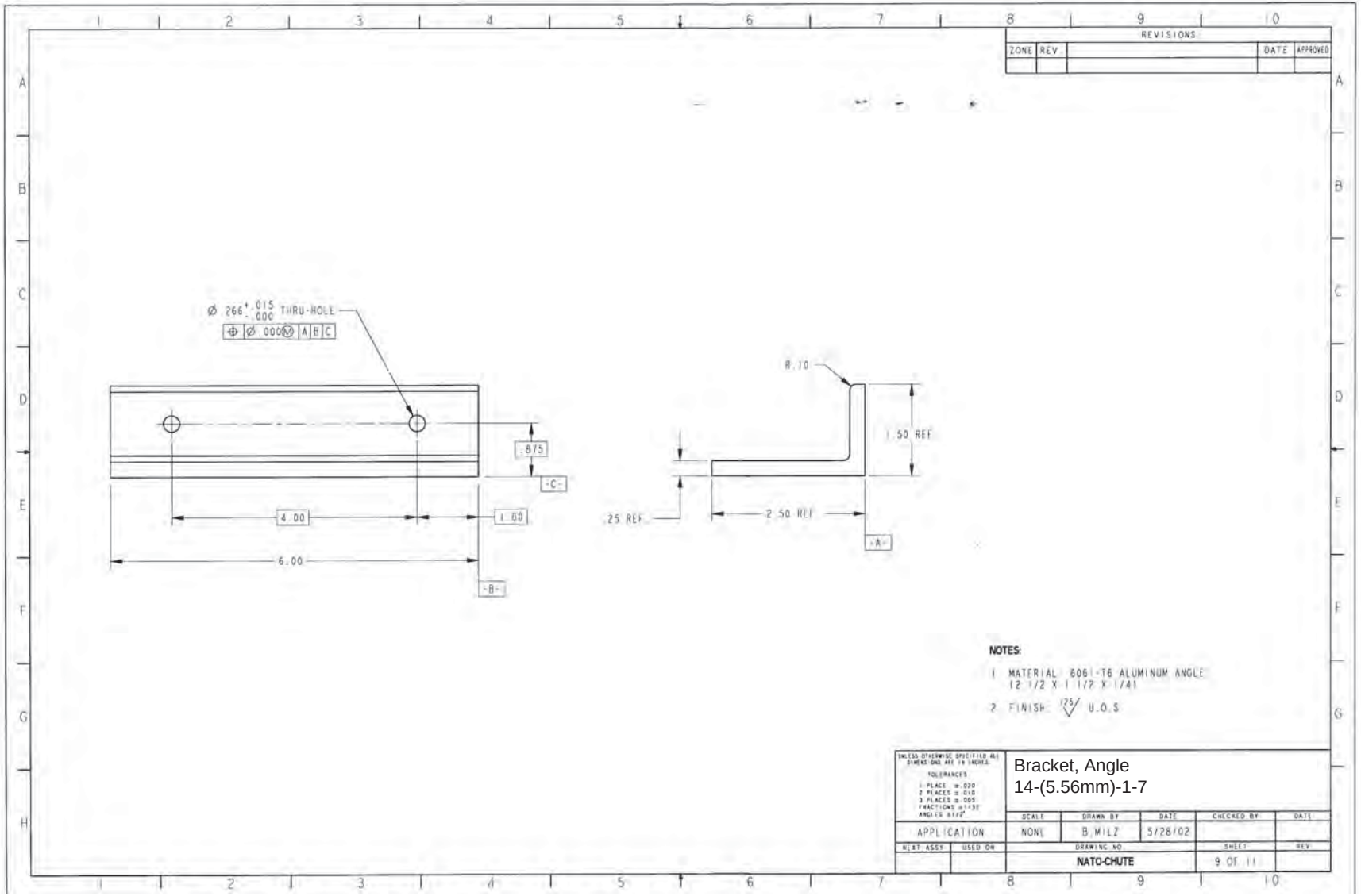


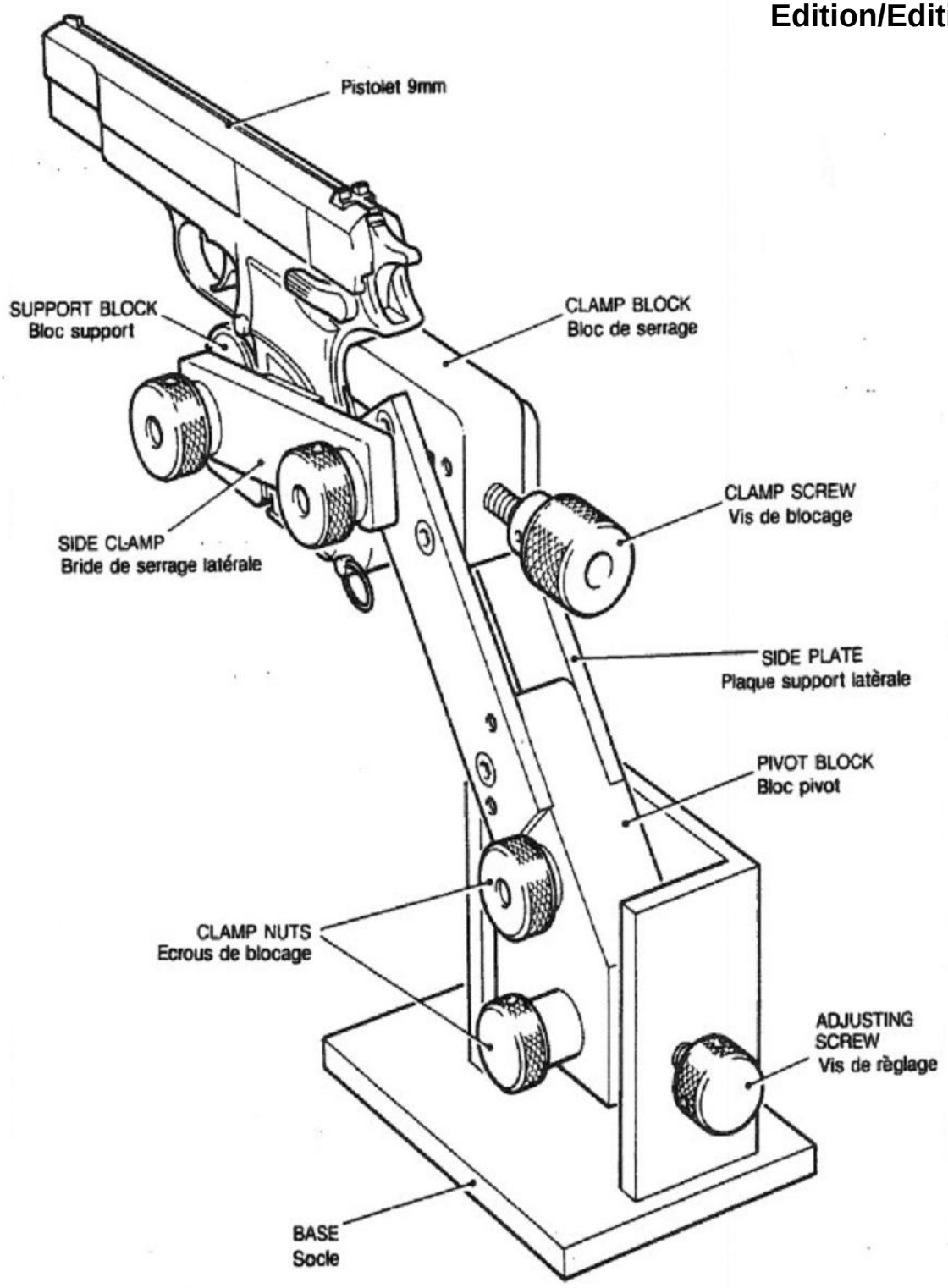
SECTION E-E			
COORDINATE	X PLANE	Y PLANE	Z PLANE
A	3.433	-2.036	6.000
B	3.658	-2.087	6.027
C	2.858	-4.127	6.876
D	3.084	-4.181	6.906
SECTION F-F			
A	3.900	-2.973	3.000
B	4.128	-2.982	3.033
C	3.723	-5.271	3.404
D	3.952	-5.283	3.439
SECTION G-G			
A	1.333	-2.764	6.000
B	1.119	-2.690	6.040
C	2.076	-0.547	5.903
D	1.862	-0.473	5.943
SECTION H-H			
A	1.151	-2.752	5.000
B	0.935	-2.673	5.022
C	1.933	-0.546	4.903
D	1.717	-0.470	4.926


REVISIONS
ZONE
REV
DATE
APPROVED
6.00
4.25
1.50
1.00
6X F (0.257) DRILL THRU HOLE
Ø.570
Ø.010 M A B C
4X 10-24 UNC-2B TAP THRU
#25 (0.149) DRILL THRU-HOLE
Ø.010 M A B C
.625
.875
2.425
4.625
1.15
6.00
-C-
.3125
-A-
2.00
4.00
5.188
.406
-B-
NOTES:
1. MATERIAL: 6061 ALUMINUM PLATE
2. FINISH 125 U.O.S.
Plate, Top
14-(5.56mm)-1-4
SCALE
DRAWN BY
DATE
CHECKED BY
APPLICATION
NONE
B.MILZ
5/28/02
NEXT ASSY
USED ON
DRAWING NO.
NATO-CHUTE
SHEET
8 OF 11
REV

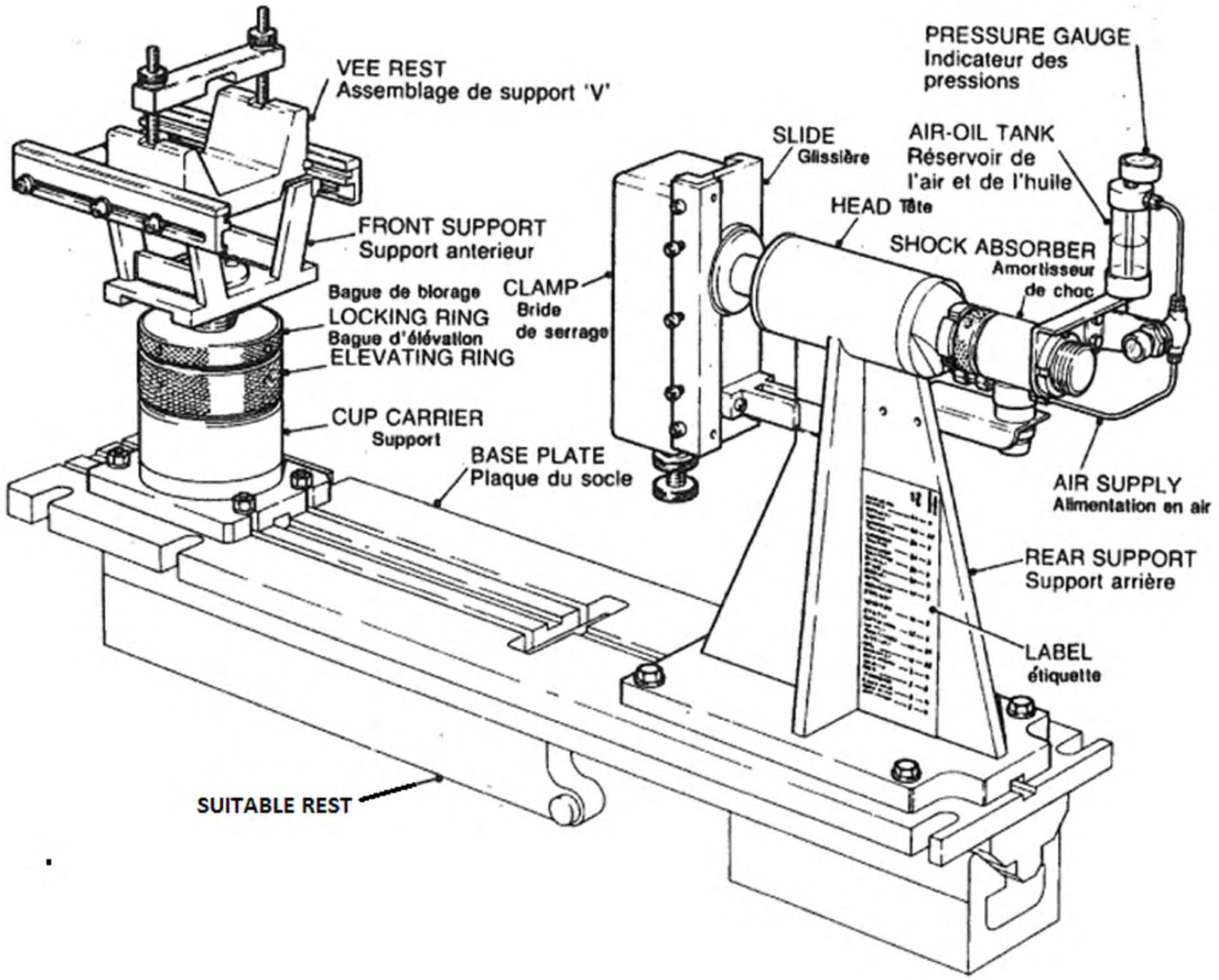

REVISIONS
ZONE REV DATE APPROVED
-B-
20°
3.50
.15
2X R.010
2X R.38 REF
.76
1.00
R.38
2X R.38 REF
13.00
9.75
12.25
.76
5.125
2.625
4.125
-C-
1.000
.875
4.000
4.5625
6.00
4X Ø.266 +.015 -.000 THRU-HOLE
Ø.000 A B C
.3125
-A-
NOTES:
1. MATERIAL: 6061 ALUMINUM PLATE
2. FINISH: 125 U.O.S.
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
TOLERANCES
1 PLACE ±.020
2 PLACES ±.010
3 PLACES ±.005
FRACTIONS ±1/32
ANGLES ±1/2°
Side Plate, Guide
14-(5.56mm)-1-5
SCALE DRAWN BY DATE CHECKED BY DATE
APPLICATION NONE B.MILZ 5/28/02
NEXT ASSY USED ON
DRAWING NO. NATO-CHUTE
SHEET 11 OF 11
REV


REVISIONS
ZONE
REV.
DATE
APPROVED
6X R.75
4X Ø.266 +.015 -.000 THRU-HOLE
Ø.010 M A B C
1.75
1.00
4.25
2.625
3.00
5.125
7.00
.875
4.00
1.00
4.5625
6.00
.3125
NOTES:
1. MATERIAL: 6061 ALUMINUM PLATE
2. FINISH: 125 U.O.S.
Side Plate, U
14-(5.56mm)-1-6
APPLICATION
NONE
B.MILZ
5/28/02
NATO-CHUTE
10 OF 11


REVISIONS
ZONE REV DATE APPROVED
Ø .266 +.015 -.000 THRU-HOLE
Ø .000 M A B C
.875
-C-
4.00
1.00
6.00
-B-
R.10
1.50 REF
.25 REF
2.50 REF
-A-
NOTES:
1 MATERIAL 6061-T6 ALUMINUM ANGLE (2 1/2 X 1 1/2 X 1/4)
2 FINISH 125 U.O.S
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
TOLERANCES
Bracket, Angle
14-(5.56mm)-1-7
SCALE DRAWN BY DATE CHECKED BY DATE
APPLICATION NONE B.MILZ 5/28/02
NEXT ASSY USED ON
DRAWING NO. NATO-CHUTE
SHEET 9 OF 11
REV



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° 2 PLACE DECIMALS ± 3 PLACE DECIMALS ±	Apparatus, Mounting, Pistol, 9mm (Sketch)
APPLICATION	
NEXT ASSY / USED ON	SIZE A / DWG NO. 14-(9mm)-1
DRAWN BY AMW / DATE (YEAR-MO-DA)	SCALE DRAWING SCALE / UNIT WT. / SHEET 1 OF 1



NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY	DATE (YEAR-MO-DA)

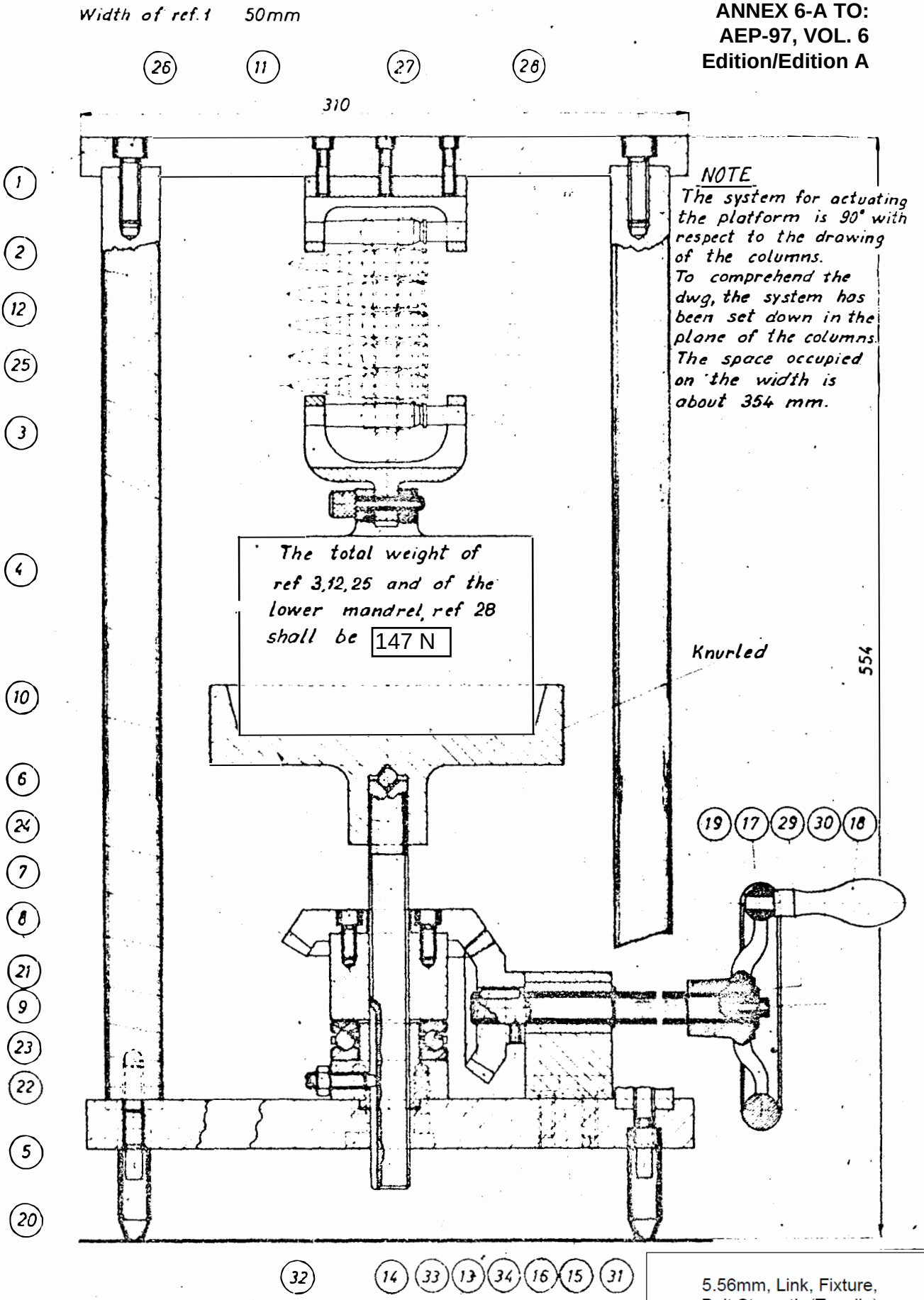
NATO 1980 Mark 2
Weapon Mount (Sketch)

SIZE	DWG NO.	
C	14-(MC)-1	
SCALE DRAWING SCALE	UNIT WT	SHEET 1 OF 1

6.A.3 AEP-97, VOLUME 15 – LINK TEST PROCEDURE

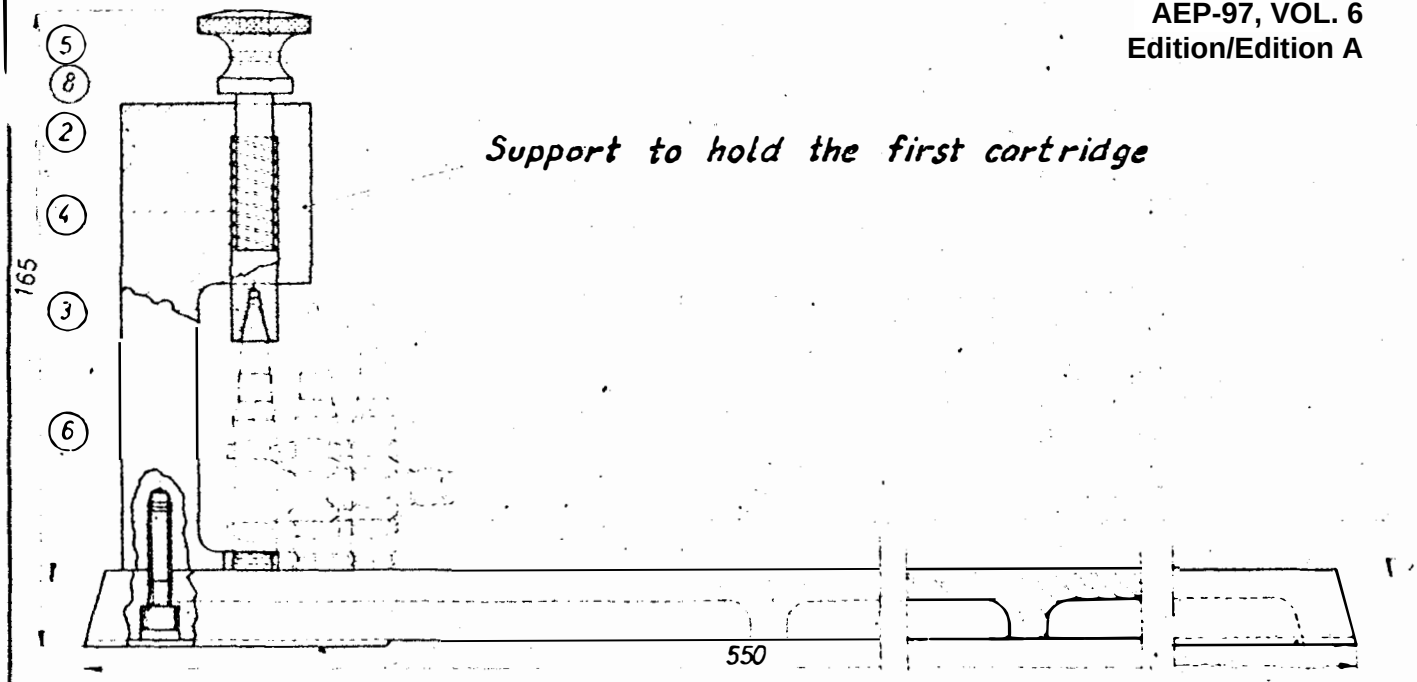
DRAWING NUMBER	DRAWING TITLE
15-(5.56 mm)-1	5.56mm, Link, Fixture, Belt Strength (Tensile)
15-(7.62 mm)-1	7.62mm, Link, Fixture, Free Helical Flexibility
15-(7.62 mm)-2	7.62mm, Link, Fixture, Belt Strength (Tensile)
15-(12.7 mm)-1	12.7mm, Link, Fixture, Belt Strength (Tensile)
15-(12.7 mm)-2	12.7mm, Fixture, Cartridge and Link Extraction Force
PEP134518	12.7mm, Link Pull Machine Assembly

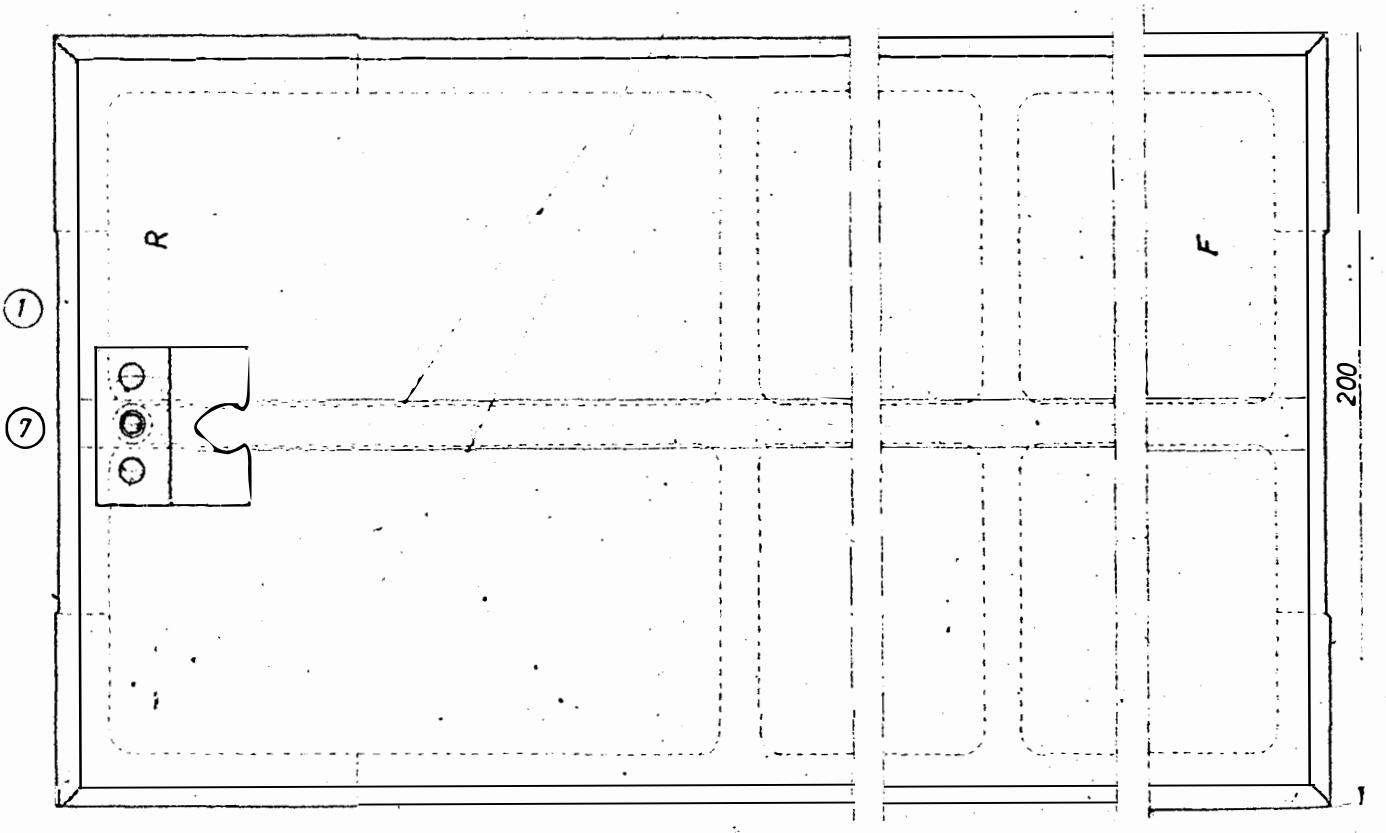
***Note: Unless annotated otherwise (METRIC) presume all drawings are in English units.**



5.56mm, Link, Fixture, Belt Strength (Tensile)

SIZE	DWG NO.	
	15-(5.56mm)-1	
SCALE	UNIT WT 0.000	SHEET 1 OF 1



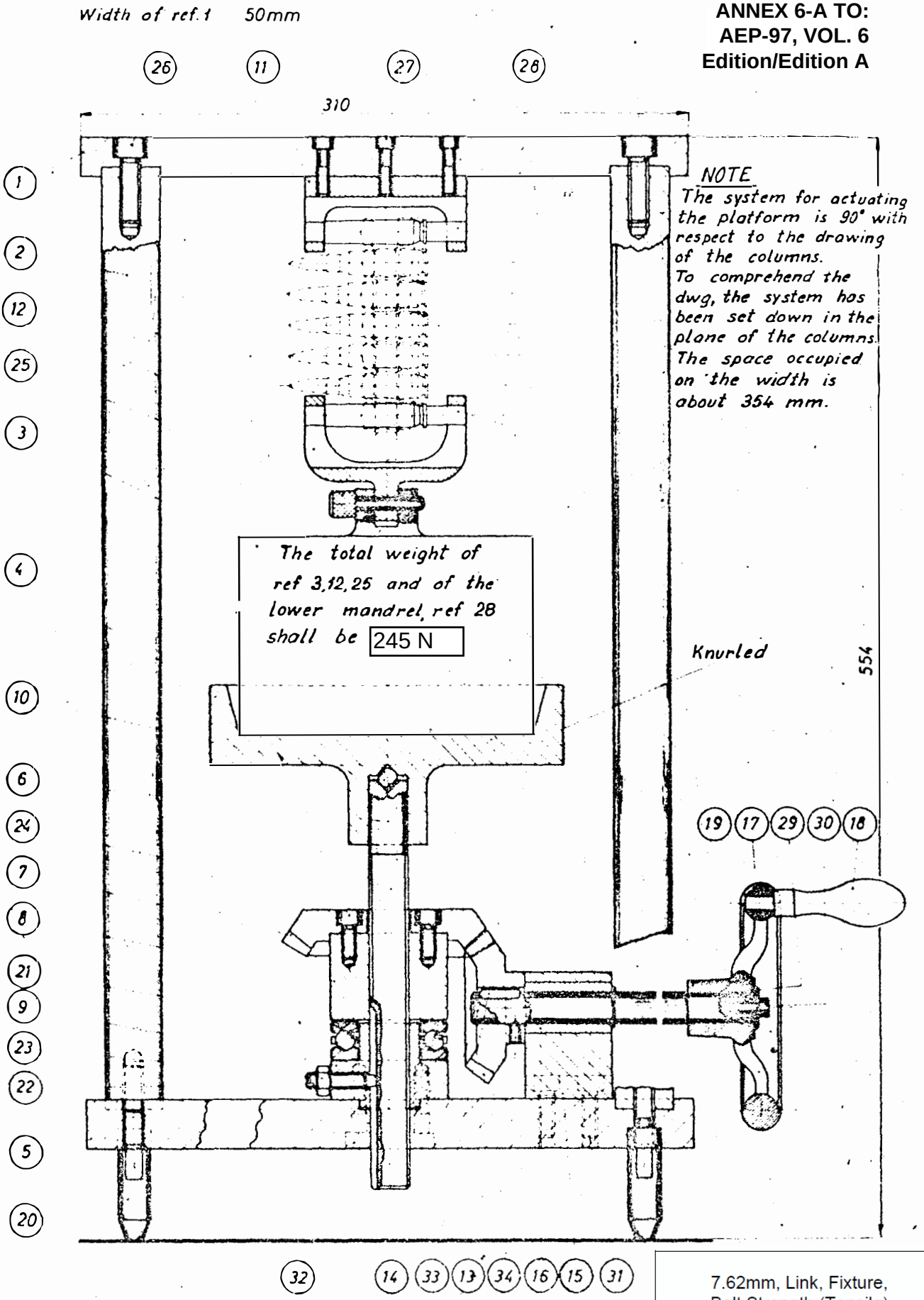


Ref	Q	Component
8	1	Pin ⌀ 3 long 13
7	2	Pin ⌀ 6 long 20
6	1	Screw with cylindrical head and internal hexagon
5	1	Knurled knob
4	1	Retainer spring
3	1	Plunger
2	1	Support
1	1	Base

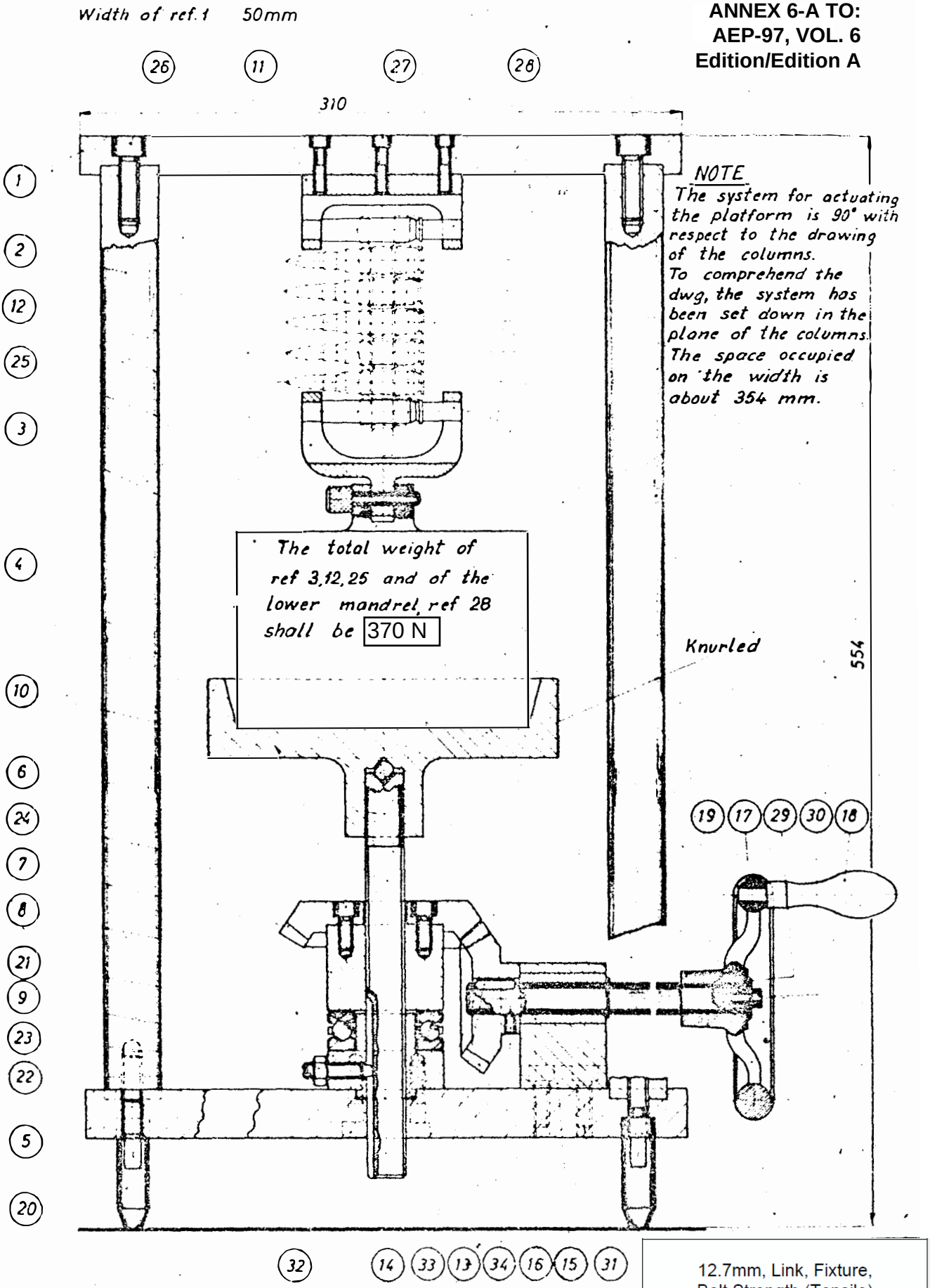
B 3.25.69 revised
A 1.7.65: revised

7.62mm, Link, Fixture,
Free Helical Flexibility

SIZE | DWG NO. 15-(7.62mm)-1
SCALE | UNIT WT 0.000 | SHEET 1 OF 1

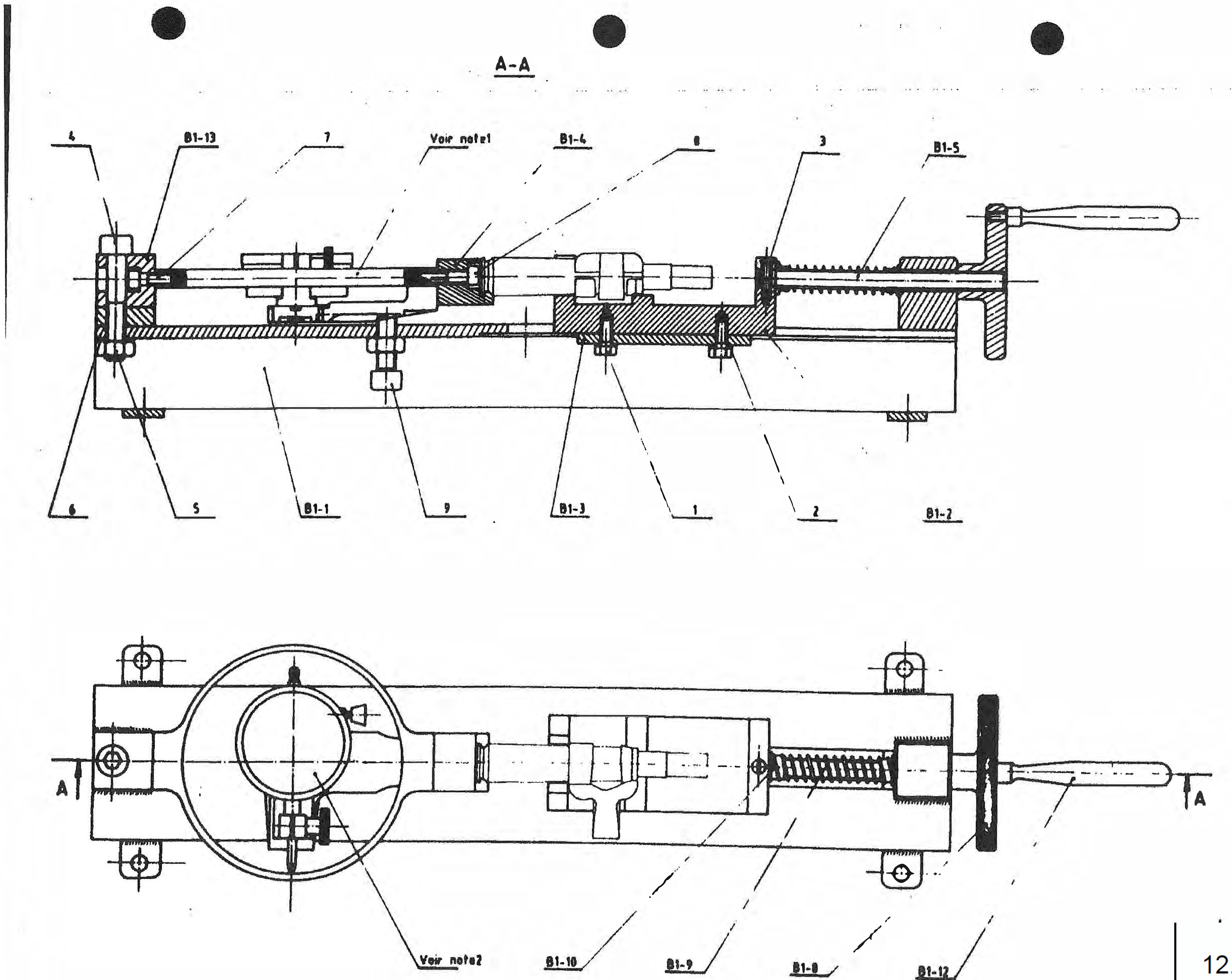


7.62mm, Link, Fixture, Belt Strength (Tensile)	
SIZE	DWG NO. 15-(7.62mm)-2
SCALE	UNIT WT 0.000 SHEET 1 OF 1



12.7mm, Link, Fixture, Belt Strength (Tensile)

SIZE	DWG NO.	
	15-(12.7mm)-1	
SCALE	UNIT WT 0.000	SHEET 1 OF 1



Note 1 [illegible]

Note 2 [illegible]

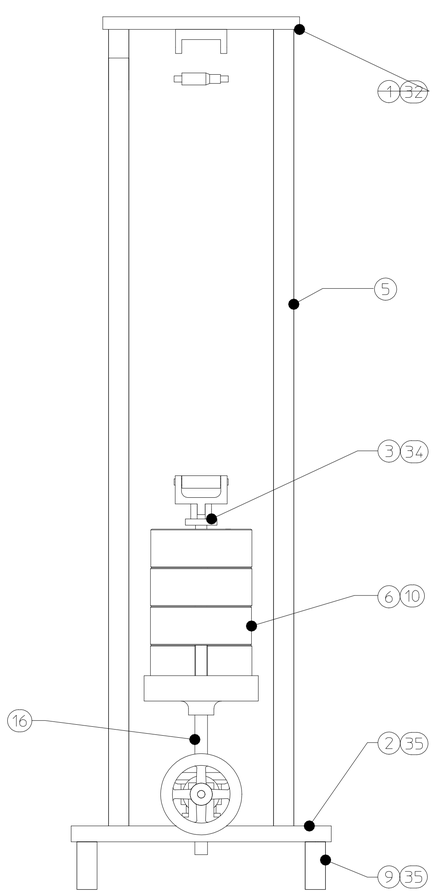
Note 3 [illegible]

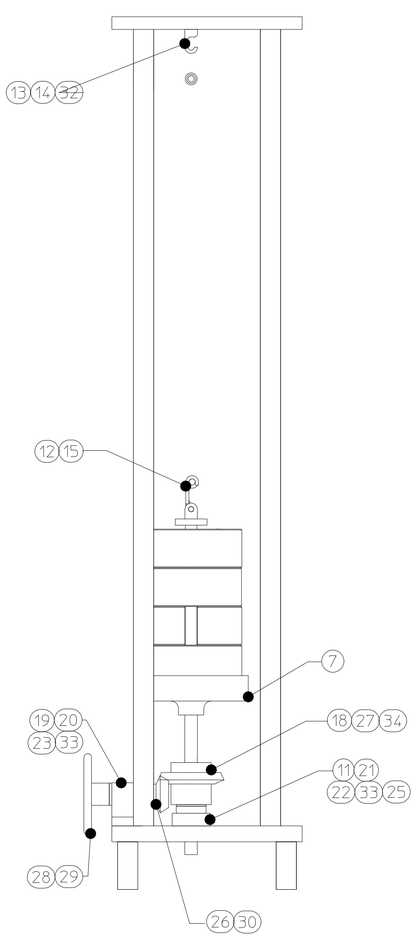
Repère	Désignation	[illegible]	Observations
9	[illegible]	1	[illegible]
8	[illegible]	1	[illegible]
7	[illegible]	1	[illegible]
6	[illegible]	1	[illegible]
5	[illegible]	2	[illegible]
4	[illegible]	1	[illegible]
3	[illegible]	1	[illegible]
2	[illegible]	1	[illegible]
1	[illegible]	2	[illegible]
B1-13	[illegible]	1	
B1-12	[illegible]	1	
B1-11	[illegible]	1	Voir note 3
B1-10	[illegible]	1	
B1-9	[illegible]	2	
B1-8	[illegible]	1	
B1-5	[illegible]	1	
B1-4	Extracteur de cartouche	1	
B1-3	[illegible]	1	
B1-2	Chariot	1	
B1-1	[illegible]	1	

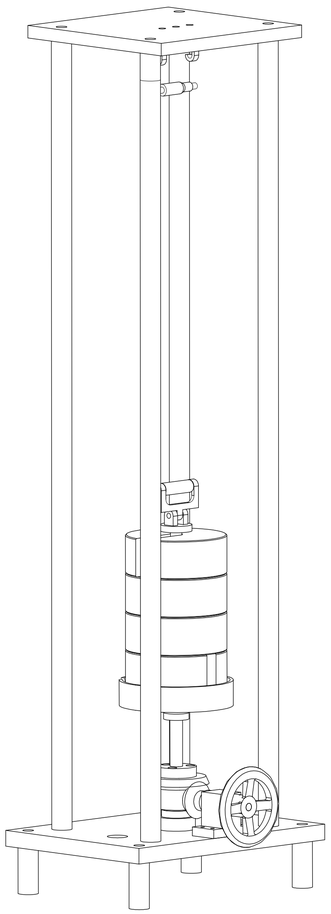
12.7mm, Fixture, Cartridge and Link Extraction Force

SIZE	DWG NO. 15-(12.7mm)-2		
SCALE	UNIT WT 0.000	SHEET 1 OF 1	

CLASSIFICATION	-------
3RD ANGLE PROJECTION	
IF IN DOUBT ASK	
DRAWING NUMBER	PEP 134518
USED ON	







NOTE:
WHEN POSITIONING FOR USE A CLEARENCE HOLE MUST BE MADE DIRECTLY BELOW POSITION OF THREADED BAR.

			3442	C	26/04/18
			1666	B	30/11/05
MOD No.	ISS.	DATE	MOD No.	ISS.	DATE
CERTIFIED				A	5/9/05

CHECKED	CLL
TRACED	-------
DRAWN	GD

Produced using SolidDesigner/ME10

MATERIAL	PROTECTIVE FINISH	TOLERANCES
EST. MASS		X ± 2 X,X ±0,5 X,XX ±0,10 ANGULAR ±0° 30' ALL DIMENSIONS IN mm UNLESS OTHERWISE STATED

SCALE	1 : 5
SURFACE ROUGHNESS	
CONTRACTOR	----------
	QinetiQ Pendine
TITLE	12,7 LINK PULL MACHINE ASSY.
CLASSIFICATION	----------
CONTRACTORS DRAWING REF	----------
DRAWING NUMBER	PEP 134518

6.A.4 AEP-97, VOLUME 16 – BARREL EROSION TEST PROCEDURE

DRAWING NUMBER	DRAWING TITLE
366-110 A1-1156	FN Herstal Drawing – M2 Steel Barrel
366-0110 A3-622	FN Herstal Drawing – M2 Steel Barrel Chamber

***Note: Unless annotated otherwise (METRIC) presume all drawings are in English units.**

FN HERSTAL

To whom it may concern

Letter of Authorization for Use of drawings

We, FN HERSTAL, S.A., Voie de Liège 33 in B4040 HERSTAL (Belgium), do hereby authorize the North Atlantic Treaty Organization (NATO) to produce in its Manual of Proof and Inspection (MOPI) Barrel Erosions the M2 Barrel drawings which belong exclusively to FN HERSTAL.

Done in Herstal on February 9th, 2017.

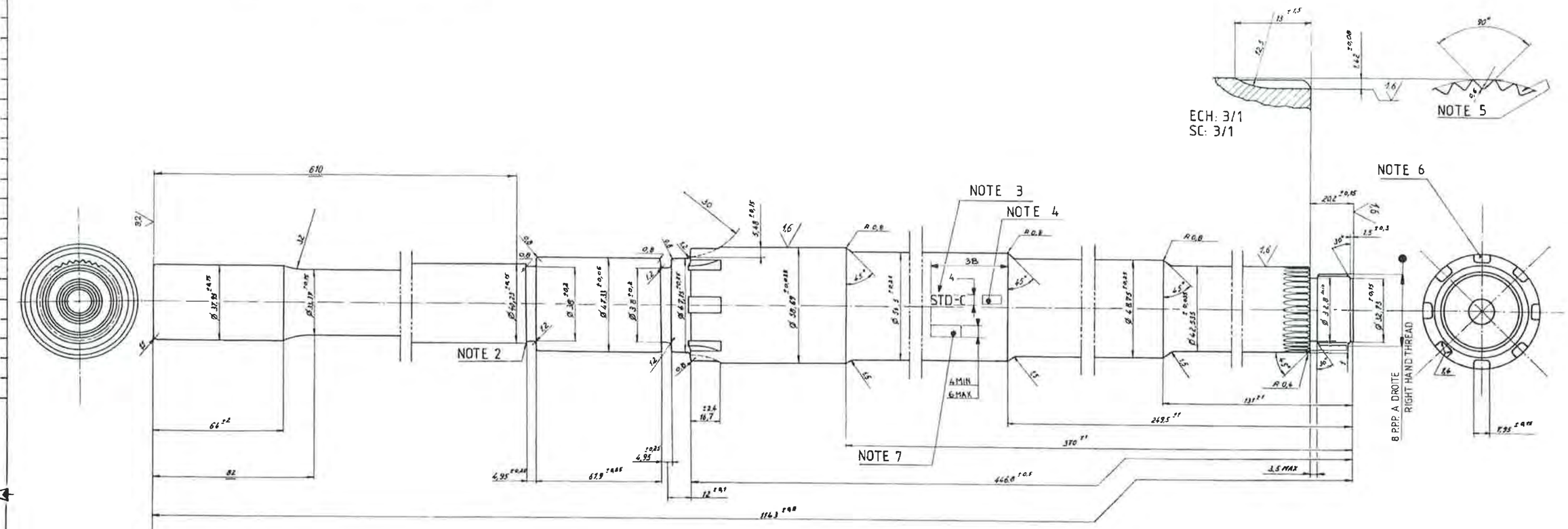
P. BOSSCHAERTS

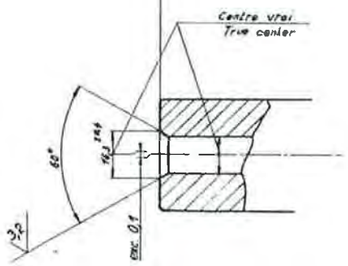
Marketing Director

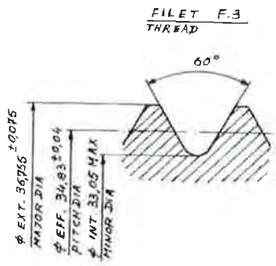
Tel: +32 4 2408224

Fax: +32 4 2408679

FILET / THREAD	ΦEFF / PITCH. DIA	ΦEXT / MAJOR DIA	ΦINT. / MINOR DIA







NOTE 1
LES CARACTERISTIQUES DE LA CHAMBRE ET DE L'AME SERONT REPRISES SUR LE PLAN SPECIAL: CLASS: 110 PL.: A3-622

THE FEATURES OF THE CHAMBER AND THE BORE ARE FOUND ON THE SPECIAL DRAWING: CLASS.: 110 PL.: A3-622

NOTE 2
ARETE BIEN BRISEE
BREAK EDGE

NOTE 3
REPERAGE DU CANON
BARREL TYPE

NOTE 4
MARQUE DU "BANC D'EPREUVES" (SUIVANT LOI BELGE)
FIRING PROOF MARK OF "BANC D'EPREUVES" (ACC. TO BELGIAN LAW)

NOTE 5
40 ENCOCHES EGALEMENT REPARTIES
40 SLOTS EQUALLY SPACED

NOTE 6
8 ENCOCHES EGALEMENT REPARTIES
8 SLOTS EQUALLY SPACED

NOTE 7 MARQUE DES 4 DERNIERS CHIFFRES DU N° DE L'ARME (PAS SUR PIECE RECHANGE)
MARK OF THE 4 LAST FIGURES OF THE PART NUMBER (NOT ON SPARE)

63 (√µm)

MAT 21 CrMoV 5 11 TRAITE DE LIVRAISON
21 CrMoV 5 11 TREATED AS SUPPLIED
PROP ——
TRAIT SURFACE PHOSPHATATION, HUILAGE
SVT. NOQ 87612
SURFACE FINISH PHOSPHATE COATING, OIL TREATMENT
ACC. TO QST 87612
PIECE/PART NO ◑ 3662008238 ◕ 3662009397
ETABLI: WALRAND A
CONTROLE MARQUET J
APPROUVE

REV	DATES	NO JUST	M	REV.	DATES	NO. JUST	M
05	13-11-86	A 12331	M.				
04	25.09.85	A.12170	M.				
03	03 07 84	A 11410	M				
02	20-06-84	A 11392	M				
01	05-06-84	A 11348	M	06	25-02-88	A 12501	M

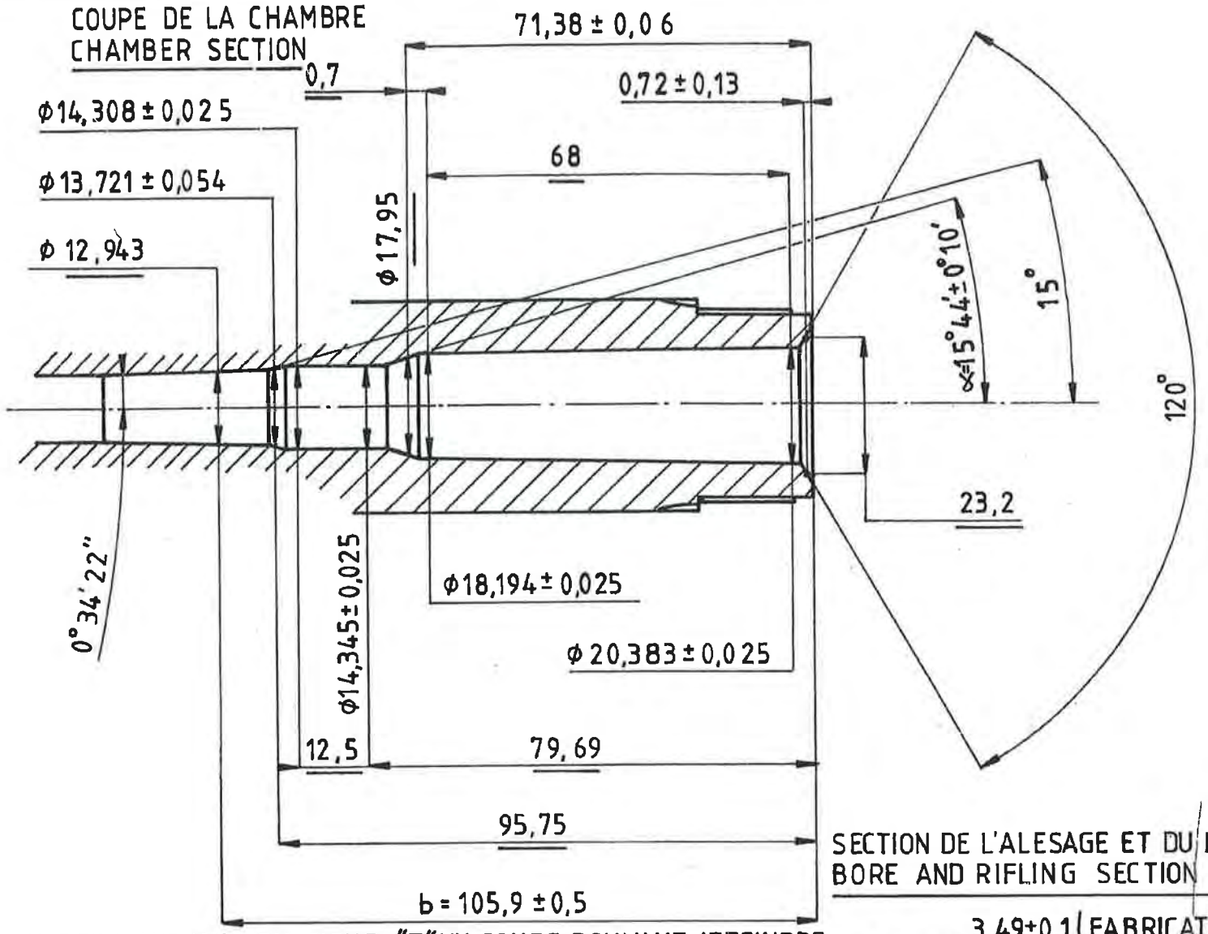
◑ CANON EPROUVE PHOS
◕ CANON EPROUVE, RECHANGE PHOS
BARREL PROVED, SPARE

366	CLASS.: 110	PAGE 1/1

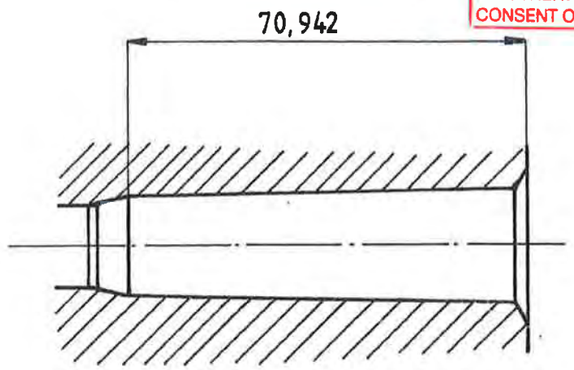
ISO | ECH SC 1/1 3/1 20/1 | A1- 1156 | TO

M150-Class 110 - PL.: A1-1156

COUPE DE LA CHAMBRE
CHAMBER SECTION



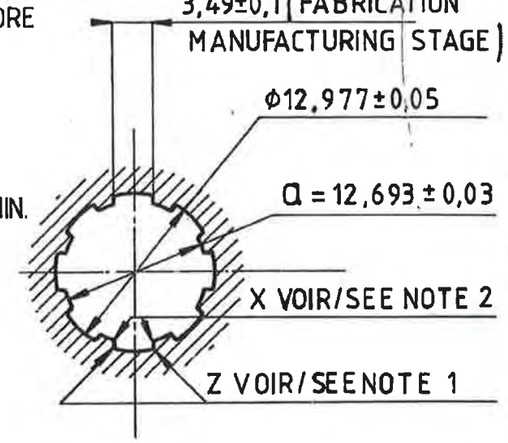
CHAMBRE MINIMUM
CHAMBER MINIMUM



PRISE DE BALLE COURTE
BULLET LEAD SHORT

✓ (✓μm)

SECTION DE L'ALESAGE ET DU RAYAGE
BORE AND RIFLING SECTION



8 RAYURES PAS 380 A DROITE
8 RIFLING GROOVES, PITCH :380 RIGHT HAND

MUN. 12,7

NOTES

1. DANS LES ENCOIGNURES MARQUEES DU SIGNE "Z", UN CONGE POUVANT ATTEINDRE LA PROFONDEUR DE LA RAYURE EST ADMIS.
2. APRES POLISSAGE, LES ARETES "X" POURRONT ETRE LEGEREMENT ARRONDIES.
3. L'ANGLE α A CONSEILLER POUR POUR L'OUTIL DE CHAMBRE EST 15°38'± 0°3'
4. TOUTES LES SURFACES DE LA CHAMBRE, DE L'ALESAGE ET DU RAYAGE DOIVENT PRESENTER UN FINI GLACE.
5. APRES TIR D'EPREUVE ET DE RECEPTION, LE φ "Q" DE L'AME PEUT ATTEINDRE 12,653 MIN ET LA COTE "b" LOCALISANT LA PRISE DE BALLE PEUT ATTEINDRE 103,9 MIN.
6. POUR LA FINITION DES SURFACES ET LA TOILETTES DE CETTE PIECE, VOIR LES FEUILLES "CONVENTIONS RELATIVES A LA TOILETTE DES PIECES D'ARMES."

1. IN CORNERS MARKED WITH "Z" IS ALLOWED A CLEARANCE THAT CAN REACH THE DEPTH OF GROOVE.
2. AFTER POLISHING, EDGES "X" CAN BE ROUNDED LIGHTLY.
3. RECOMMENDED α ANGLE FOR CHAMBERING TOOL IS OF 15°38'±0°3'
4. ALL CHAMBER, BORE AND RIFLING SURFACES MUST BE GLAZE FINISHED.
5. AFTER AND ACCEPTANCE FIRE, "Q" BORE DIAMETER CAN REACH 12,653 MIN. AND "b" READING, WHICH LOCATES BULLET LEAD, CAN REACH 103,9 MIN.
6. FOR SURFACE FINISH AND DEBURRING OF THIS PART, REFER TO APPENDIX SHEETS: "CONVENTIONS RELATING TO DEBURRING THE WEAPONS PARTS."

MAT.: ———
PROP.: ———
TRAIT. SURFACE: ———
SURFACE FINISH: ———

PIECE/PART NO.: ———
ETABLI: P. LEWANDOWSKI
CONTROLE: J. MARQUET
APPROUVE: M. DRIESEN

REV.	DATES	NO. JUST.	M	REV.	DATES	NO. JUST.	M
02	11-05-87	A 12451					
01	18-11-86	A 12331 ● M.					

DETAILS DE LA CHAMBRE DE L'AME DU CANON
STD
SPECIFICATIONS OF BARREL CHAMBER AND BORE
STD

366	CLASS. 0110	PAGE 1/1

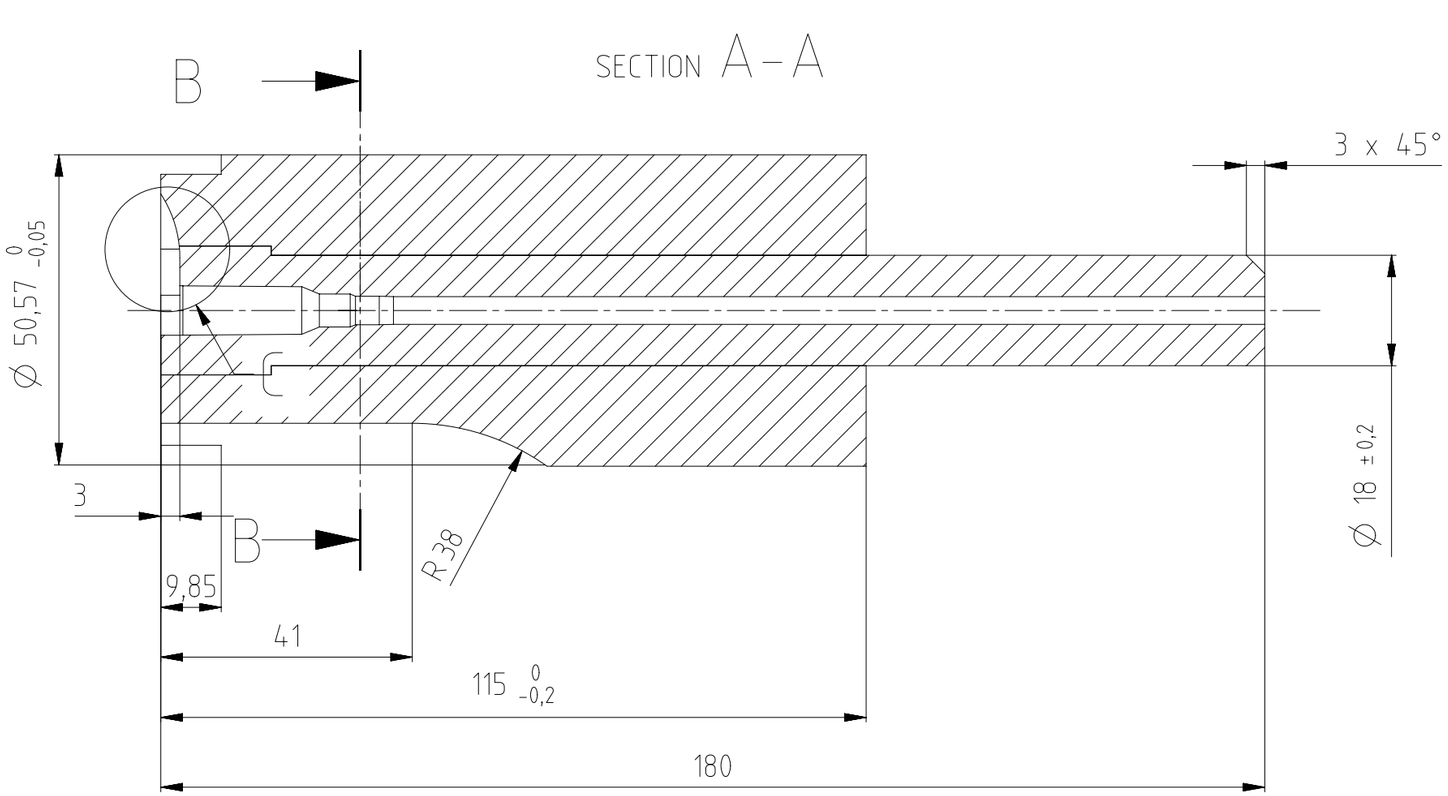
ISO | ECH. SC.: 1/1, 2/1 | A3-622 | TD

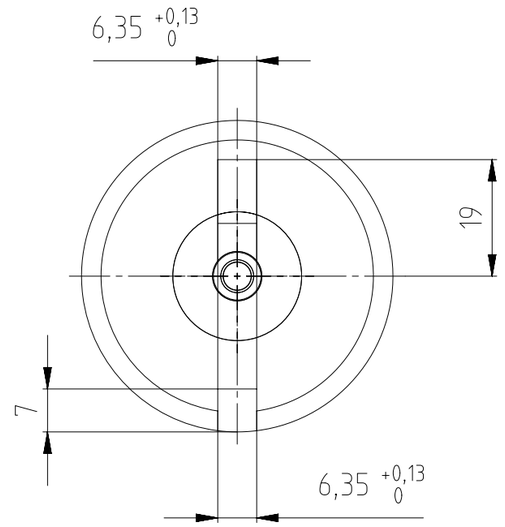
er-821101

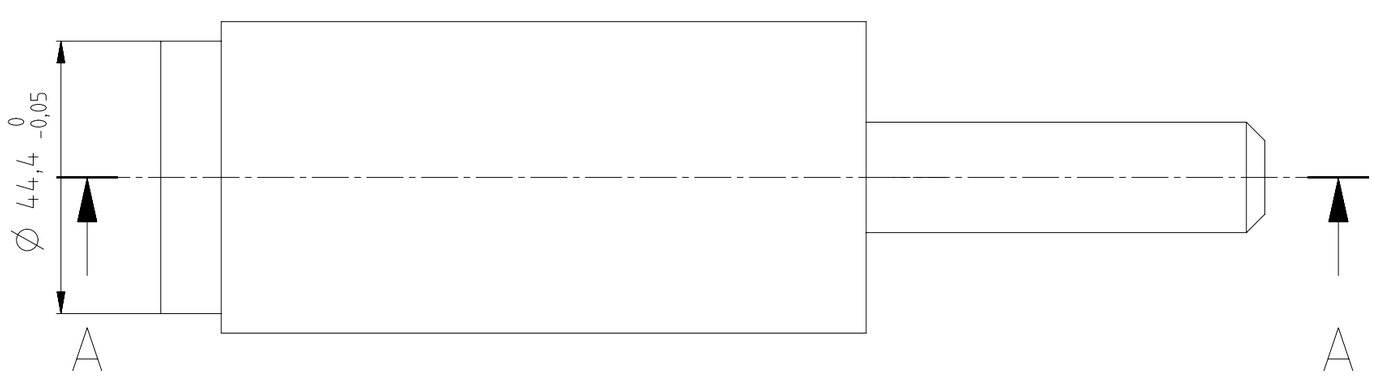
6.A.5 AEP-97, VOLUME 18 – PRECISION TEST PROCEDURE

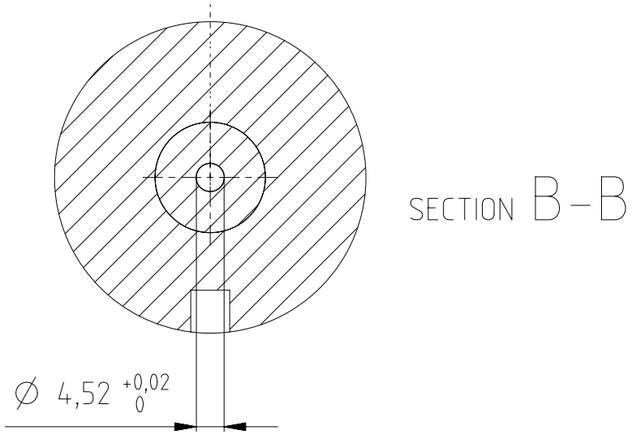
DRAWING NUMBER	DRAWING TITLE
18-(4.6mm)-1	Barrel, Test, Precision, 4.6mm
18-(5.56mm)-1	Barrel, Test, Precision, 5.56mm
18-(5.56mm)-2	Rifle, Test, Precision, Mauser Action, 5.56 mm (Sketch)
18-(5.56mm)-3	Rifle, Test, Precision, Remington 700 Action, 5.56 mm (Sketch)
18-(5.7mm)-1	Barrel, Test, Precision, 5.7mm
18-(7.62mm)-1	Barrel, Test, Precision, 7.62mm
18-(9mm)-1	Barrel, Test, Precision, 9mm
18-(9mm)-2	Adapter, Barrel, Test, Precision, 9 mm
18-(12.7mm)-1	Barrel, Test, Precision, 12.7mm
18-(12.7mm)-2	Action, Test, Precision, 12.7mm
18-(12.7mm)-2-1	Spring, Hammer, 12.7mm
18-(12.7mm)-2-2	Retainer, Spring, 12.7mm
18-(12.7mm)-2-3	Pin, Pivot, Plunger, 12.7mm
18-(12.7mm)-2-4	Pin, Pivot, Bushing, 12.7mm
18-(12.7mm)-2-5	Screw, Pivot, Hammer, 12.7mm
18-(12.7mm)-2-6	Guide, Spring, 12.7mm
18-(12.7mm)-2-7	Bolt Assembly, Precision, 12.7mm
18-(12.7mm)-2-7-1	Pin, Firing, Precision, 12.7mm
18-(12.7mm)-2-7-2	Bushing, Retainer, 12.7mm
18-(12.7mm)-2-7-3	Spring, Retracting, 12.7mm
18-(12.7mm)-2-7-4	Plate, Recoil, 12.7mm
18-(12.7mm)-2-7-5	Bolt, 12.7mm
18-(12.7mm)-2-7-7	Screw, Pivot, Handle, 12.7mm
18-(12.7mm)-2-7-8	Roll Pivot, Handle, 12.7mm
18-(12.7mm)-2-7-9	Handle, Bolt, 12.7mm
18-(12.7mm)-2-8	Receiver, Precision, 12.7mm
18-(12.7mm)-2-9	Hammer, 12.7mm

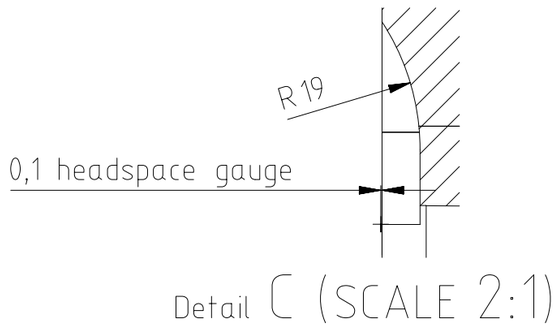
***Note: Unless annotated otherwise (METRIC) presume all drawings are in English units.**











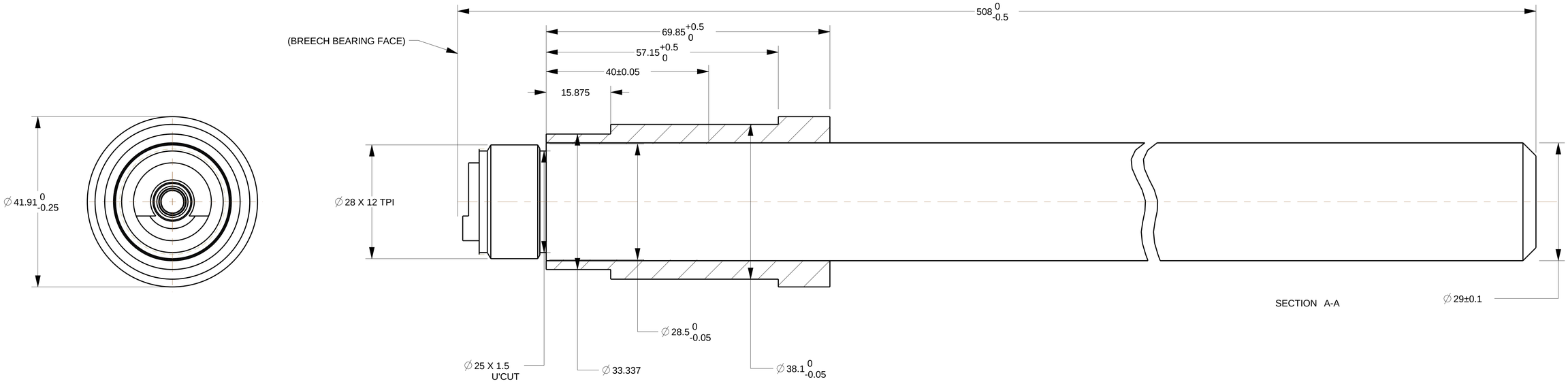
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± 0° 30' DECIMALS ± .01 FRACTIONS ± 1/64	
DRAWN BY: DRU	DATE (YEAR-MO-DA): 2010-07-27

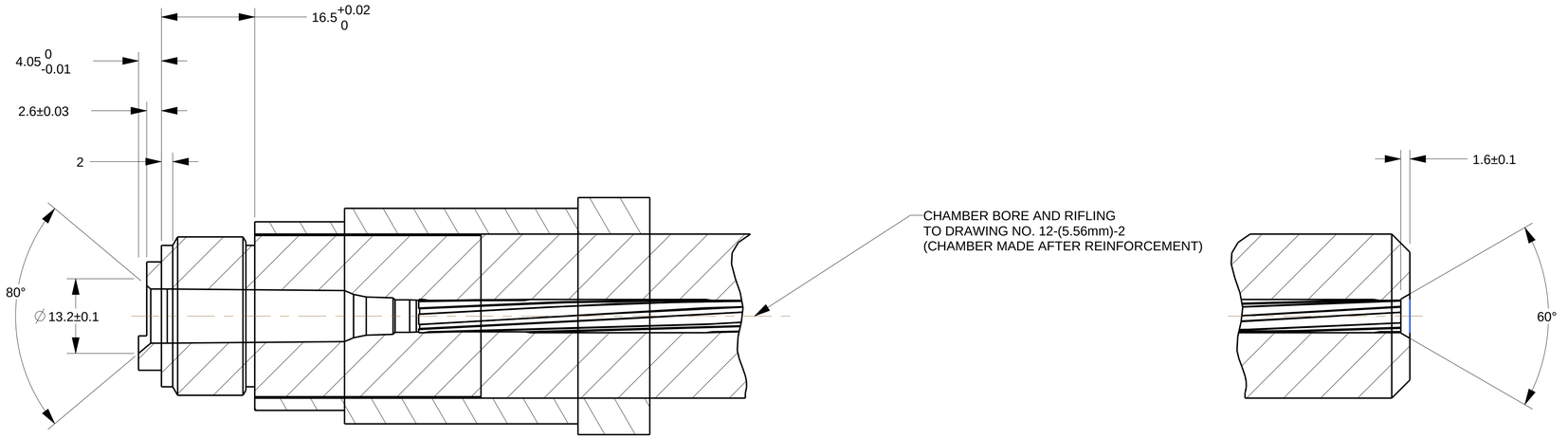
Barrel, Test, Precision, 4.6mm

SIZE: D	DWG NO.: 18-(4.6mm)-1			
SCALE: 5/1	UNIT WT: 0.000	SHEET 1 OF 1		

REVISIONS

MODEL REV	DRAWING REV	DESCRIPTION	DATE(YEAR-MO-DA)	APPROVED





MUZZLE

METRIC

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES

TOLERANCE ON ANGLES ± °
DECIMALS ±
FRACTIONS ±

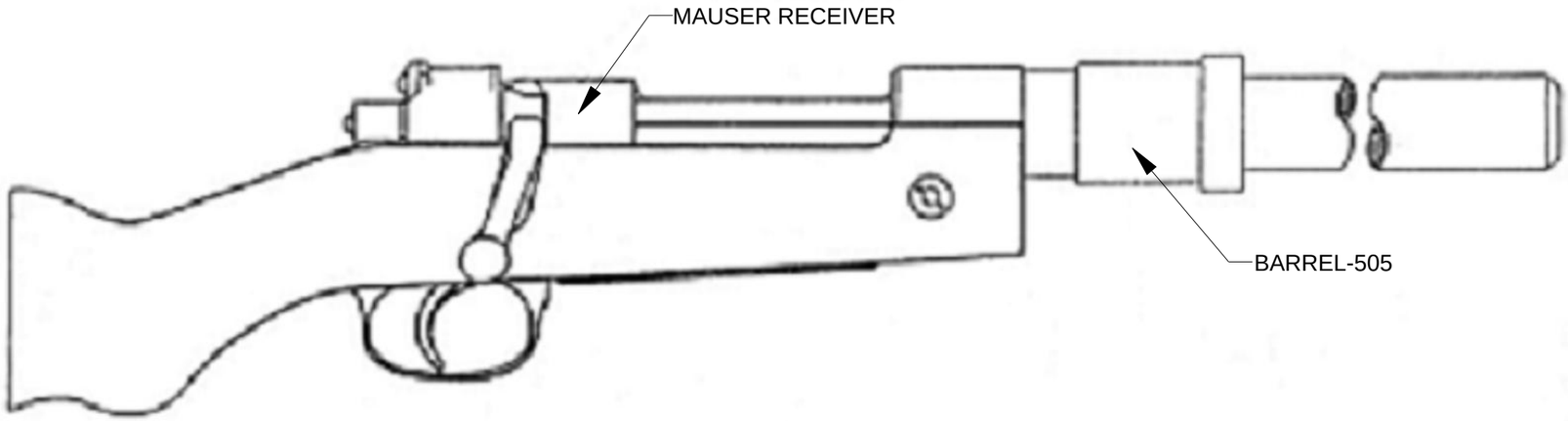
DRAWN BY	DATE (YEAR-MO-DA)
AMW	2012-05-01

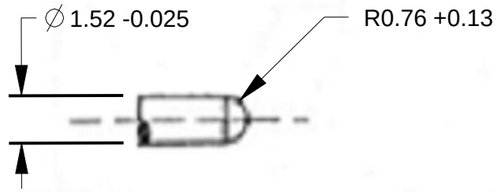
Barrel, Test, Precision, 5.56mm

SIZE	DWG NO.	
D	18-(5.56mm)-1	
SCALE 1/2	UNIT WT 0.000	SHEET 1 OF 1

NOTES:

1. THE HEAD SPACE AT 7.663 DATUM DIA. SHALL BE 38.024 MIN.
2. THE FIRING PIN PROTRUSION SHALL BE 0.76 MIN. TO 0.99 MAX.
3. THE FIRING PIN INDENT IN AN ANNEALED COPPER CYLINDER SHALL BE 0.51 MIN. TO 0.64 MAX.





FIRING PIN POINT CONTOUR

METRIC

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY J. DUEHRING	DATE (YEAR-MO-DA) 2012-05-23

Rifle, Test, Precision, Mauser Action, 5.56 mm (Sketch)

SIZE	DWG NO.		
B	18-(5.56mm)-2		
SCALE 1/1	UNIT WT 0.000	SHEET 1 OF 1	

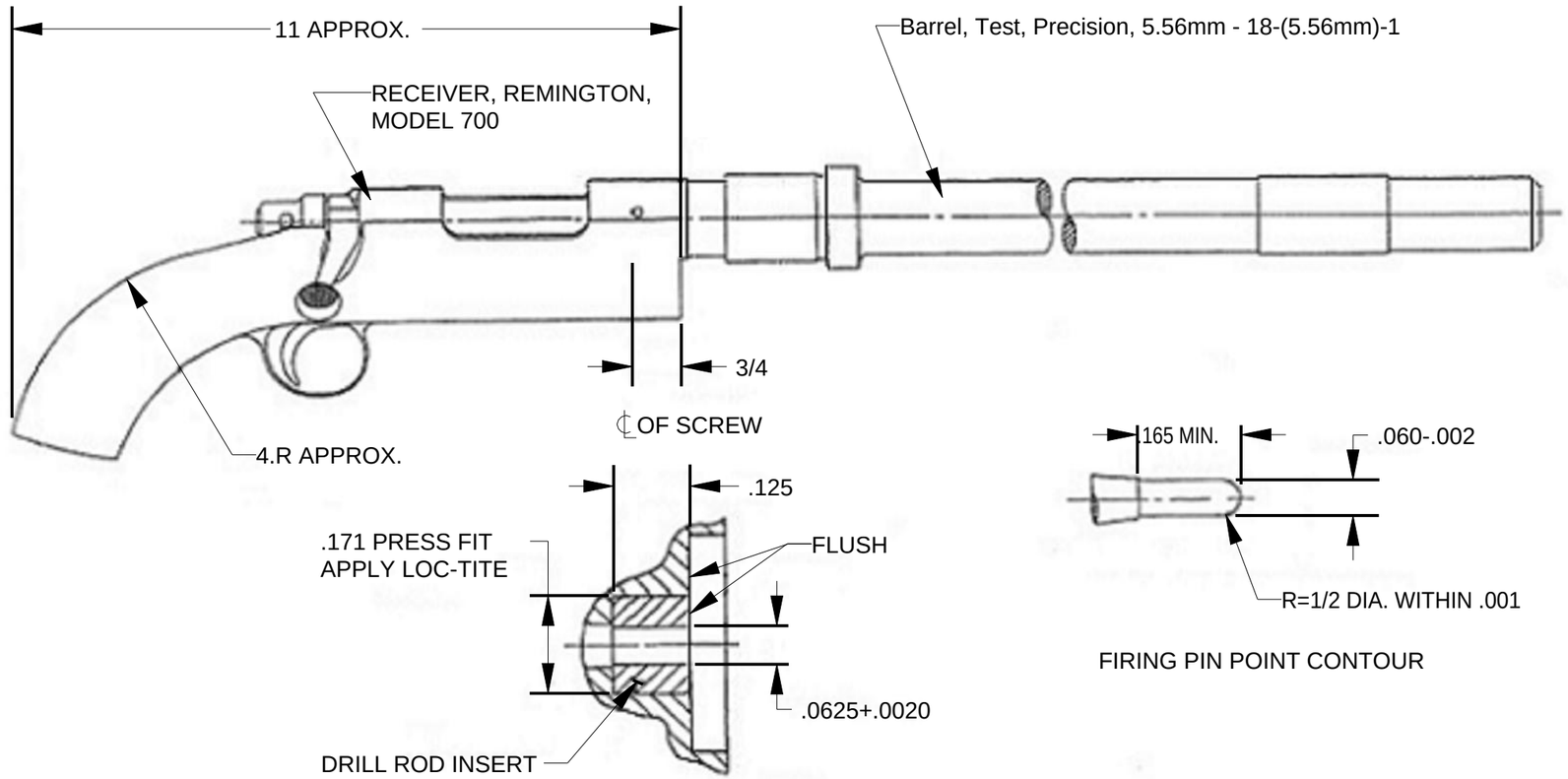
NOTES:-

1-THE HEAD SPACE AT .3017 DATUM DIA SHALL BE 1.497 MIN. TO 1.500 MAX.

2-THE FIRING PIN PROTRUSION SHALL BE .03 MIN. TO .04 MAX.

3-THE FIRING PIN INDENT IN AN ANNEALED COPPER CYLINDER SHALL BE .020 MIN. TO .025 MAX.

4-NO ADHESIVE IS PERMITTED IN THREADED JOINTS.



BOLT FACE ALTERATION

FIRING PIN POINT CONTOUR

RECEIVER REPLACEMENT PARTS REMINGTON ARMS CO., MODEL 700	
NOMENCLATURE OR DESCRIPTION	MFG. PART NO.
BOLT BODY (MOD. AS SHOWN)	20198
BOLT STOP	17013
BOLT STOP PIN	24475
BOLT STOP SPRING	15224
CENTER GUARD SCREW	15287
EJECTOR	15852
EJECTOR PIN	17676
EJECTOR SPRING	17019
EXTRACTOR	15850
EXTRACTOR RIVET	27342
FIRING PIN ASSY. (MOD. AS SHOWN)	22041
FRONT GUARD SCREW	22035
MAGAZINE	15282
MAGAZINE FOLLOWER	16793
MAGAZINE SPACER	15742
MAGAZINE SPRING	17983
REAR GUARD SCREW	26355
RECEIVER HOUSING	26577
SHEAR PIN	24476
STOCK (MOD. AS SHOWN)	26380
TRIGGER ASSY.	26345
TRIGGER GUARD	15281

METRIC

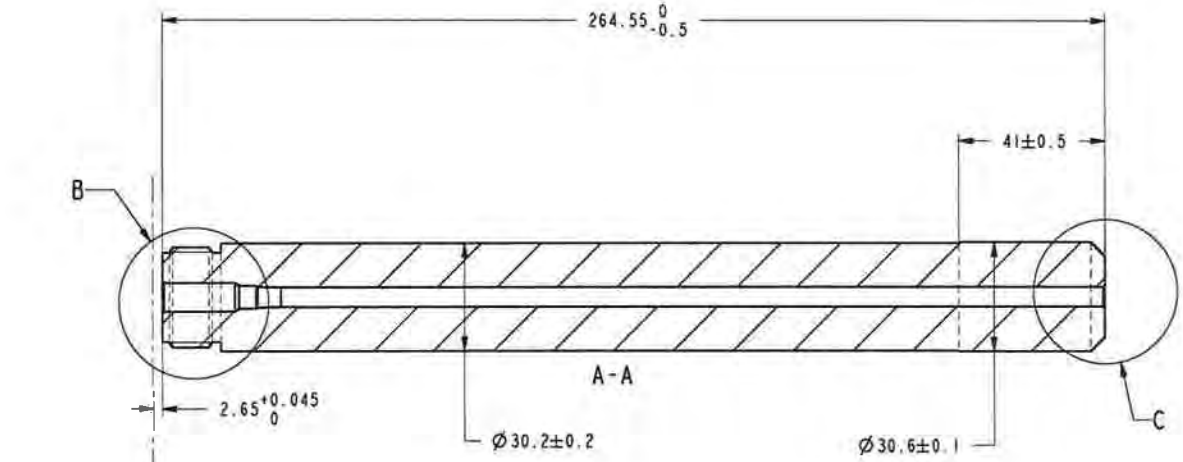
NEXT ASSY	USED ON
APPLICATION	

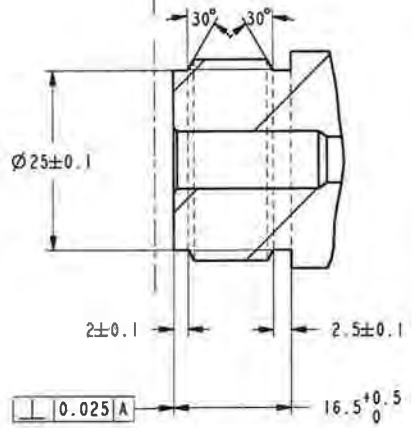
UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± 2°
DECIMALS ±
FRACTIONS ± 1/32

DRAWN BY	DATE (YEAR-MO-DA)
J. DUEHRING	2012-05-24

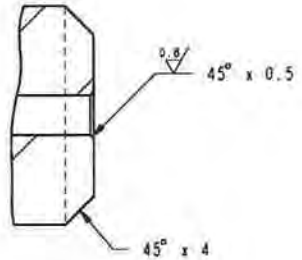
Rifle, Test, Precision, Remington 700 Action, 5.56mm (Sketch)

SIZE	DWG NO.	
B	18-(5.56mm)-3	
SCALE 1/1	UNIT WT 0.000	SHEET 1 OF 1





B
2/1

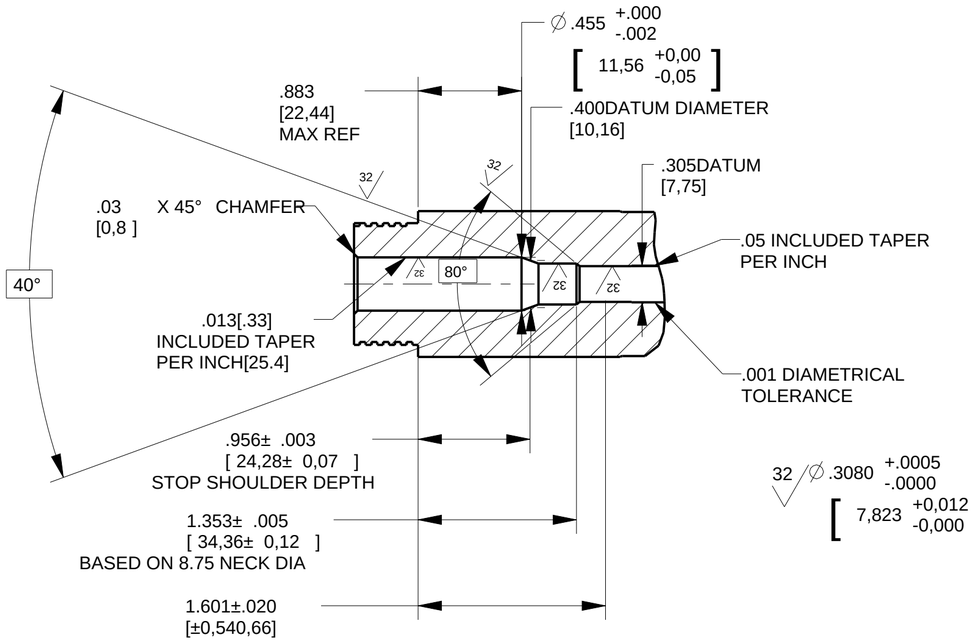


C
2/1

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY BEL	DATE (YEAR-MO-DA) 2018-07-27

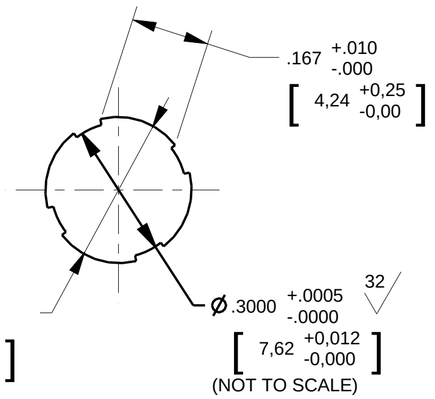
Barrel, Test,
Precision, 5.7mm

SIZE D	DWG NO. 18-(5.7mm)-1		
SCALE H	UNIT WT 0.000	SHEET 1 OF 1	



CHAMBER

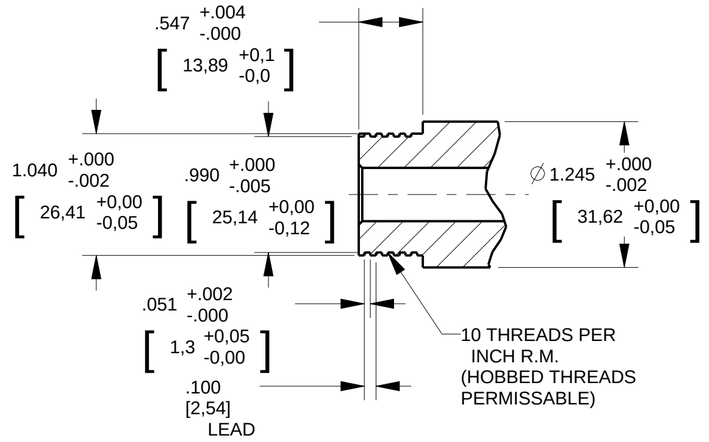
32 ∅ .3080 +.0005 -.0000
[7,823 +0,012 -0,000]



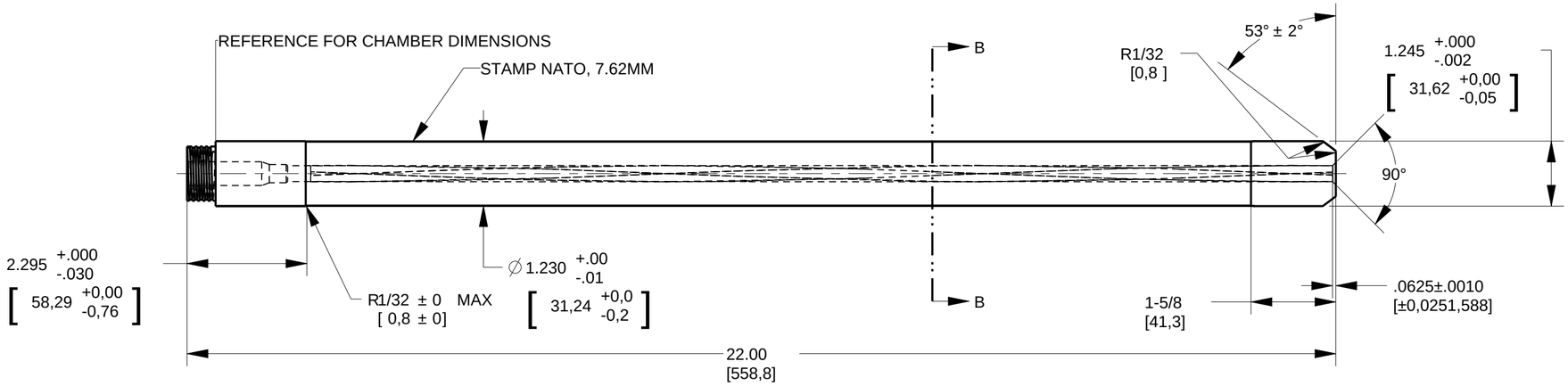
(NOT TO SCALE)

RIFLING

4 GROOVES,
RIGHT HAND TWIST,
1 TURN IN 12 INCHES



ENLARGED VIEW OF BARREL



NOTES:

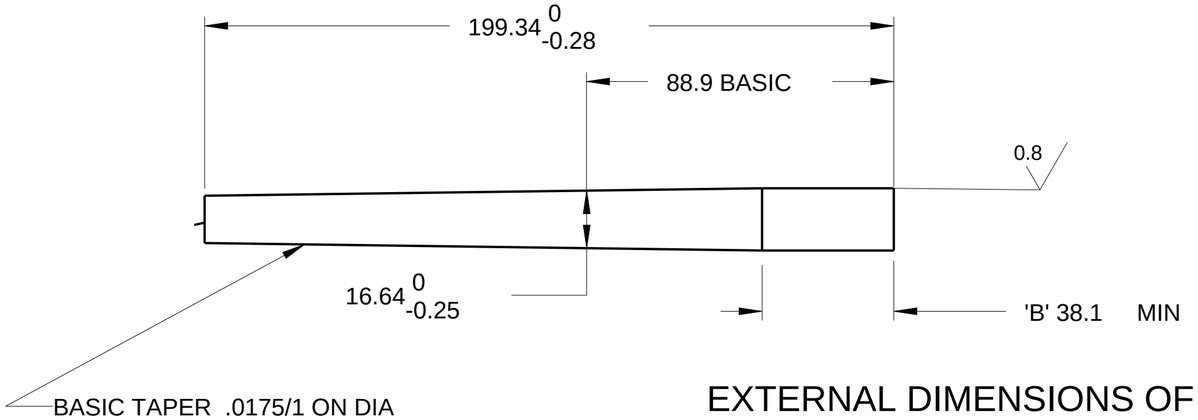
1. DIMENSIONS SHALL BE CONCENTRIC WITHIN .006 INCHES TOTL INDICATOR READING WITH CHAMBER MARKED.
2. FINISH ALL 32 OVER.
3. STEEL, RESULPHERIZED
   CHEMICAL REQUIREMENTS
   CARBON: 0.47-0.55%
   MANGANSE 0.70-1.00%
   PHOSPHORUS 0.040% MAX
   SULPHUR 0.05-0.09%
   SILICONE 0.20-0.35%
   CHROMIUM 0.80-1.15%
   MOLYBDENUM 0.15-0.25%
   QUENCH AND TEMPER
4. SEE DWG FOR MODIFICATION WHEN USED FOR ACCURACY.
5. DIMENSIONS IN [ ] ARE IN MILLIMETERS.

BARREL, TEST

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY A. WALKER	DATE (YEAR-MO-DA) 2012-05-11

Barrel, Test, Precision, 7.62mm

SIZE	DWG NO.		
C	18-(7.62mm)-1		
SCALE 3/16	UNIT WT 0.000	SHEET 1 OF 1	

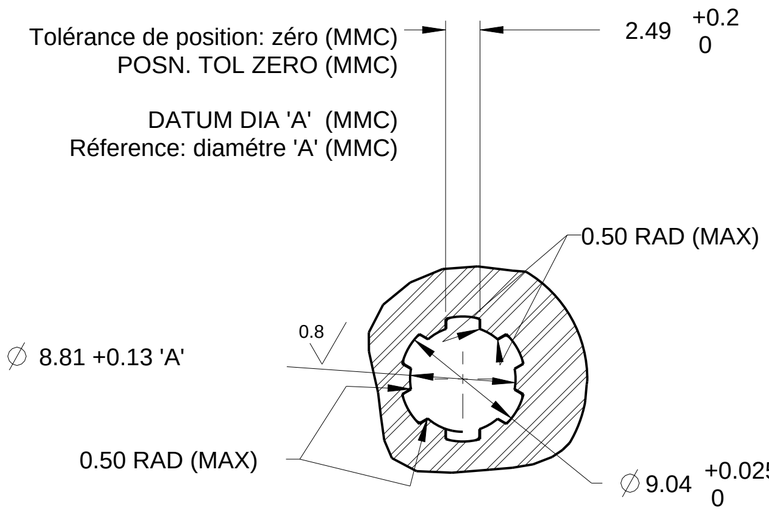


BREECH END MACHINED TO 17.27-0.051 DIA

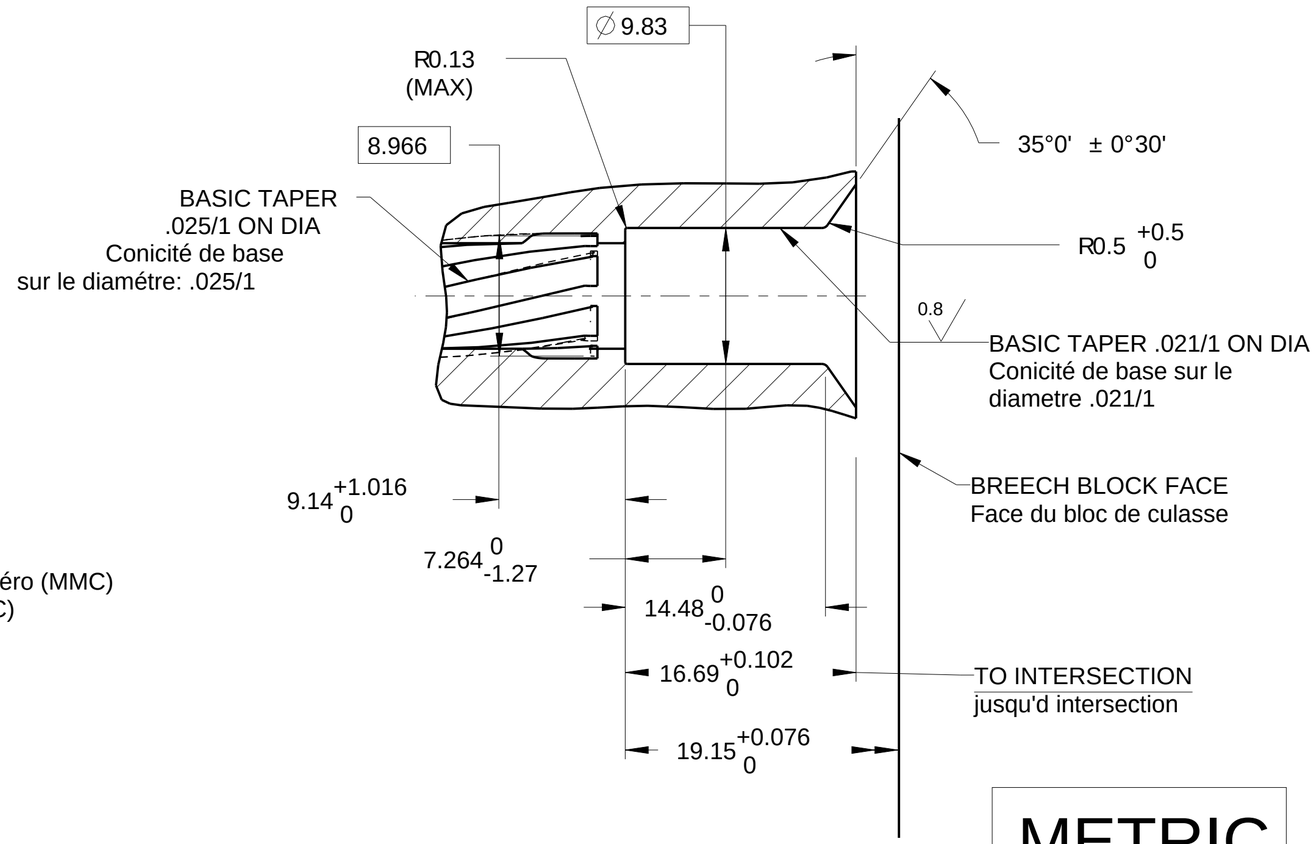
FOR LENGTH 'B' CONC TOL -0.051 DIA.
DATUM AXIS OF BARREL AND CHAMBER

Extrémité culasse au usinée diamétre de 17.27-0.051
Pour la langueur "B". tolérance de concetnricite -0.051
Sur le diamétre. Reference: axe du tube et de la chambre.

EXTERNAL DIMENSIONS OF BARREL
COTES EXTERNES DU TUBE



Diamétre 9.04 +0.025/ -0
Tolérance de concentricite: zéro (MMC)
Reference diamétre 'A' (MMC)



METRIC

RIFLING - 6 GROOVES EQUALLY SPACED 1 TURN IN 250MM R.H.
MMC EQUALS MAXIMUM METAL CONDITION
Rayures: 6 rayures également spacées - 1 tour â draite en 250mm
MMC = condition maximum du métal

DIMENSION IN MM
Les coles sont en mm

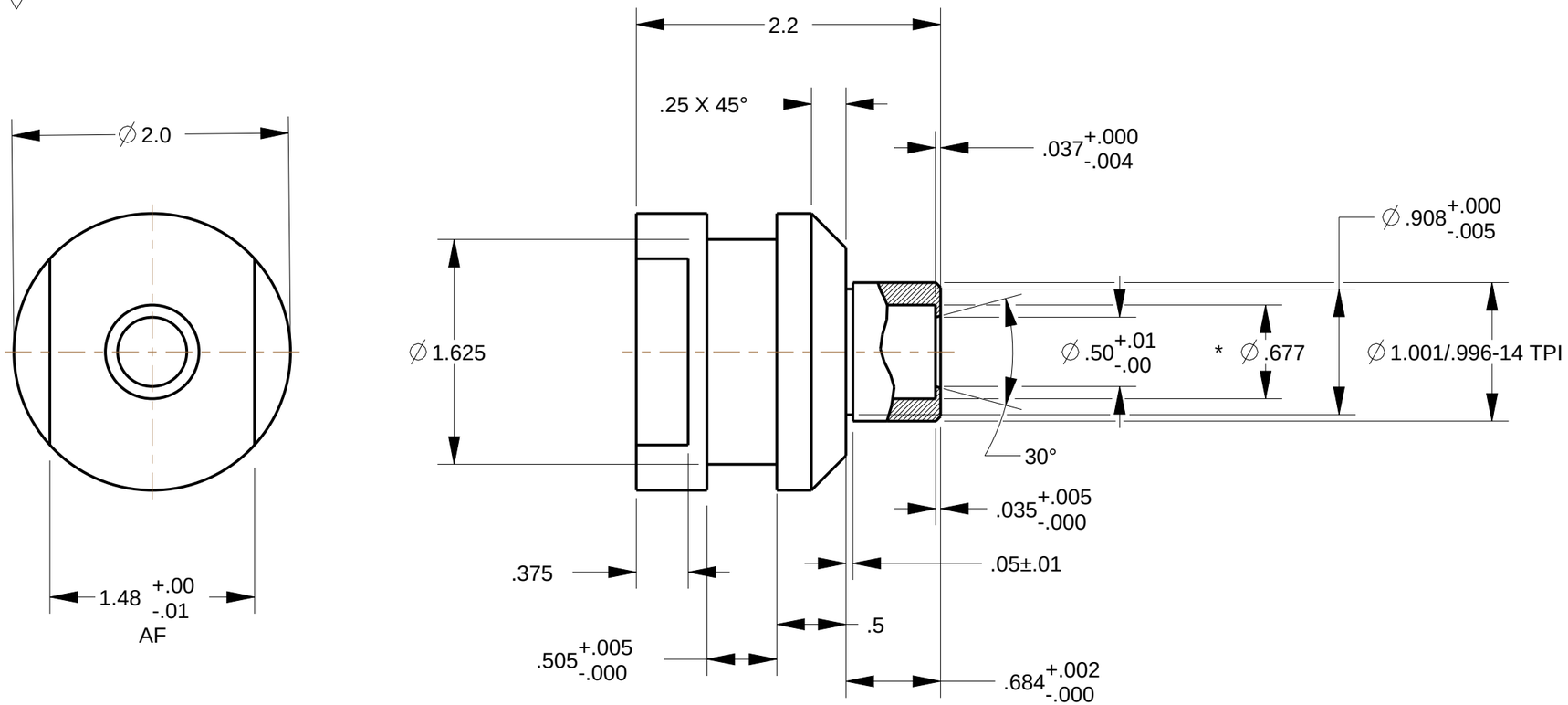
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY AMW	DATE (YEAR-MO-DA) 2012-05-10

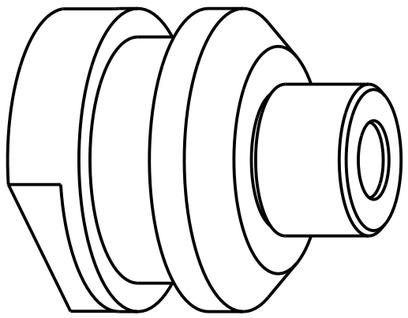
Barrel, Test, Precision, 9mm

SIZE	DWG NO.	
C	18-(9mm)-1	
SCALE 1/4	UNIT WT	SHEET 1 OF 1

NOTES:

1. TO BE SHRUNK ON BARREL 18-(9mm)-1, MAX INTERFERENCE .0015.
2. MATERIAL STEEL, DEF STAN 01-6 GROUP Q.
3. FINISH PHOSPHATE, DEF STAN 03-11.
4. SURFACE TEXTURE: 64





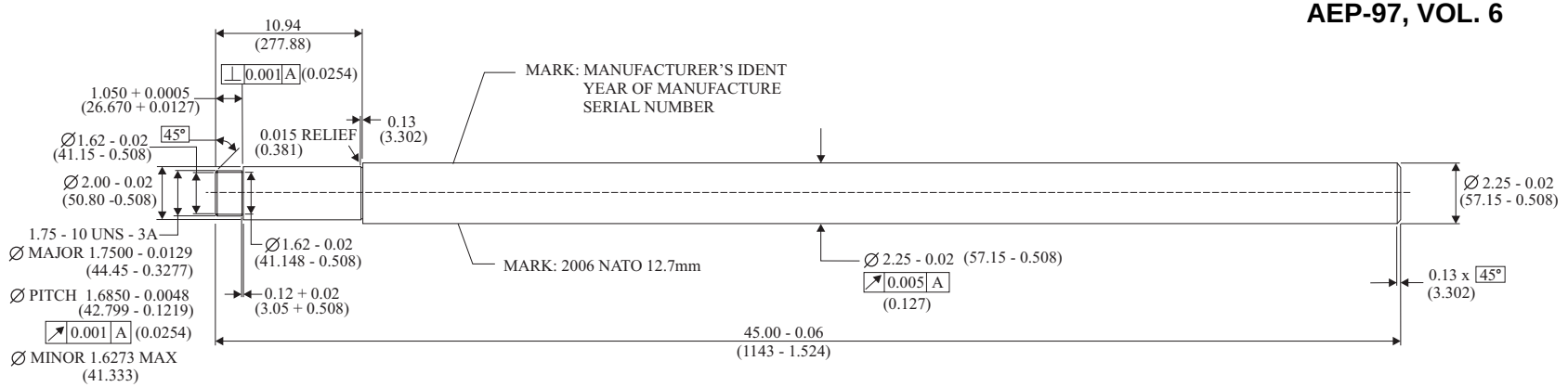
	PF209A
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± 1° DECIMALS ±.01 FRACTIONS ±	
DRAWN BY A. WALKER	DATE (YEAR-MO-DA) 2012-11- 05

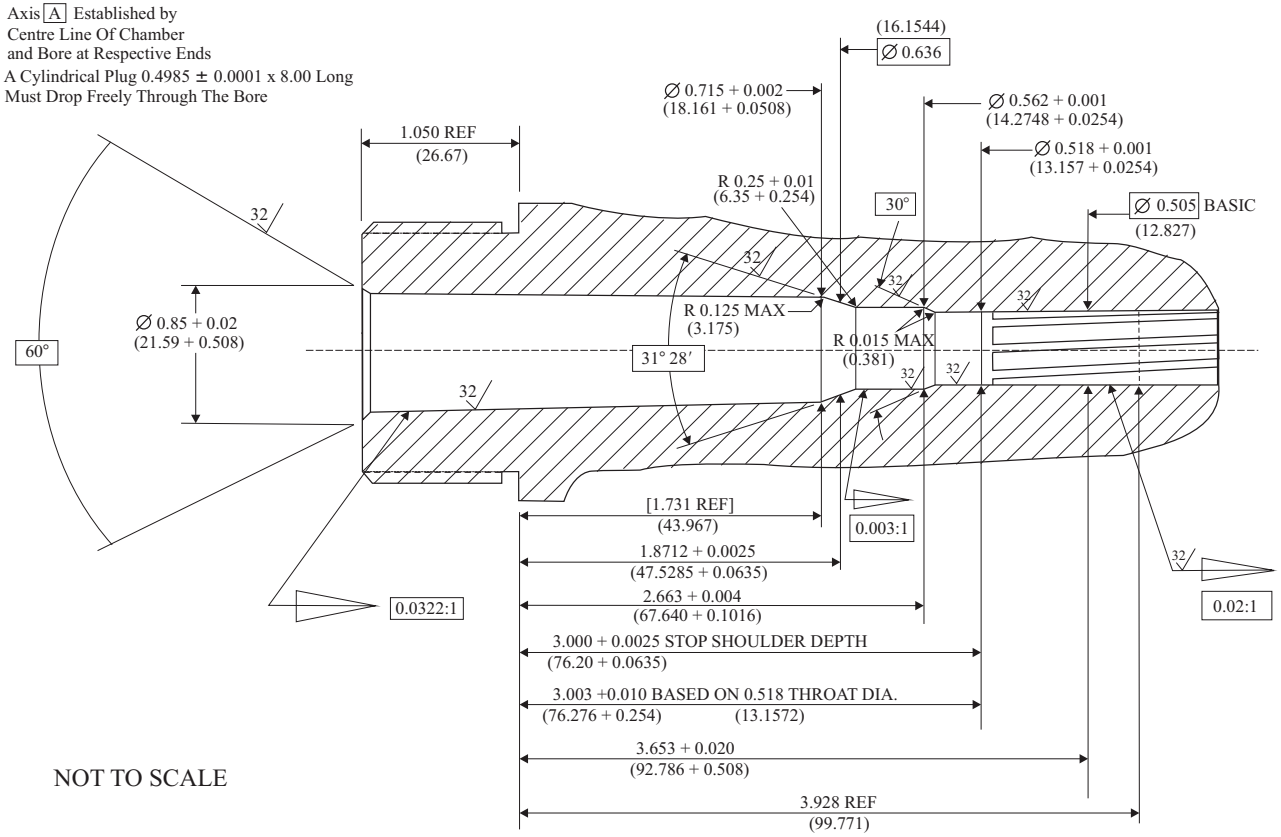
Adapter, Barrel, Test Precision, 9mm

SIZE	DWG NO.		
B	18-(9mm)-2		
SCALE 1/1	UNIT WT 0.000	SHEET 1 OF 1	

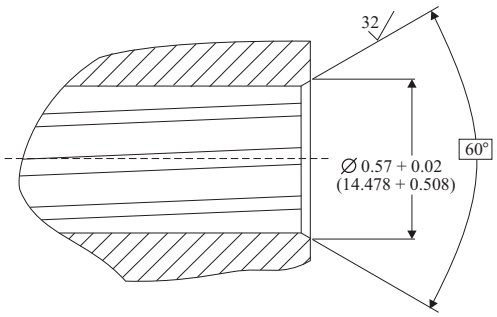
Notes:

1. Applicable Standards/Specifications
   A. MIL-STD-100E
   B. MIL-A-2550
   C. ANSI Y14 M-1982
2. MATERIAL:
   Crucible 416R St Steel or Steel, MIL-S-46047, Quench and Temper or other material as agreed in contract
3. If appropriate Heat Treat and Stress Relieve Rc 28-32 prior to machining
4. Protective finish if appropriate: Black Oxide, MIL-C-13924 Exterior only
5. Finish 64 Except as Noted
6. Break all Exterior Corners
7. Edges of Lands Shall be Sharp and Free of Burrs
8. Axis A Established by Centre Line Of Chamber and Bore at Respective Ends
9. A Cylindrical Plug 0.4985 ± 0.0001 x 8.00 Long Must Drop Freely Through The Bore

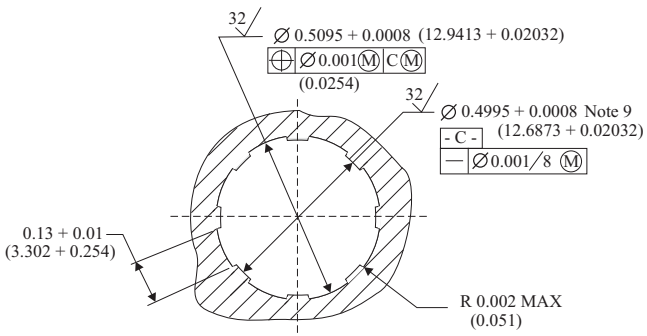




NOT TO SCALE



MUZZLE

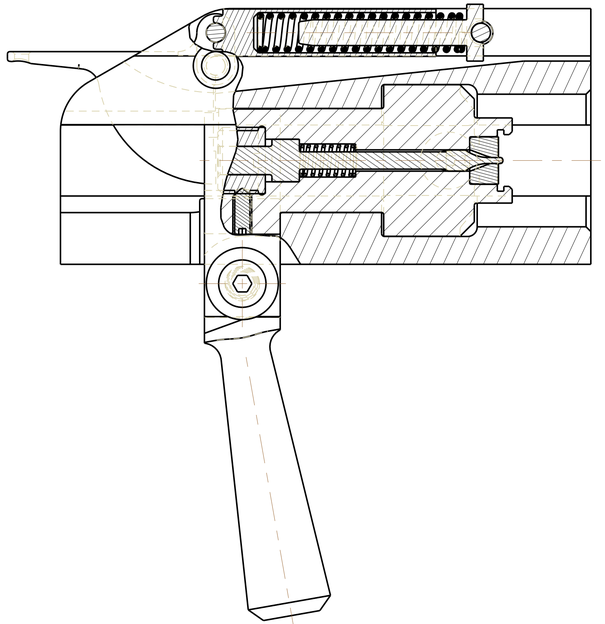


RIFLING

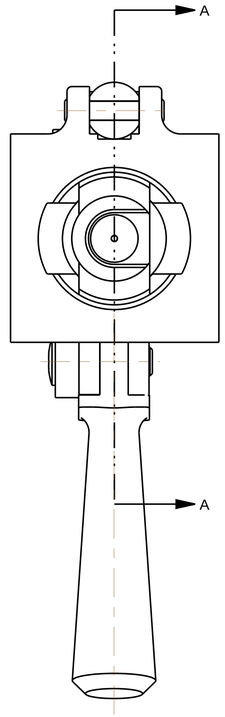
8 GROOVES
RIGHT HAND TWIST
ONE TURN IN 15.000 ± 0.375
(381 ± 9.525)

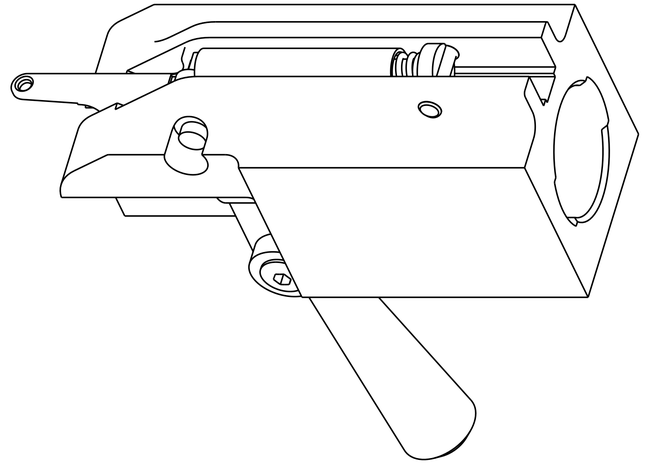
CHAMBER

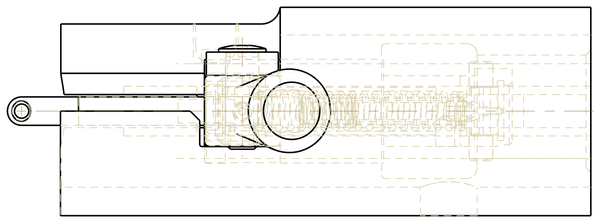
Dimensions are in Inches (Metric Dimensions are shown in brackets for information only)	THIRD ANGLE PROJECTION	Barrel, Test, Precision, 12.7mm		
		PFP(NAAG-LG/3-SG/1)D(2004)1	07 Dec 2006	18-(12.7mm)-1



SECTION A-A







ITEM OR FIND NO.	QTY. REQ.	PART NO. OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
9	1	18-(12.7mm)-2-1	Spring, Hammer, 12.7mm
8	1	18-(12.7mm)-2-5	Screw, Pivot, Hammer, 12.7mm
7	1	18-(12.7mm)-2-2	Retainer, Spring, 12.7mm
6	1	18-(12.7mm)-2-8	Reciever, Precision, 12.7mm
5	1	18-(12.7mm)-2-3	Pin, Pivot, Plunger, 12.7mm
4	1	18-(12.7mm)-2-4	Pin, Pivot, Bushing, 12.7mm
3	1	18-(12.7mm)-2-9	Hammer, 12.7mm
2	1	18-(12.7mm)-2-6	Guide, Spring, 12.7mm
1	1	18-(12.7mm)-2-7	Bolt Assembly, Precision, 12.7mm

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY A. WALKER	DATE (YEAR-MO-DA) 2012-05-05

Action, Test, Precision, 12.7mm

SIZE	DWG NO.	
D	18-(12.7mm)-2	
SCALE 1/1	UNIT WT 0.000	SHEET 1 OF 1

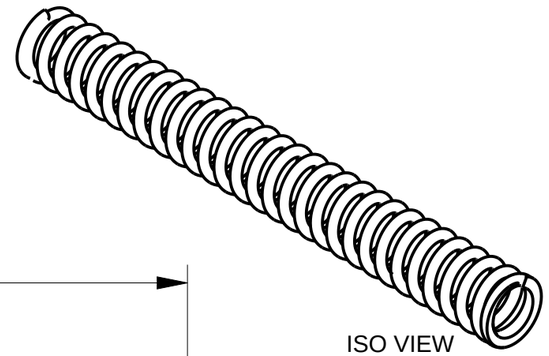
ANNEX 6-A TO:
AEP-97, VOL. 6

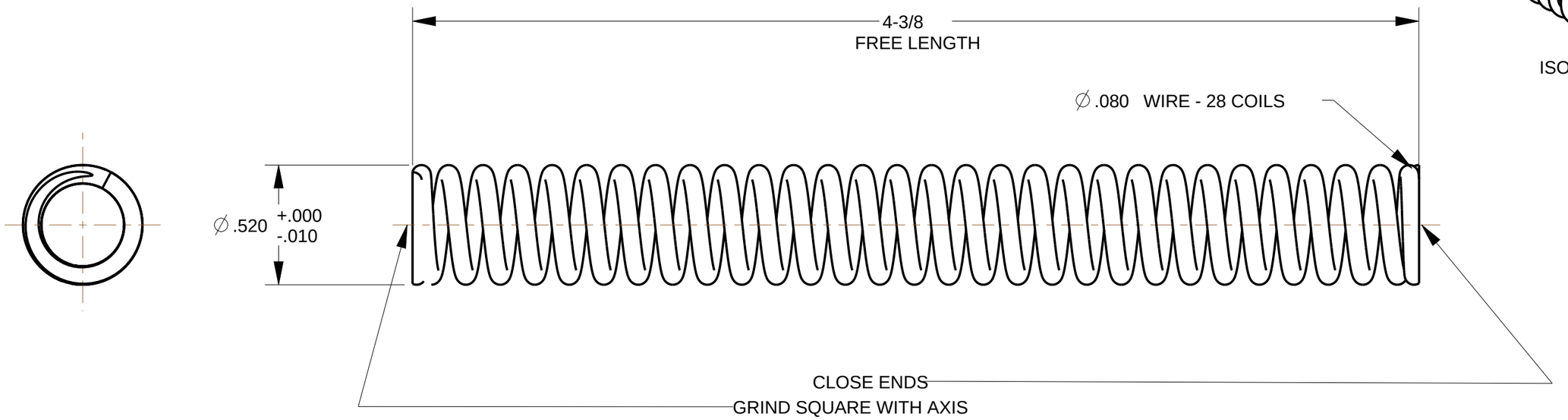
NOTES:

1. SPECIFICATION ANSI Y14.5 AND ANSI B46.1 APPLY.

2. HEAT TREATMENT: HEAT TO 1440° F. QUENCH IN OIL.
   DRAW TO BLUE AT 600° F COOL AIR.

3. MATERIAL: WIRE, STEEL C1095, SPECIFICATION QQ-W-470.





NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± °
DECIMALS ±
FRACTIONS ±1/64

DRAWN BY	DATE (YEAR-MO-DA)

Spring, Hammer, 12.7mm

SIZE	DWG NO.		
B	18-(12.7mm)-2-1		
SCALE 2/1	UNIT WT 0.003	SHEET 1 OF 1	

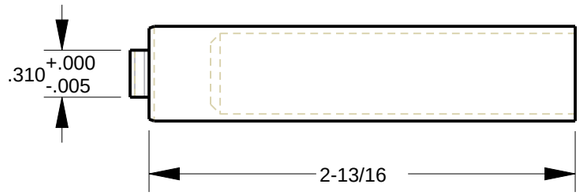
NOTES:

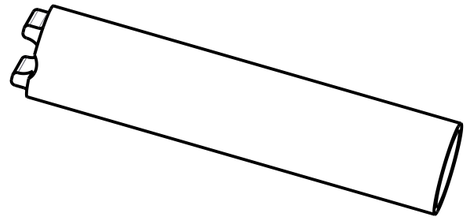
1- SPECIFICATIONS: ANSI Y14.5 & ANSI B46.1 APPLY.

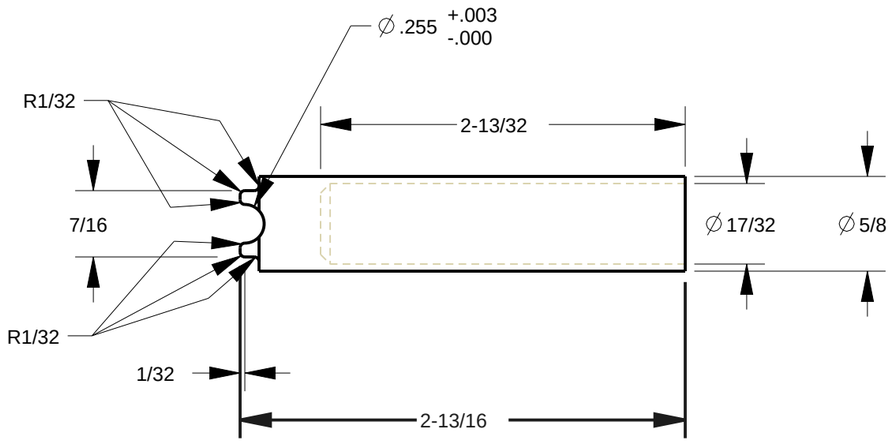
2- FINISH ALL OVER 125

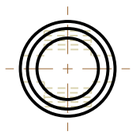
3- HEAT TREATMENT:- HEAT TO 1440° F QUENCH IN OIL. DRAW TO LIGHT STRAW AT 600° F. COOL IN

4- MATERIAL: STEEL C1095 ANSI/ASTM A108









PART NO. 18-(12.7mm)-2-2

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± °
DECIMALS ±
FRACTIONS ± 1/64

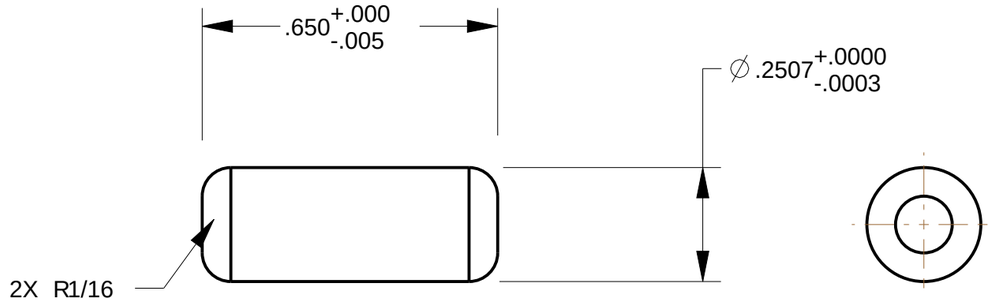
DRAWN BY JTD	DATE (YEAR-MO-DA) 2012-03-13

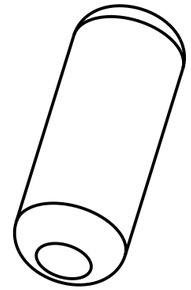
Retainer, Spring, 12.7mm

SIZE	DWG NO.		
B	18-(12.7mm)-2-2		
SCALE 1/1	UNIT WT 0.000	SHEET 1 OF 1	

NOTES:

1. SPECIFICATION ANSI Y14.5 AND ANSI B46.1 APPLY.
2. FINISH ALL OVER 125.
3. MATERIAL: DRILL ROD, W1-10 SPECIFICATION QQ-T-580.





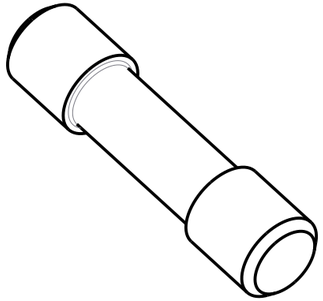
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY GJC	DATE (YEAR-MO-DA) 2012-02-23

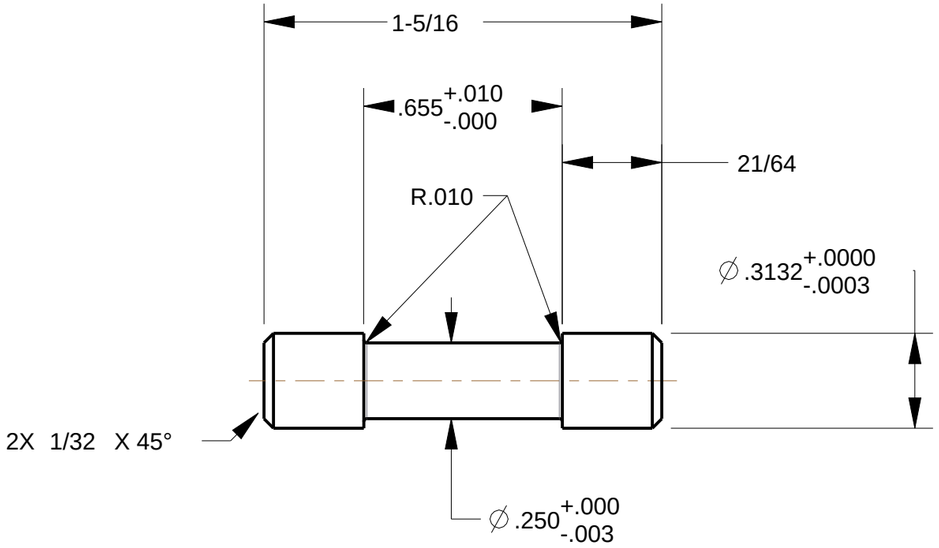
Pin, Pivot, Plunger, 12.7mm

SIZE	DWG NO.		
B	18-(12.7mm)-2-3		
SCALE 3/1	UNIT WT 0.000	SHEET 1 OF 1	

NOTES:

1. SPECIFICATION ANSI Y14.5 AND ANSI B46.1 APPLY.
2. FINISH ALL OVER 125
3. MATERIAL: DRILL ROD, W1-10
   SPECIFICATION QQ-T-580.





NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY GJC	DATE (YEAR-MO-DA) 2012-03-08

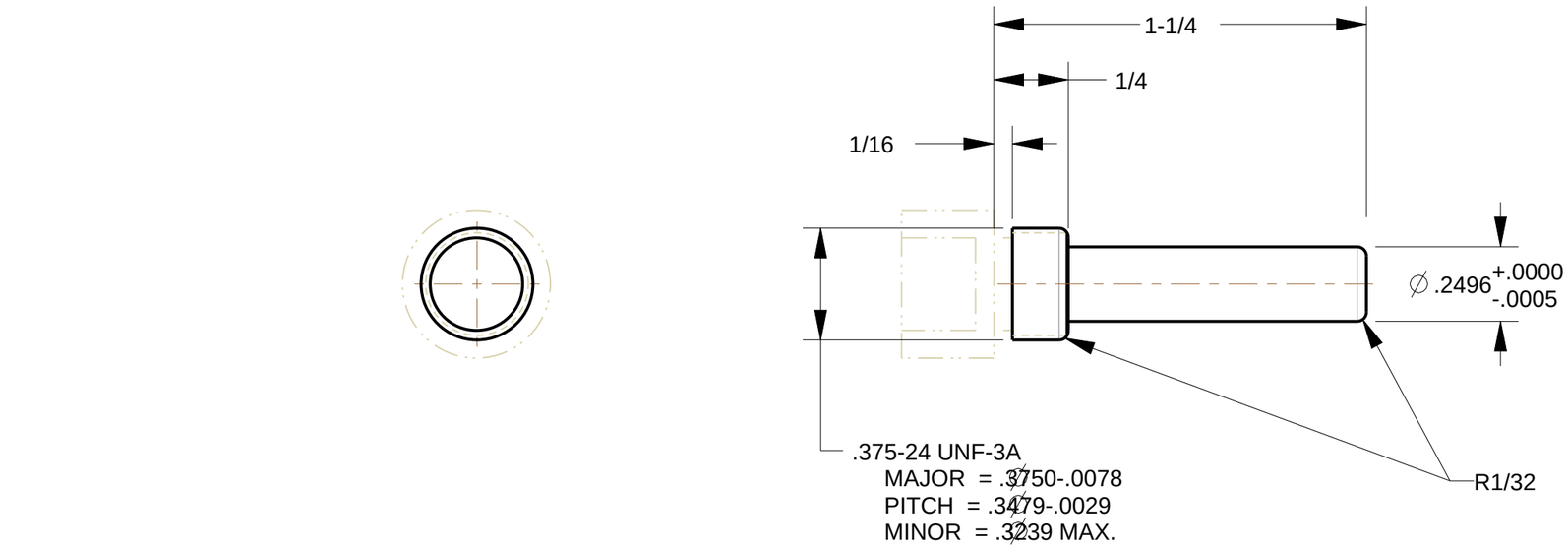
Pin, Pivot, Bushing, 12.7mm

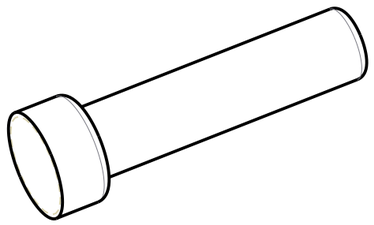
SIZE	DWG NO.		
B	18-(12.7mm)-2-4		
SCALE 2/1	UNIT WT 0.000	SHEET 1 OF 1	

NOTES:-

1- SPECIFICATION ANSI Y14.5, MIL-STD-9, ANSI B46.1 APPLY.
2- FINISH ALL OVER 185

3- USE SOCKET HEAD SCREW, MS 16998-75 MODIFIED AS SHOWN.
4- MATERIAL: STEEL, SPECIFICATION QQ-S-630





PART NO. 18-(12.7mm)-2-5

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES

TOLERANCE ON ANGLES ± °
DECIMALS ±
FRACTIONS ± 1/64

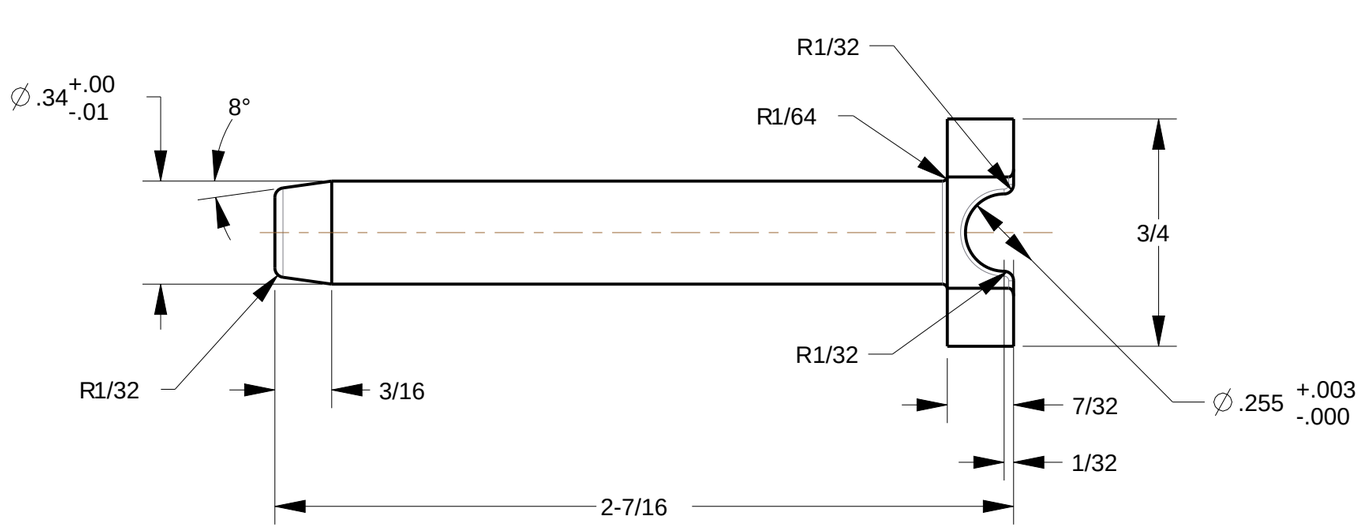
DRAWN BY J. DUEHRING	DATE (YEAR-MO-DA) 2012-03-14

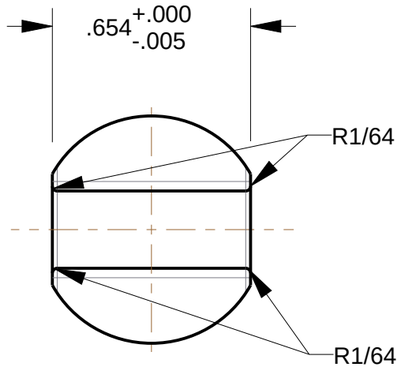
Screw, Pivot, Hammer, 12.7mm

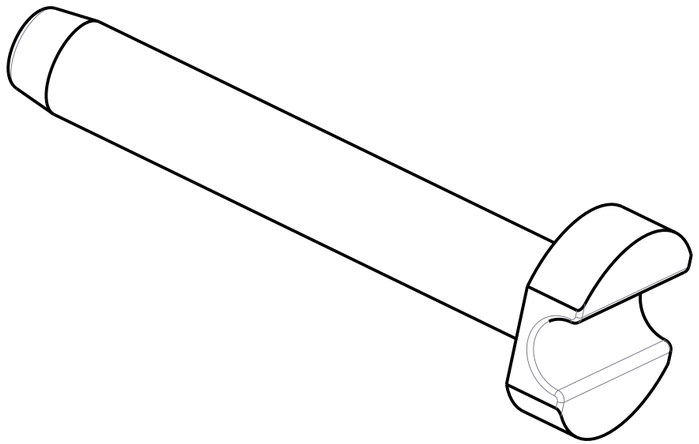
SIZE B	DWG NO. 18-(12.7mm)-2-5		
SCALE 2/1	UNIT WT 0.000	SHEET 1 OF 1	

NOTES:-

1-SPECIFICATION ANSI Y14.5 AND ANSI B46.1 APPLY.
2-FINISH ALL OVER 125
3-HEAT TREATMENT:-LIQUID CARBURIZE AT 1550° F FOR ONE HOUR. QUENCH IN OIL.
4-MATERIAL:-STEEL-C1020 ANSI/ASTM A576.







PART NO. 18-(12.7mm)-2-6

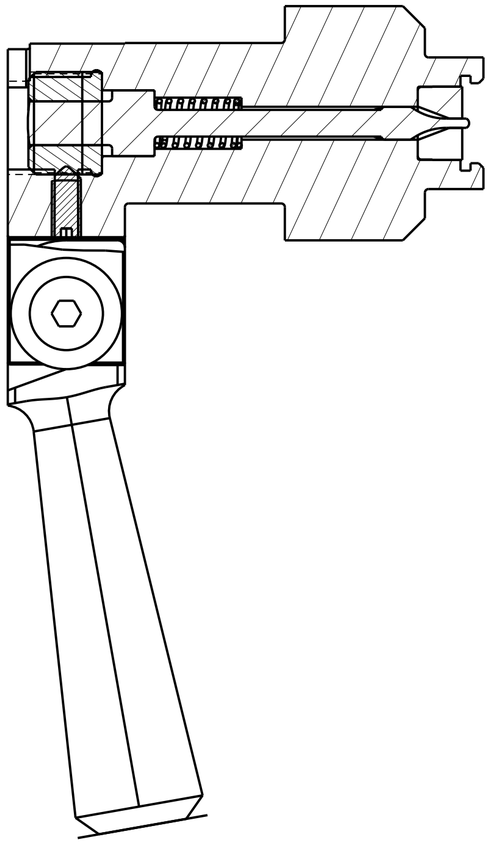
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± °
DECIMALS ± 1°
FRACTIONS ± 1/64

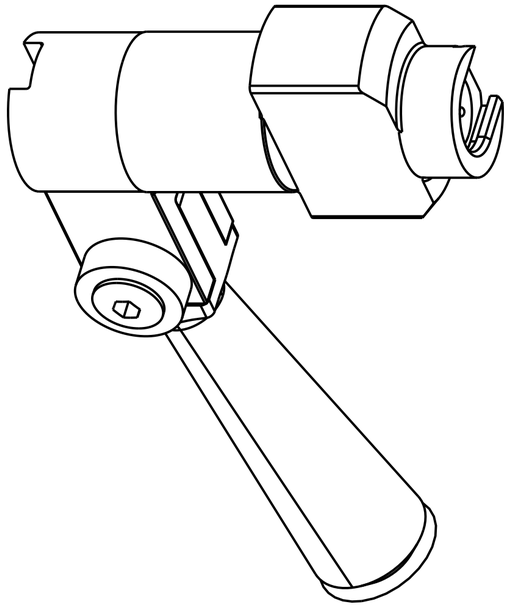
DRAWN BY J. DUEHRING	DATE (YEAR-MO-DA) 2012-03-20

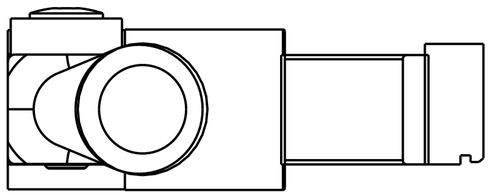
Guide, Spring, 12.7mm

SIZE	DWG NO.		
B	18-(12.7mm)-2-6		
SCALE 2/1	UNIT WT 0.000	SHEET 1 OF 1	



SECTION A-A





ITEM OR FIND NO.	QTY. REQ.	PART NO. OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
9	1	18-(12.7mm)-2-7-3	Spring, Retracting, 12.7mm
8	1	18-(12.7mm)-2-7-9	Handle, Bolt, 12.7mm
7	1	18-(12.7mm)-2-7-8	Roll Pivot, Handle, 12.7mm
6	1	18-(12.7mm)-2-7-7	Screw, Pivot, Handle, 12.7mm
5	1	18-(12.7mm)-2-7-6	Screw, 12.7mm
4	1	18-(12.7mm)-2-7-5	Bolt, 12.7mm
3	1	18-(12.7mm)-2-7-4	Plate, Recoil, 12.7mm
2	1	18-(12.7mm)-2-7-2	Bushing, Retainer, 12.7mm
1	1	18-(12.7mm)-2-7-1	Pin, Firing, Precision, 12.7mm

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY A. WALKER	DATE (YEAR-MO-DA) 2012-05-03

Bolt Assembly, Precision, 12.7mm

SIZE	DWG NO.	
C	18-(12.7mm)-2-7	
SCALE 1.000	UNIT WT 0.000	SHEET 1 OF 1

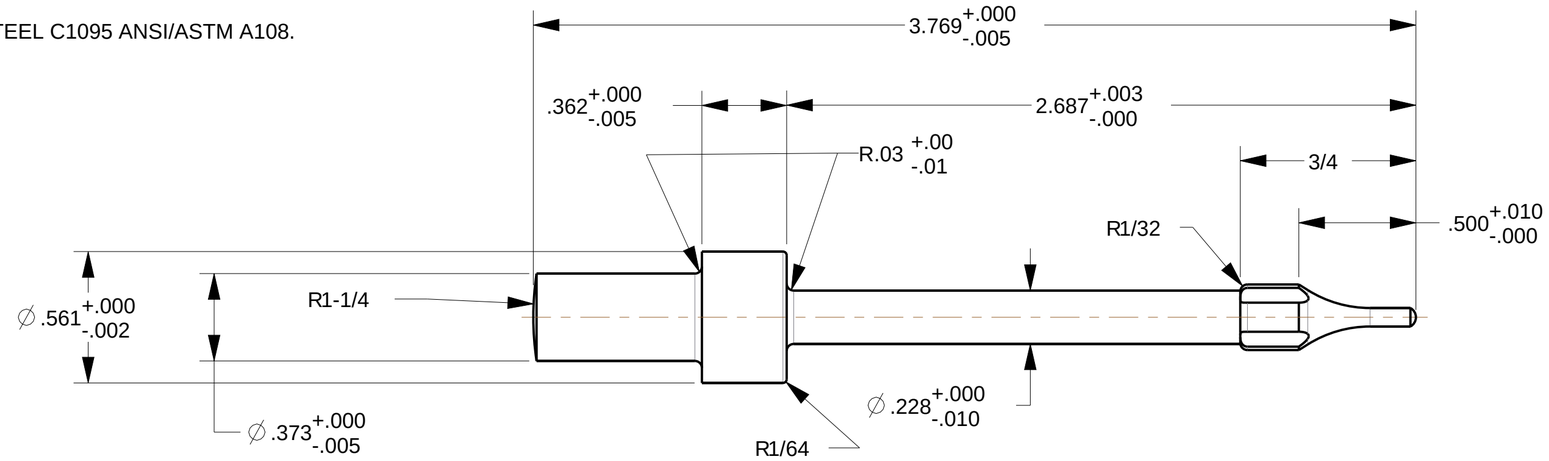
NOTES:-

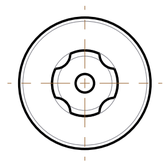
1- SPECIFICATION ANSI Y14.5 & ANSI B46.1 APPLY.

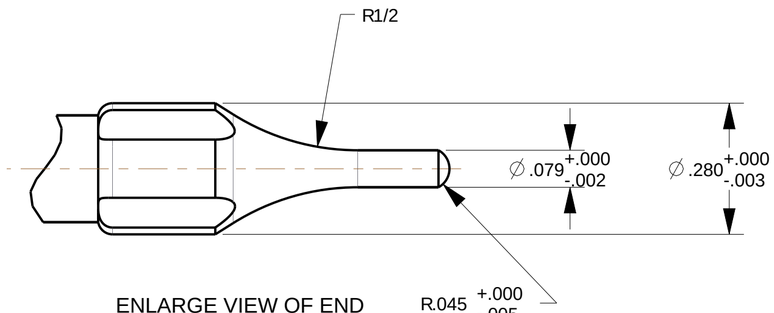
2- FINISH ALL OVER 63

3- HEAT TREATMENT:- HEAT TO 1400°F. QUENCH IN OIL.
DRAW TO DARK STRAW AT 600°F. COOL IN AIR.

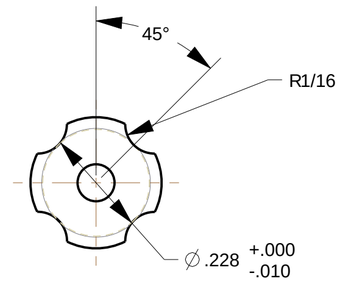
4- MATERIAL:- STEEL C1095 ANSI/ASTM A108.



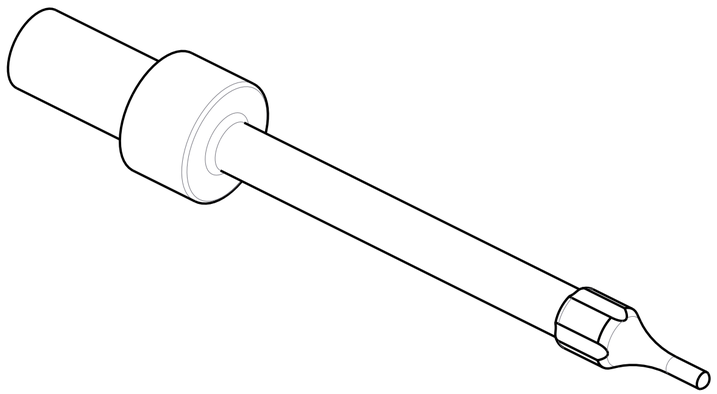




ENLARGE VIEW OF END
SCALE 4/1



ENLARGE VIEW OF END
SCALE 4/1



PART NO. 18-(12.7mm)-2-7-1

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES

TOLERANCE ON ANGLES ± 2
DECIMALS ±
FRACTIONS ± 1/64

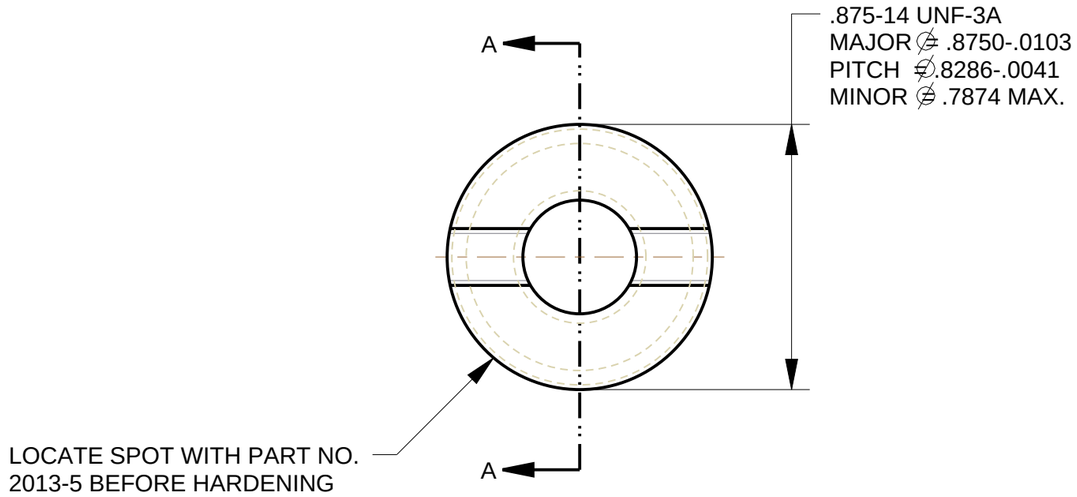
DRAWN BY J. DUEHRING	DATE (YEAR-MO-DA) 2012-04-06

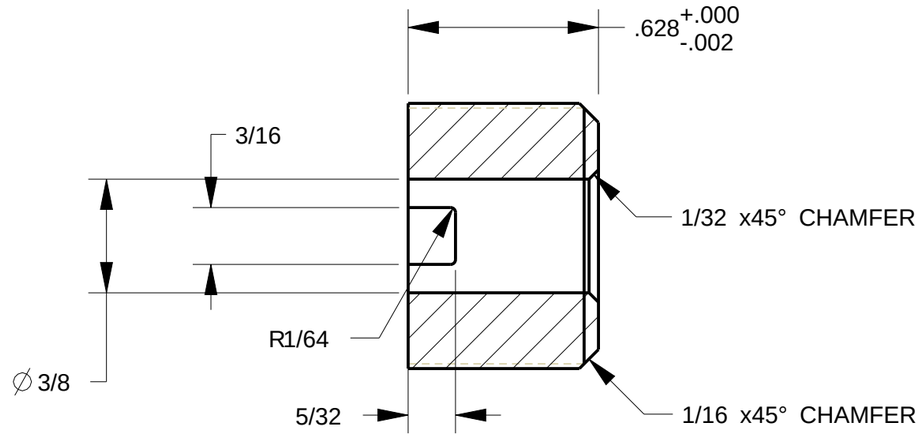
Pin, Firing, Precision, 12.7mm

SIZE	DWG NO.		
C	18-(12.7mm)-2-7-1		
SCALE 2/1	UNIT WT 0.000	SHEET 1 OF 1	

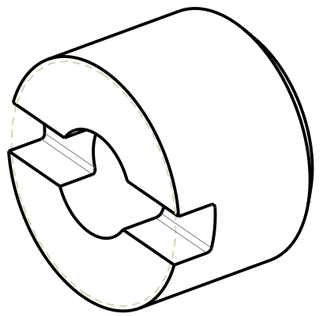
NOTES:

1- SPECIFICATIONS ANSI Y14.5, MIL-STD-9 & ANSI B46.1 APPLY
2- FINISH ALL OVER 125
3- HEAT TREATMENT:-HEAT TO 1420°F. QUENCH IN OIL.
DRAW TO MEDIUM STRAW AT 600°F. COOL IN OIL.
4- MATERIAL: STEEL C1095 ANSI/ASTM A108.





SECTION A-A



PART NO. 18-(12.7mm)-2-7-2

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± 2 DECIMALS ± FRACTIONS ±	
DRAWN BY J. DUEHRING	DATE (YEAR-MO-DA) 2012-03-09

Bushing, Retainer, 12.7mm

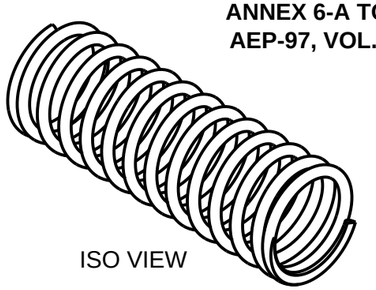
SIZE	DWG NO.	
B	18-(12.7mm)-2-7-2	
SCALE 2/1	UNIT WT 0.000	SHEET 1 OF 1

Notes:

1. SPECIFICATION ANSI Y14.5 AND ANSIB46.1 APPLY.

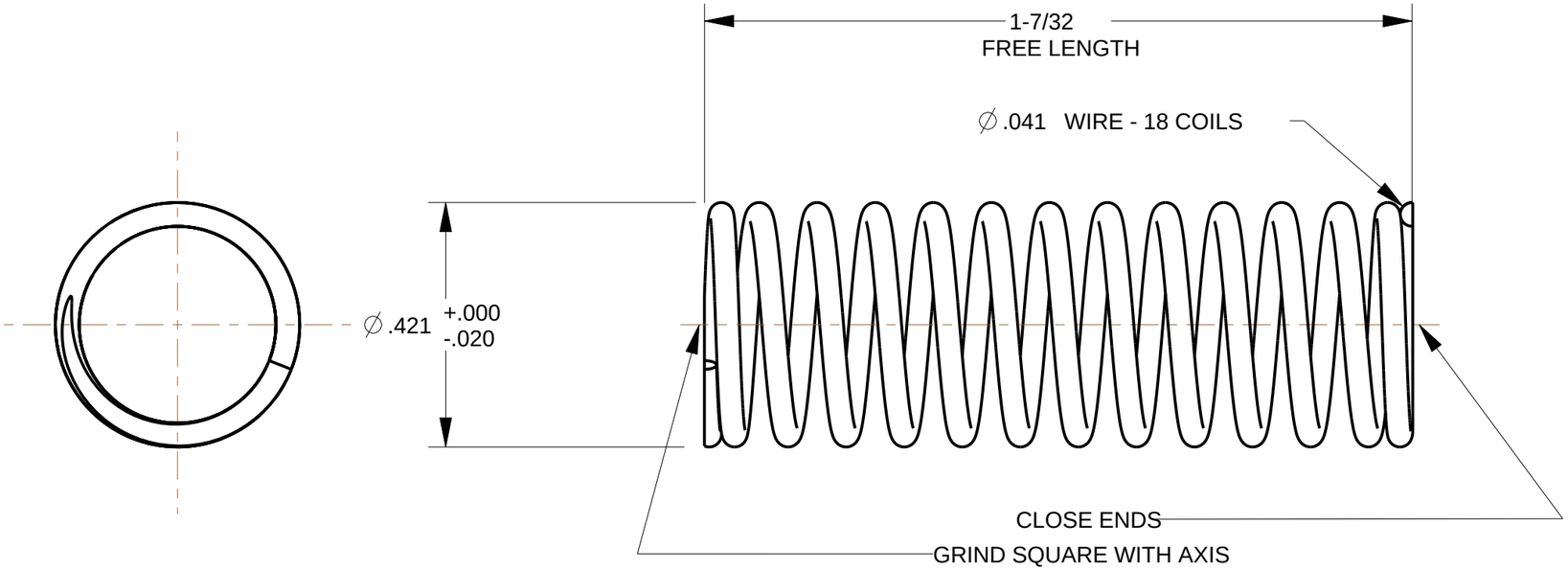
2. HEAT TREATMENT: HEAT TO 1440°F. QUENCH OIL
   DRAW TO BLUE AT 600°F COOL AIR.

3. MATERIAL: WIRE, STEEL C1095, SPECIFICATION QQ-W-470



ISO VIEW

SCALE 2/1



NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±1/64	
DRAWN BY	DATE (YEAR-MO-DA)

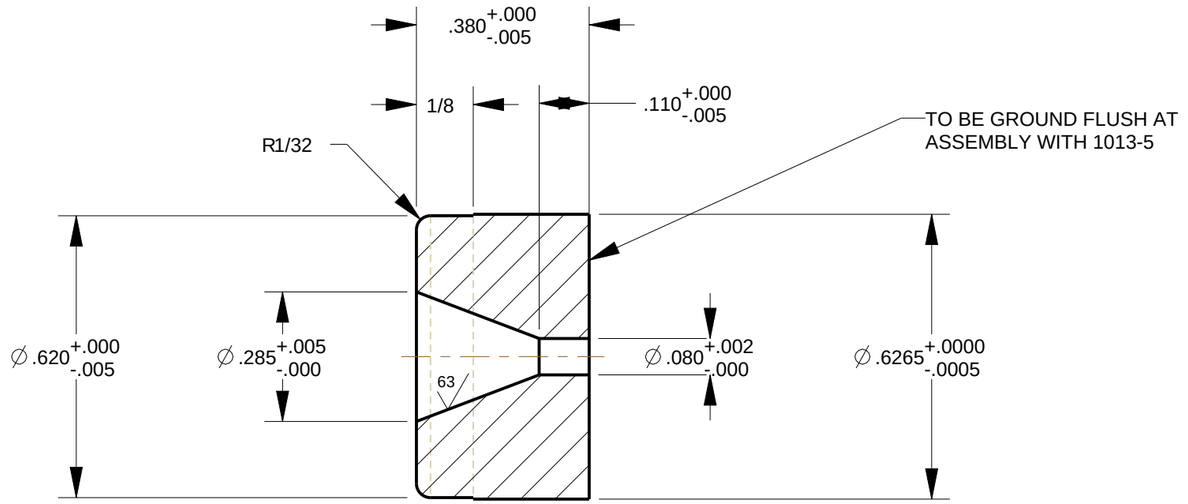
Spring, Retracting, 12.7mm

SIZE	DWG NO.	
B	18-(12.7mm)-2-7-3	
SCALE 4/1	UNIT WT 0.003	SHEET 1 OF 1

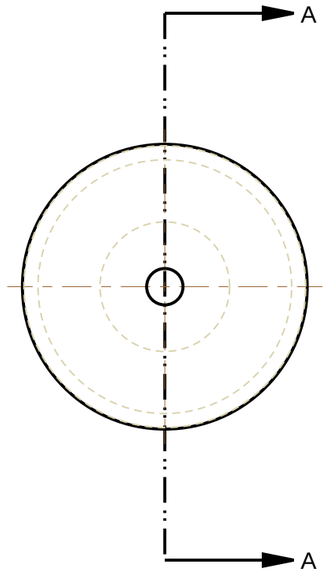
ANNEX 6-A TO:
AEP-97, VOL. 6

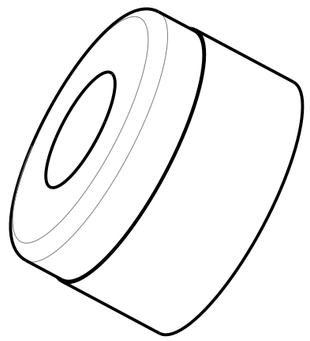
NOTES:

1. SPECIFICATION ANSI Y14.5 AND ANSI B46.1 APPLY.
2. MATERIAL:-STEEL C1095, ANSI/ASTM A108.
3. $\sqrt{^{125}}$ FINISH EXCEPT AS NOTED.
4. HEAT TREATMENT:-HEAT TO 1420°F. QUENCH IN OIL.
   DRAW TO MEDIUM STRAW AT 600°F. COOL IN OIL.
5. LEAVE O.D. OVERSIZE AND GRIND (AFTER HEAT TREATING) TO
   FINAL DIMENSION CONCENTRIC (WITHIN .001) WITH .080+.002 HOLE.



SECTION A-A





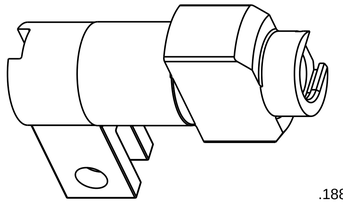
NEXT ASSY	USED ON
APPLICATION	

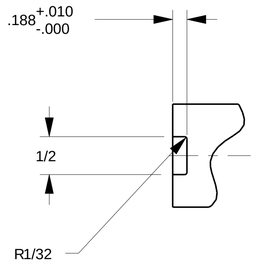
UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ± °
DECIMALS ±
FRACTIONS ± 1/64

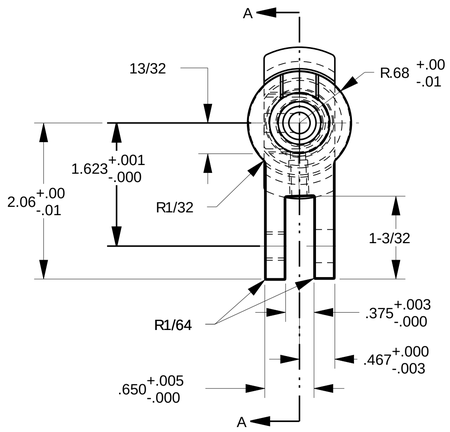
DRAWN BY	DATE (YEAR-MO-DA)
J. DUEHRING	2012-04-20

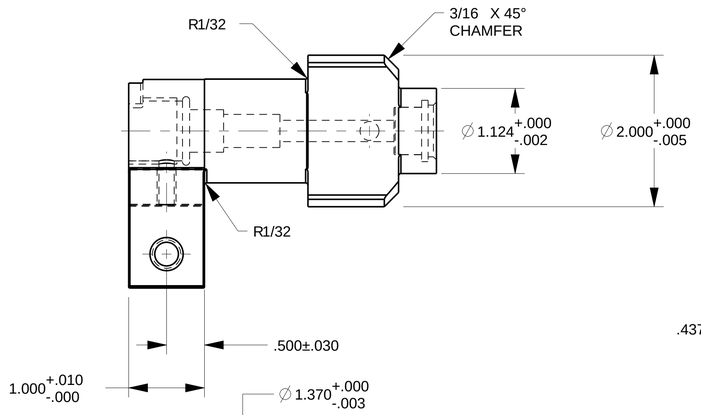
Plate, Recoil, 12.7mm

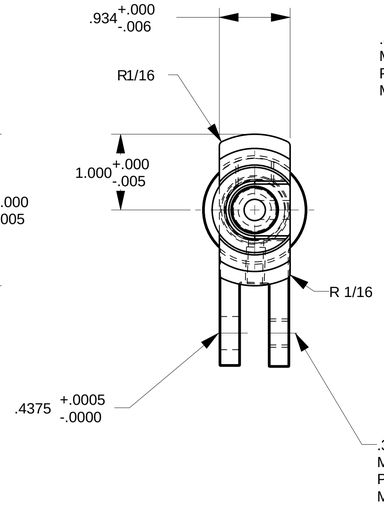
SIZE	DWG NO.		
B	18-(12.7mm)-2-7-4		
SCALE 3/1	UNIT WT 0.000	SHEET 1 OF 1	

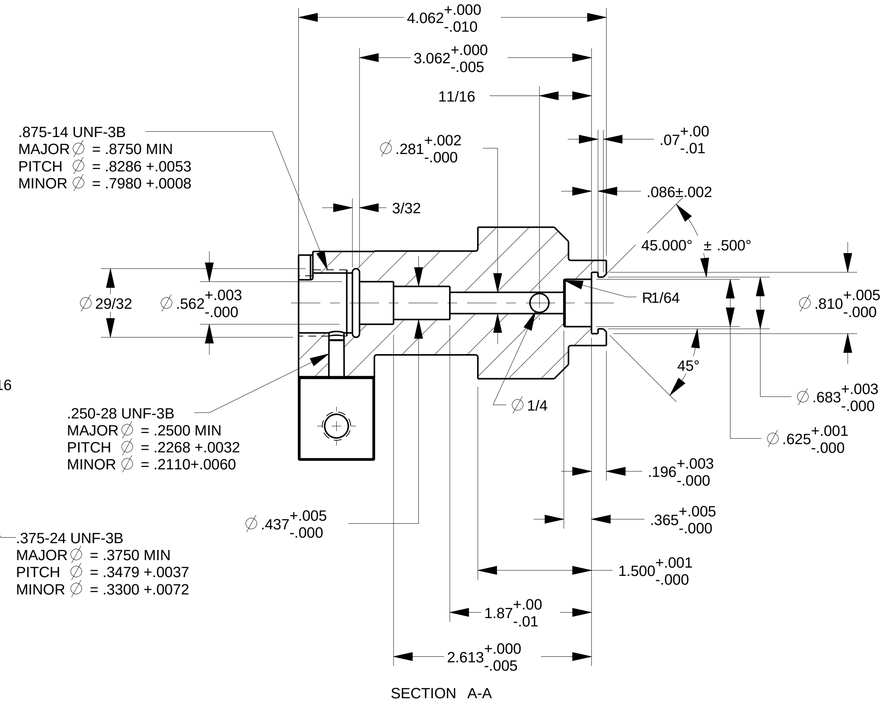




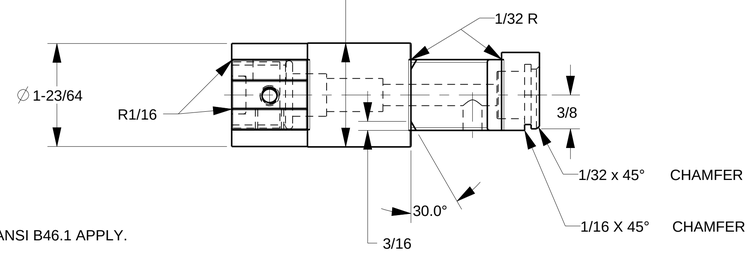








SECTION A-A



NOTES:

1. SPECIFICATION ANSI Y14.5, MIL-STD-9 & ANSI B46.1 APPLY.
2. FINISH ALL OVER 125
3. HEAT TTREATMENT: LIQUID CARBURIZE AT 1550°F. FOR 1 1/2 HOURS QUENCH IN OIL.
4. REMOVE ALL SHARP EDGES.
5. MATERIAL: STEEL C1020 PER ANSI ASTM A576.

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± 2 DECIMALS ± - FRACTIONS ±1/64	
DRAWN BY A. WALKER	DATE (YEAR-MO-DA) 2012-04-04

Bolt, 12.7mm

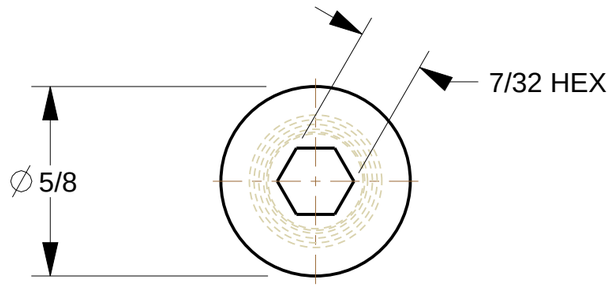
SIZE	DWG NO.
D	18-(12.7mm)-2-7-5
SCALE 1/1	UNIT WT 0.000
	SHEET 1 OF 1

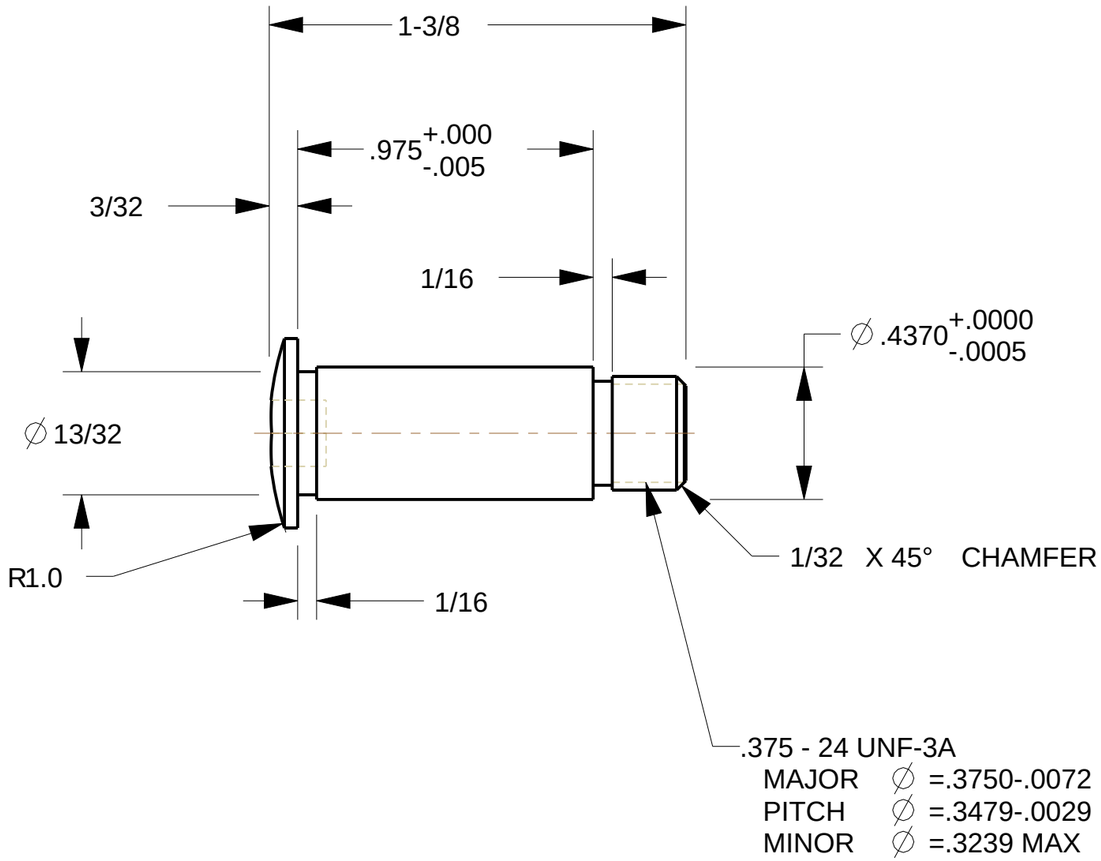
NOTES:

1. SPECIFICATION ANSI Y14.5 MIL-STD-9 AND ANSI B46.1 APPLY.

2. FINISH ALL OVER 63.

3. MATERIAL-STEEL C1020 ANSI/ASTM A575.





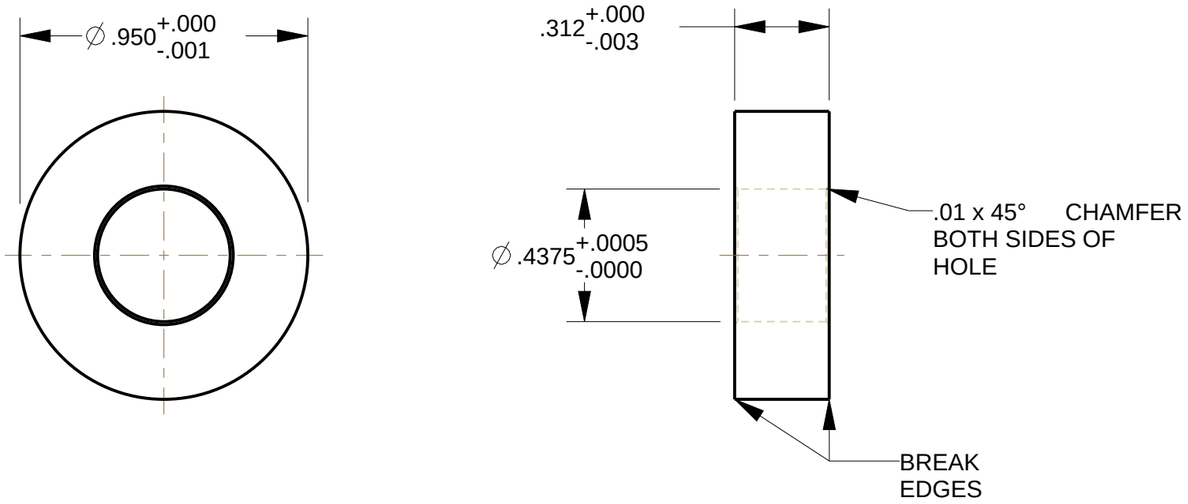
NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY GJC	DATE (YEAR-MO-DA) 2012-06-14

Screw, Pivot, Handle, 12.7mm

SIZE	DWG NO.		
B	18-(12.7mm)-2-7-7		
SCALE 2/1	UNIT WT 0.000	SHEET 1 OF 1	

NOTES:

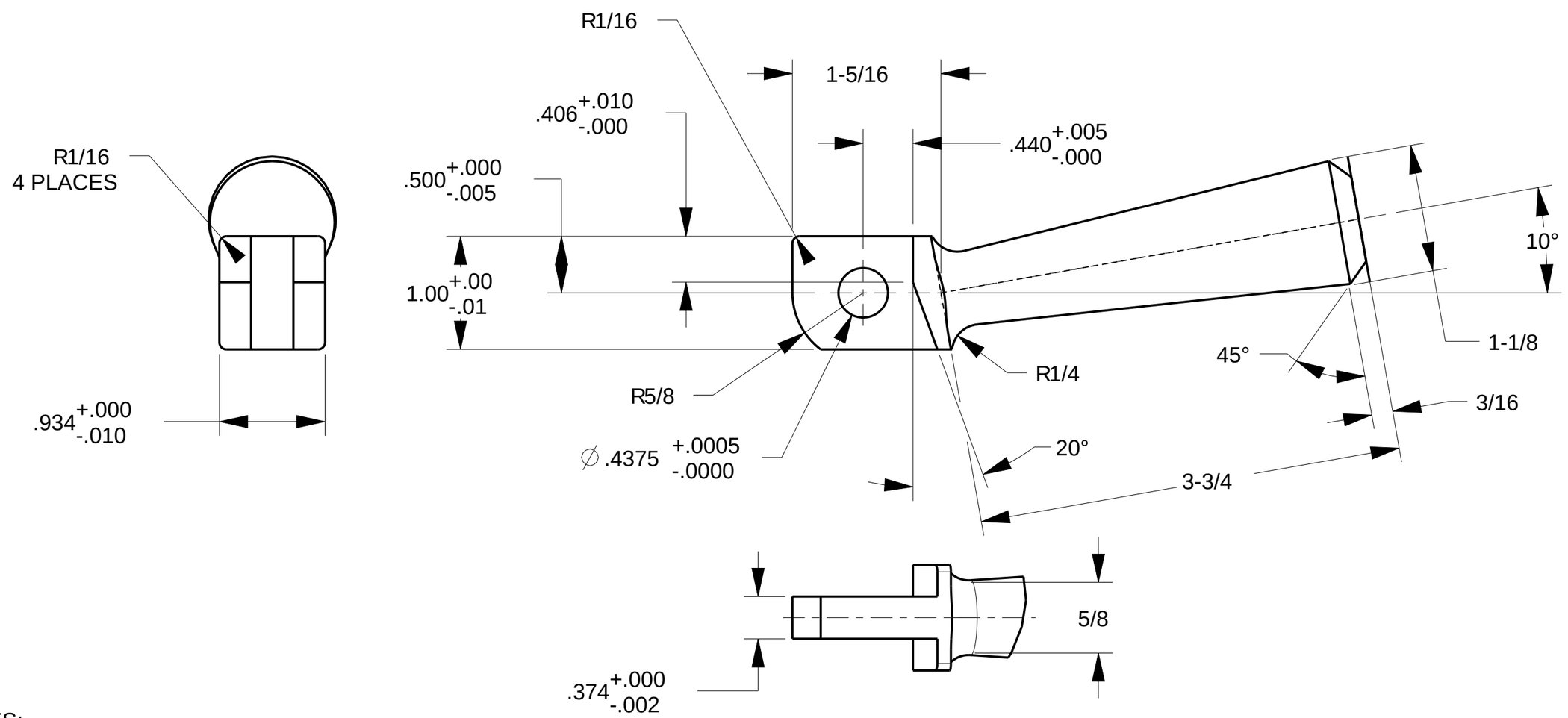
1. SPECIFICATION ANSI Y14.5 AND ANSI B46.1 APPLY.
2. FINISH ALL OVER 125 ∨.
3. HEAT TREATMENT: HEATTO 1400°F QUENCH IN WATER.
   DRAW TO LIGHT STRAW AT 600°F COOL IN AIR.
4. MATERIAL: STEEL C1095 ANSI / ASTM A108.



NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY GJC	DATE (YEAR-MO-DA) 2012

Roll Pivot, Handle, 12.7mm

SIZE	DWG NO.		
B	18-(12.7mm)-2-7-8		
SCALE 2/1	UNIT WT 0.000	SHEET 1 OF 1	



NOTES:

1. SPECIFICATION ANSI Y14.5 & ANSI B46.1 APPLY.
2. FINISH ALL OVER 125
3. HEAT TREATMENT: LIQUID CARBURIZE AT 1550° FOR ONE HOUR. QUENCH IN OIL.
4. BREAK ALL SHARP EDGES.
5. MATERIAL: STEEL C1020 ANSI/ASTM A576

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± ° DECIMALS ± FRACTIONS ±	
DRAWN BY B. GUNTHER	DATE (YEAR-MO-DA) 2012-04-04

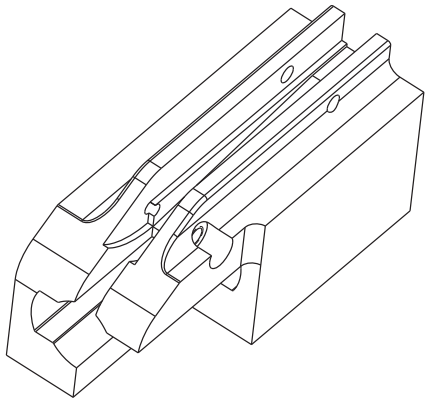
Handle, Bolt, 12.7mm

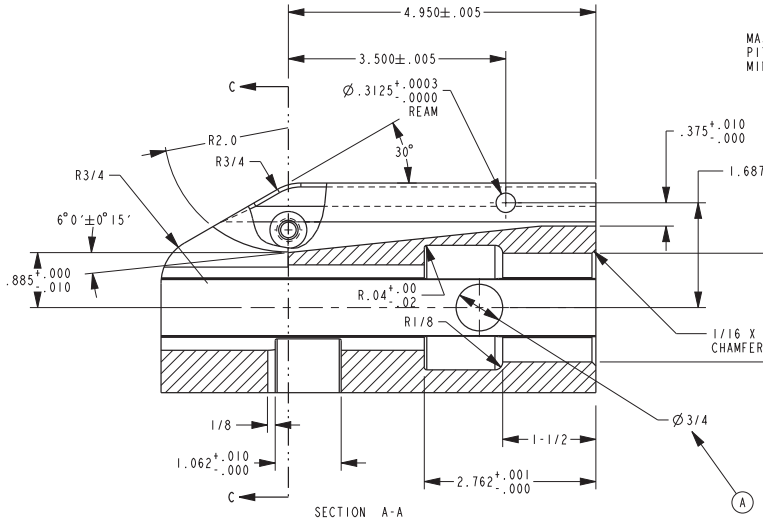
SIZE	DWG NO.	
B	18-(12.7mm)-2-7-9	
SCALE 1/1	UNIT WT 0.000	SHEET 1 OF 1

DRAWING SIZE D

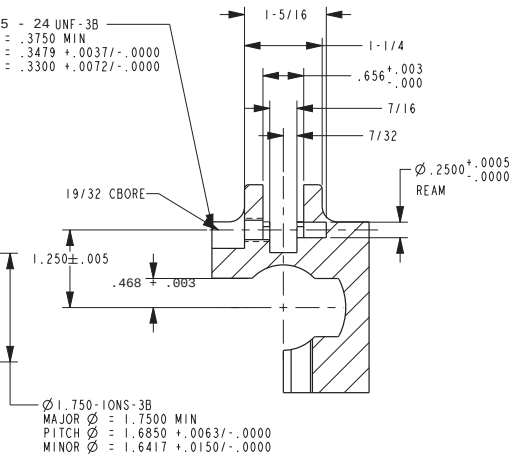
NOTES:

1. SPECIFICATION ANSI Y14.5, MIL-STD-9 AND ANSI B46.1 APPLY.
2. FINISH ALL OVER 125
3. HEAT TREATMENT: LIQUID CARBURIZE AT 1550°F FOR 1 1/2 HOURS QUENCH VERTICALLY IN OIL (STATIC LINE BETWEEN 300° AND 400°F) TO ELIMINATE DISTORTION.
4. REMOVE ALL SHARP EDGES.

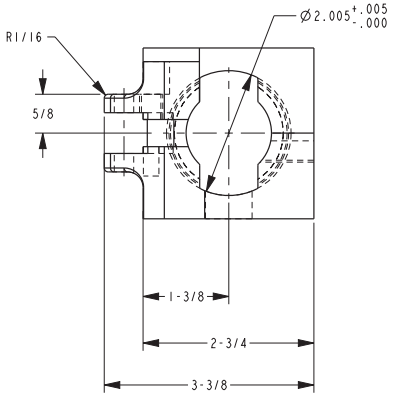


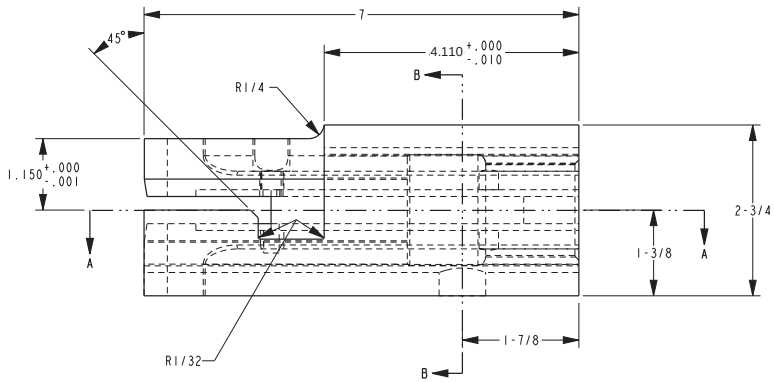


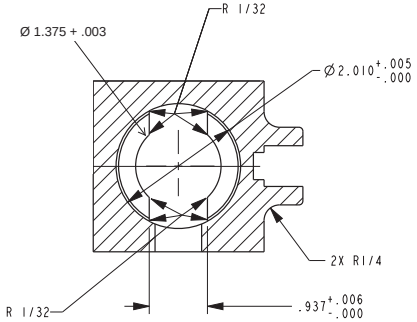
SECTION A-A



SECTION C-C







SECTION B-B

	(REQUIRED)	
NEXT ASSY	USED ON	
APPLICATION		

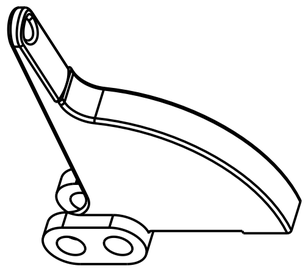
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLES ±2 °
DECIMALS ±
FRACTIONS ± 1/64

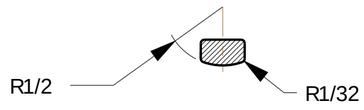
Receiver, Precision, 12.7mm

SIZE	DWG NO.
D	18-(12.7mm)-2-8

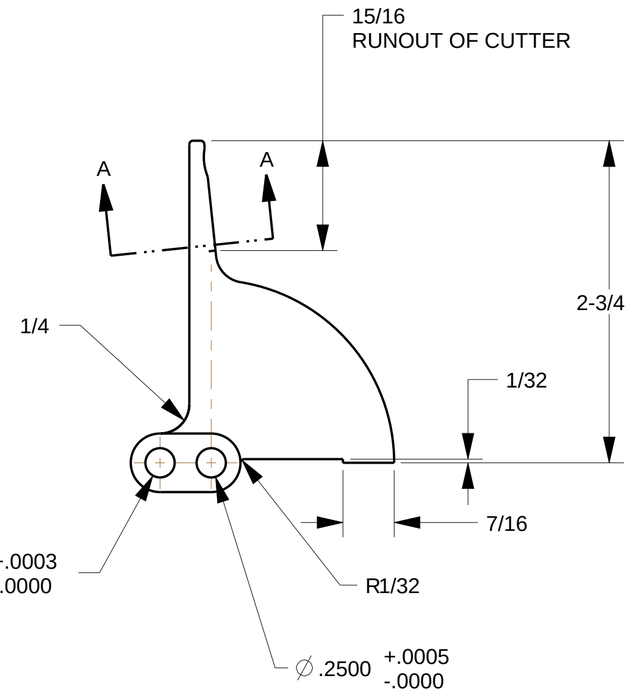
DRAWN BY	DATE (YEAR-MO-DA)	SCALE	UNIT WT	SHEET
A. WALKER	2012-03-22	1/1	0.000	1 OF 1

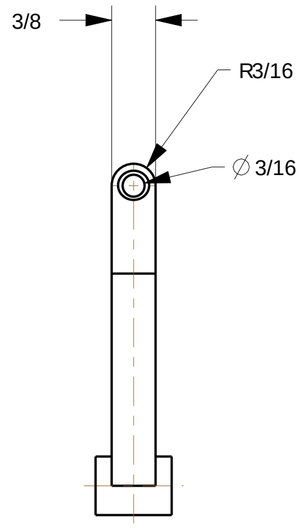
FORMAT: D_NATO_TESTEQUIP

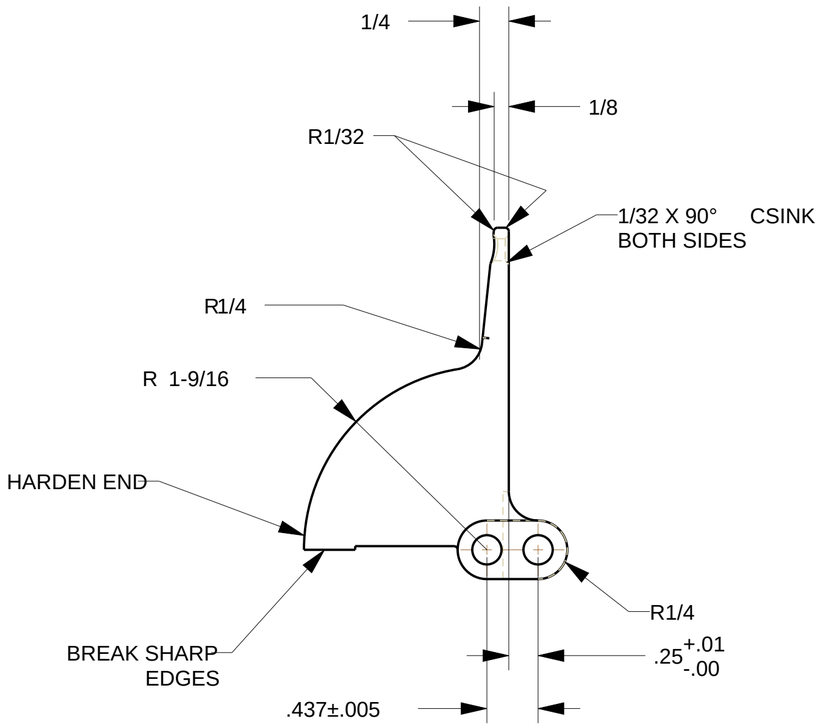


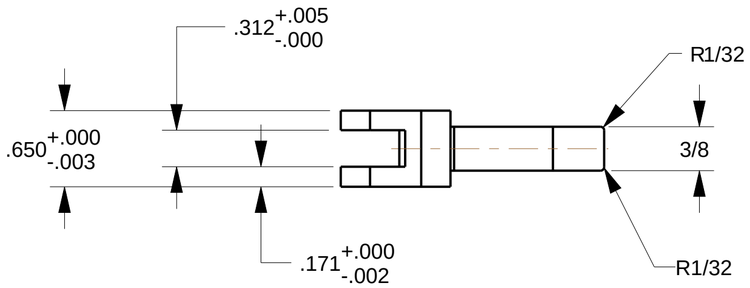


SECTION A-A









NOTES:

1. SPECIFICATION ANSI Y14.5 AND ANSI B46.1 APPLY.
2. FINISH ALL OVER 125
3. HEAT TREATMENT: HEAT TO 1430°F. QUENCH WORKING END IN BRINE AT 75°-80°F. DRAW TO LIGHT STRAW AT 600°F. COOL IN OIL.

NEXT ASSY	USED ON
APPLICATION	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCE ON ANGLES ± 2 DECIMALS ± FRACTIONS ± 1/64	
DRAWN BY A. WALKER	DATE (YEAR-MO-DA) 2012-03-22

Hammer, 12.7mm

SIZE	DWG NO.		
C	18-(12.7mm)-2-9		
SCALE 1/1	UNIT WT 0.000	SHEET 1 OF 1	

ANNEX 6-B

SET-UP PICTURES OF NATO TESTS

6.B.1 AEP-97, VOLUME 12 – COMBINATION ELECTRONIC PRESSURE, VELOCITY, AND ACTION TIME (EPVAT) TEST PROCEDURE

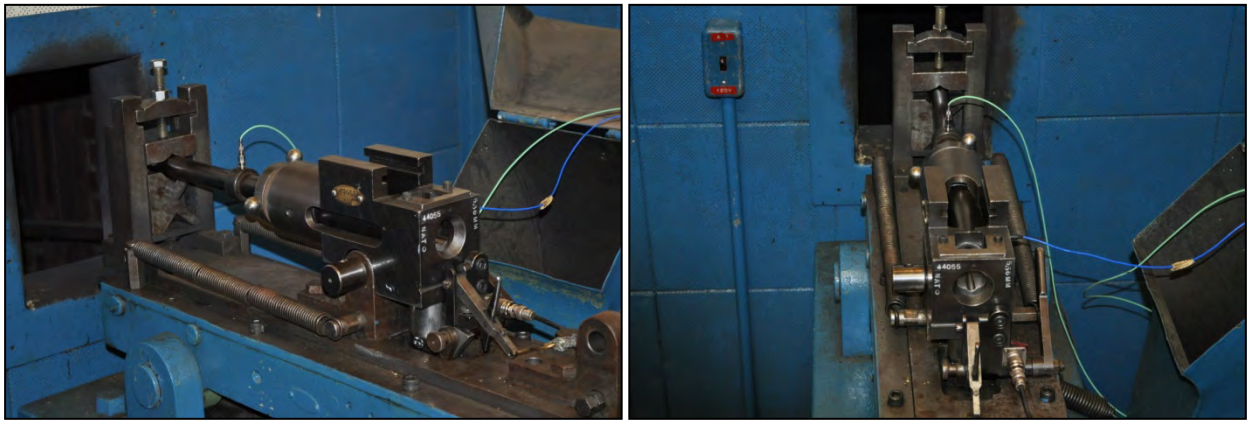


Figure. 6-B-1: Two views of the set-up for the 5.56mm EPVAT Test

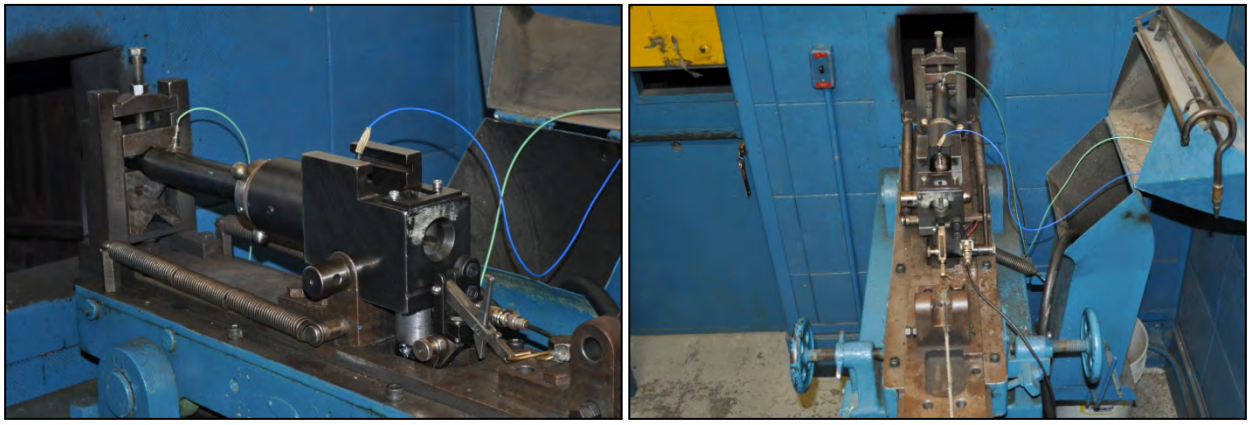


Figure. 6-B-2: Two views of the set-up for the 7.62mm EPVAT Test

6.B.1 AEP-97, VOLUME 12 – COMBINATION ELECTRONIC PRESSURE, VELOCITY, AND ACTION TIME (EPVAT) TEST PROCEDURE

Figure. 6-B-3: Two views of the set-up for the 4.6mm, 5.7mm, and 9mm EPVAT Test

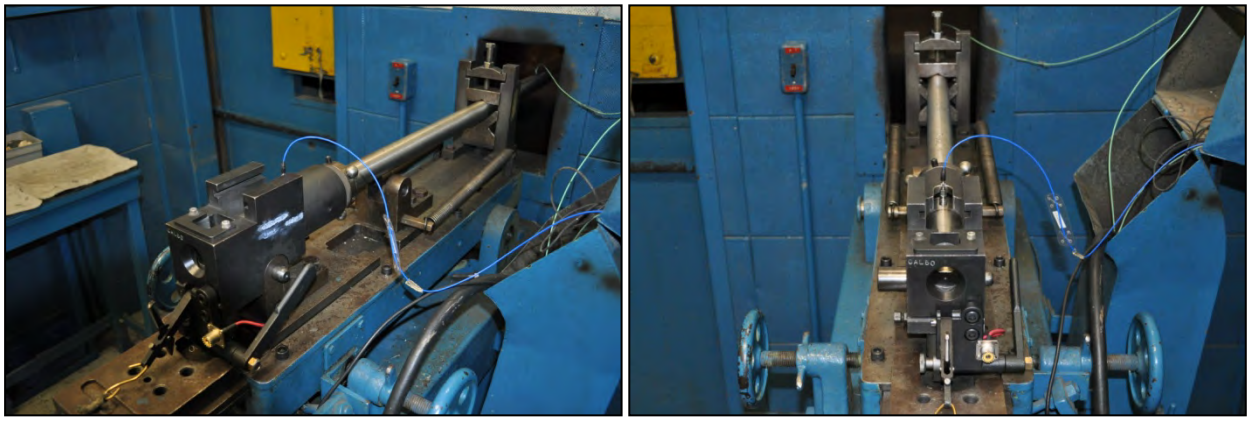


Figure. 6-B-4: Two views of the set-up for the 12.7mm EPVAT Test

6.B.2 AEP-97, VOLUME 14 – FUNCTION AND CASUALTY TEST PROCEDURE

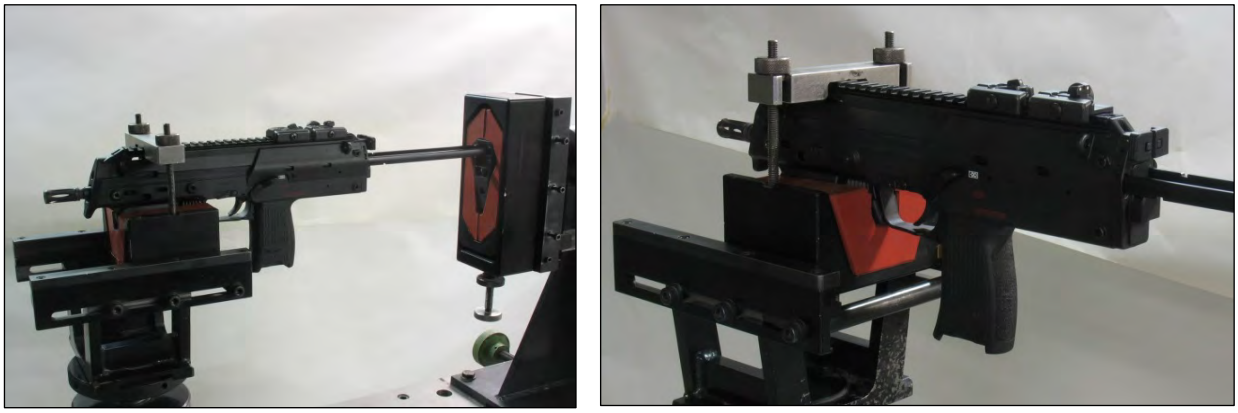


Figure. 6-B-5: Two views of the 4.6mm Function and Casualty Test with the MP7 Sub-Machine Gun

Figure. 6-B-6: Two views of the 5.56mm NATO Chute portion of the Function and Casualty Test with the MINIMI Mk1 Machine Gun

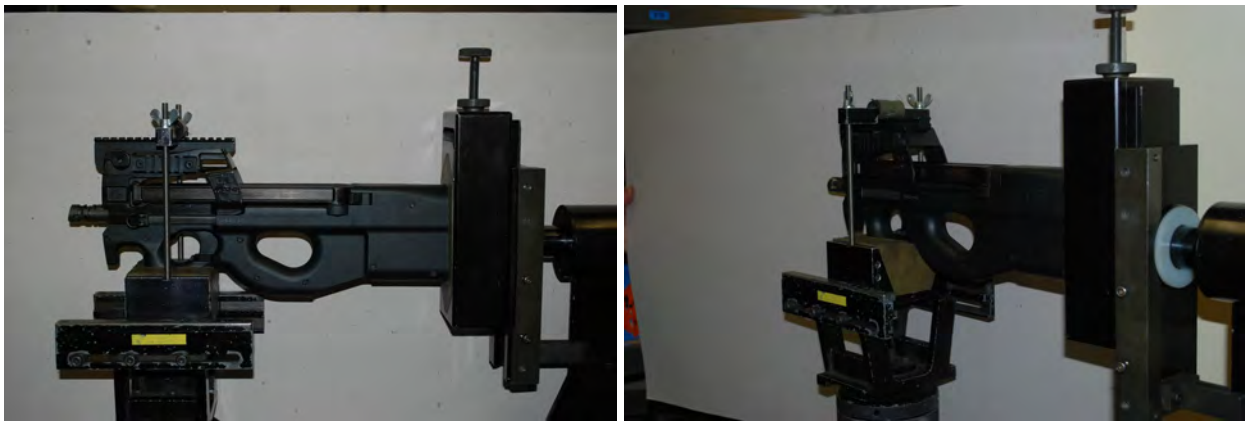


Figure. 6-B-6a: Two views of the 5.7mm Function and Casualty Test with the P90 Sub- Machine Gun

6.B.2 AEP-97, VOLUME 14 – FUNCTION AND CASUALTY TEST PROCEDURE

Figure. 6-B-6b: Two views of the 5.7mm Function and Casualty Test with the Five-seveN Pistol

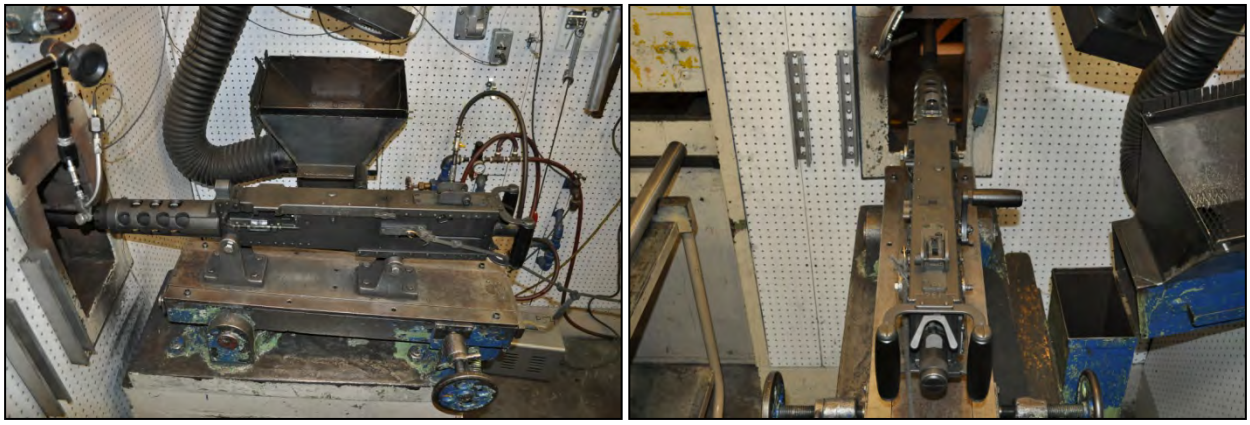


Figure. 6-B-7: Two views of the 12.7mm Function and Casualty Test with the M2HB Machine Gun

6.B.3 AEP-97, VOLUME 18 – PRECISION TEST PROCEDURE

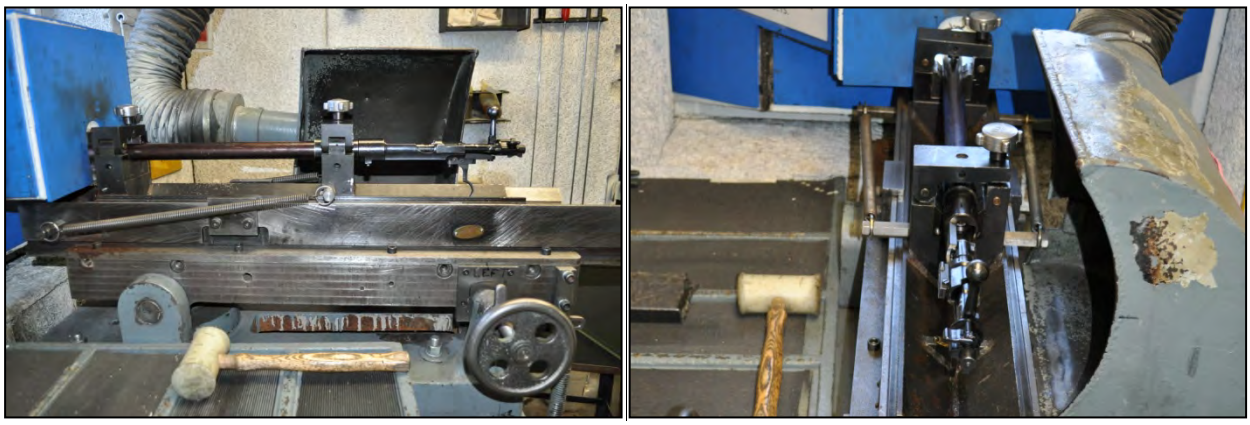


Figure. 6-B-8: Two views of the set-up for the 5.56mm Precision Test

Figure. 6-B-8a: Two views of the set-up for the 5.7mm Precision Test

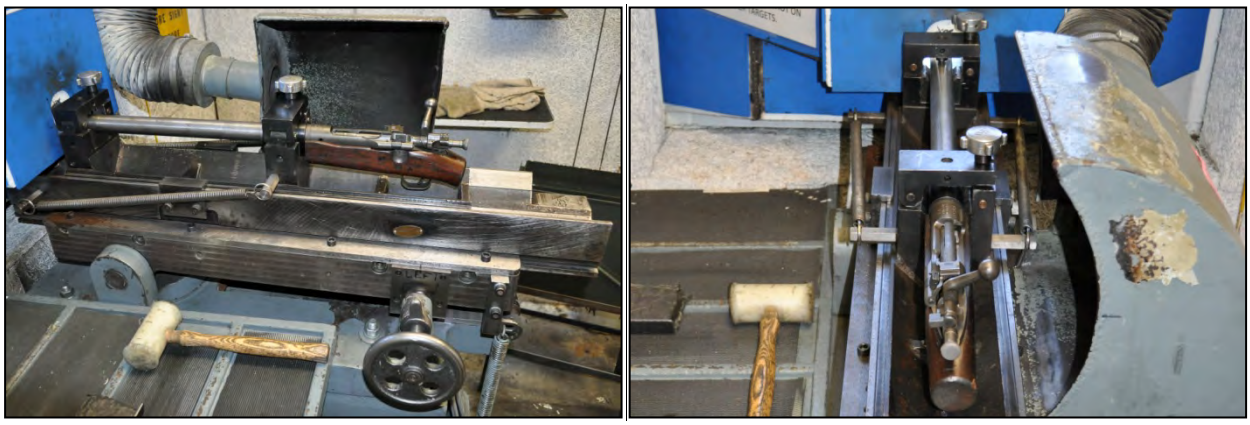


Figure. 6-B-9: Two views of the set-up for the 7.62mm Precision Test

6.B.3 AEP-97, VOLUME 18 – PRECISION TEST PROCEDURE

Figure. 6-B-10: Two views of the set-up for the 4.6mm, 5.7mm and 9mm Precision Test

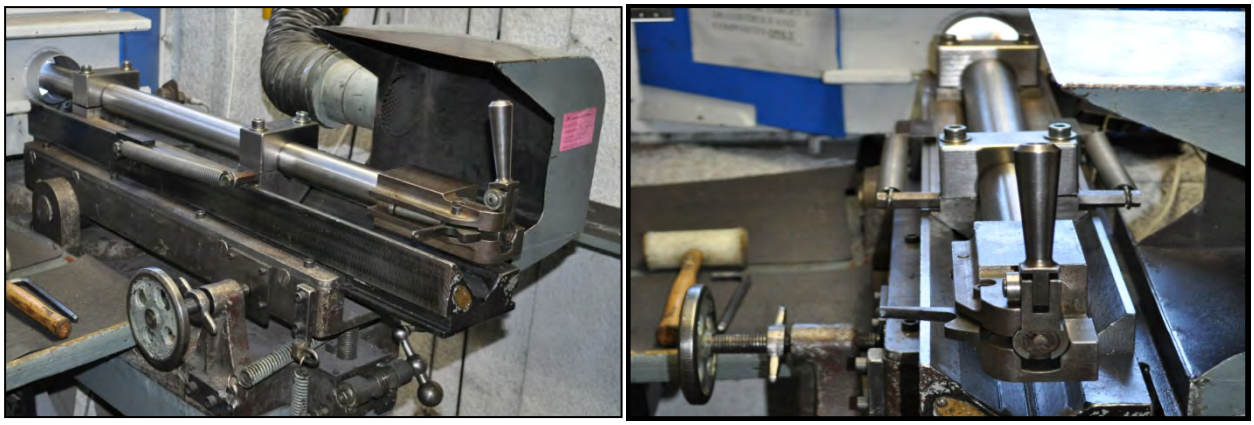


Figure. 6-B-11: Two views of the set-up for the 12.7mm Precision Test

6.B.4 AEP-97, VOLUME 19 – TERMINAL EFFECTS

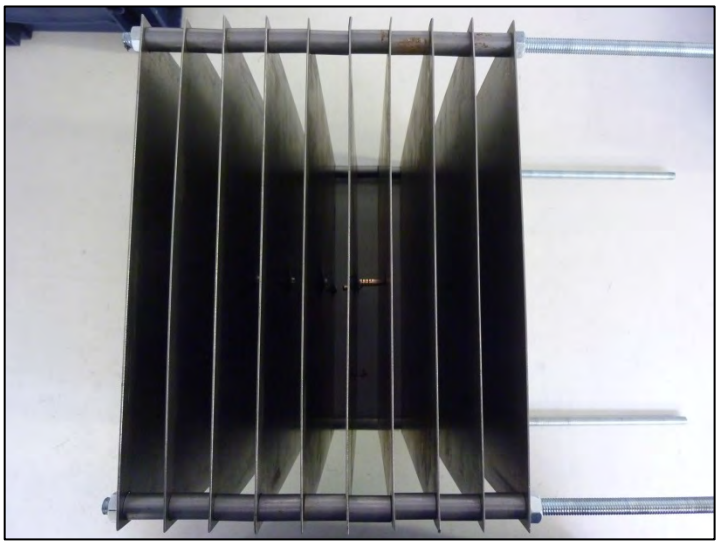


Figure. 6-B-12: A view of the multiple target array for the 4.6mm and 5.7mm Terminal Effects Test with ten (10) mounted and separated steel plates

6.B.5 AEP-97, VOLUME 22 – TRACE TEST PROCEDURE

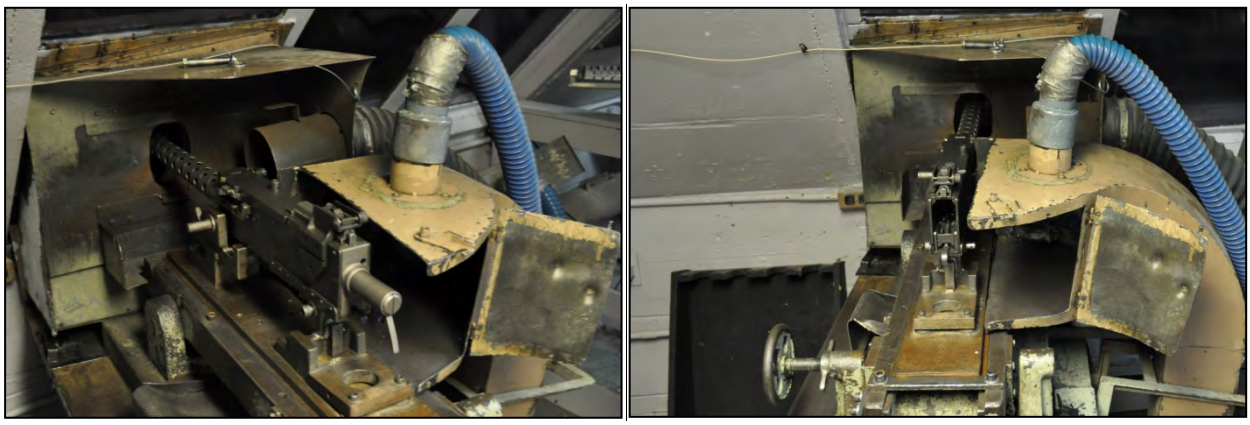


Figure. 6-B-13: Two views of the set-up for the 7.62mm Trace Test with the T65E1 Machine Gun

6.B.6 AEP-97, VOLUME 24 – PRIMER SENSITIVITY TEST PROCEDURE

Figure. 6-B-14: Two views of the Primer Sensitivity Test Fixture

ANNEX 6-C

VISUAL STANDARDS OF PRODUCTION DEFECTS

No.#	APPLICABLE CARTRIDGE	4.6mm	5.7mm	5.56mm	7.62mm	9mm	12.7mm
	CARTRIDGE						
1.	Discolored, Dirty, Oily, Smeared (Waterproofing)	X	X		X		X
2.	Corroded or Stained	X	X	X	X	X	X
3.	Mixed Ammunition Types (Not Illustrated)	X	X	X	X	X	X
	CASE						
4.	Round Head	X	X	X	X	X[1]	X
5.	Dent (Case)	X	X	X	X	X	X
6.	Split Case	X	X	X	X	X	X
6A.	Incipient Split (Steel Cases)						X
7.	Perforated Case	X	X	X	X		X
8.	Draw Scratch	X	X	X	X	X	X
9.	Scratch (Case)	X	X		X		X
10.	Beveled Underside of Head	X	X	X	X	X	X
11.	Case Mouth not Crimped in Cannelure			X	X	X[2]	X
12.	Scaly Metal (Case)	X	X	X	X	X	X
13.	No Chamfer on Head (Rim)	X	X	X	X	X[3]	X
14.	Fold	X	X		X		X
15.	Wrinkle	X	X		X		X
16.	Buckle	X	X		X		X
17.	Bulge	X	X		X		X
18.	Illegible or Missing Head Stamp (Not Illustrated)	X	X		X		X
19.	Defective Head	X	X		X		X
20.	Defective Mouth	X	X		X		X
21.	No Visible Evidence of Mouth Anneal			X	X		X
21A.	Defective Protective Finish (Steel Cases)				X		X
	BULLET						
22.	Dent (Bullet)	X	X		X		X
23.	Scratch (Bullet)	X	X		X		X
24.	Split Bullet Jacket	X	X	X	X	X	X
25.	Loose Bullet (Not Illustrated)	X	X	X	X	X	X
26.	Missing Cannelure (Not Illustrated)				X		X
27.	Scaly Metal (Bullet)	X	X	X	X	X	X
28.	Upset (crooked) Point	X	X		X		X
29.	Exposed Steel (Clad jacket)	X	X		X	X	X
30.	Blunt Point	X	X		X		X
31.	Defective Cannelure				X		X
	PRIMER						
32.	No Primer	X	X	X	X	X	X
33.	Cocked Primer	X	X	X	X	X	X
34.	Inverted Primer	X	X	X	X	X	X
35.	Loose Primer (Not Illustrated)	X	X	X	X	X	X
36.	Nicked or Dented Primer	X	X		X		X
37.	No Waterproofing (Primer pocket joint)	X	X		X		X
38.	Defective Crimp	X	X		X		X
39.	Double Primer (Not Illustrated)					X	

Note 1: 9mm, Excessive Radius on Head.
Note 2: 9mm, Mouth not Coned.
Note 3: 9mm, No Radius on Head.

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

a b c d e f g h i

[---------- Minor ----------] [---------- Permissible ----------]

No. 1. Discoloured, Dirty, Oily, Smeared (Waterproofing)

a) Dirty
b) Discoloured
c) Smeared Identification Paint
d) Smeared Primer Waterproofing
e) Dirty Cartridge Cases
f) Dirty Cartridge Cases
g) Smeared Primer Waterproofing
h) Permissible/Acceptable
i) Permissible/Acceptable

[---------- Major ----------] [--- Permissible ---]

No. 2. Corroded or Stained

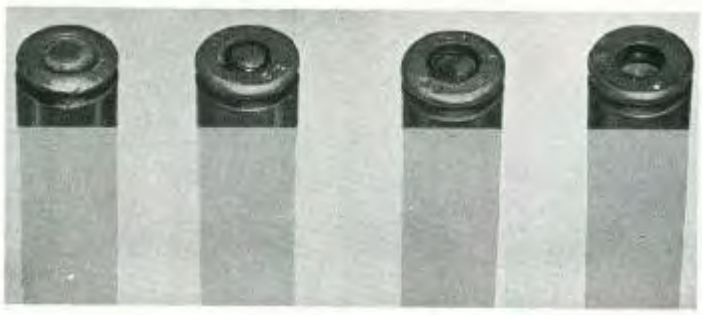
Where etching appears in stained areas, local or general, the cartridge will be classified as a major defect.

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

Not Illustrated

No. 3. Mixed Ammunition Types (Cartridge Type, incorrect)

Critical or Major depending on cartridge specification. (Also includes incorrect or poor identification)



[---------- Major ---------] [----- Permissible -----]

No. 4. Round Head

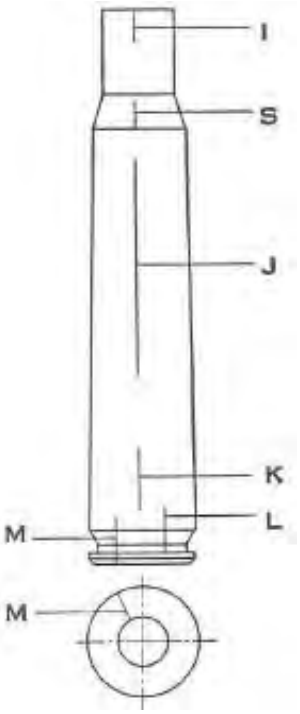
Cartridges having excessive head chamfers at any point on the circumference of the head are to be counted as Round Heads.

[---------- Major ----------] [---------- Minor ----------] [- Permissible -]

No. 5. Dent (Case)

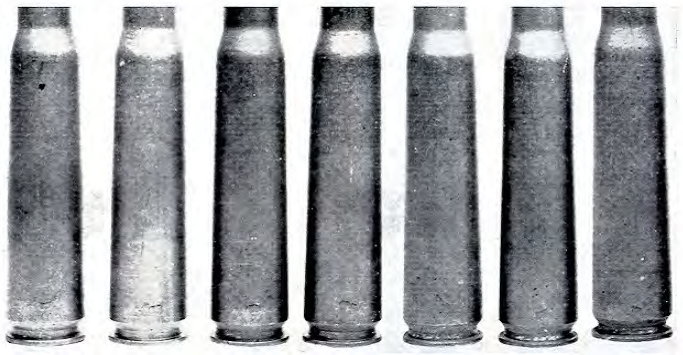
6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

[---------- Major ----------]



No. 6. Split Case

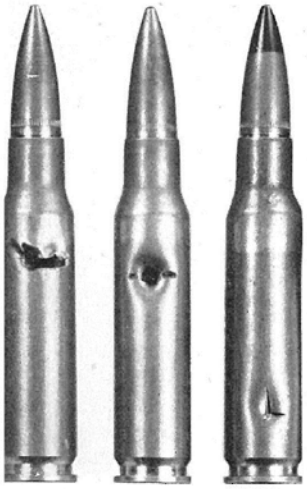
A cartridge is to be counted as defective because of a split case if the cartridge case shows a definite separation of the metal entirely through the case wall. A cartridge is to be classified either as a “major” or a “critical” defect depending on location of split. A split in the I, S, or J position shall be counted as a “major” defect when no loss of powder occurs and as a “critical” defect when loss of powder occurs. A split in the K, L, or M position shall be counted as a “critical” defect.



[--------- Major ----------] [--------- Permissible ----------]

No. 6A. Incipient Split 12.7mm Steel Case

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS



[---------- Critical ----------]

No. 7. Perforated Case

[--- Major ---] [--- Minor ---] [---- Permissible ----]

No. 8. Draw Scratch

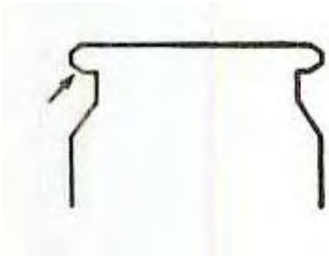
The seriousness of a draw scratch is to be determined by the depth, location, and shape of the scratch. Draw scratches which cannot be detected by the finger nail are permissible. Draw scratches which can be detected by the finger nail but do not extend in the neck section are to be counted as minor draw scratches. Draw scratches which can be detected by the finger nail and extend into the neck section are to be counted as major draw scratches.

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

[---------- Minor ----------] [Permissible]

No. 9. Scratch (Case)

[------ Major -----] [---------- Permissible ----------]



No. 10. Beveled Underside of Head

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

[---------- Major ----------]

No. 11. Case Mouth not Crimped in Cannelure

[---------- Major ----------]

No. 11. Case Mouth Not Crimped in Cannelure

A cartridge is also to be counted as defective because of case mouth not crimped in cannelure if the crimp does not extend around the entire circumference of the case mouth.

[---------- Major ----------]

No. 11. Case Mouth Not Crimped in Cannelure

[---------- Major ----------]

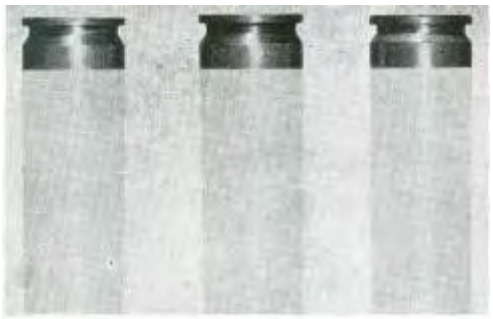
No. 11. Case Mouth Not Crimped in Cannelure (twice normal size inclined view)

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

[---------- Major ----------] [Minor] [Permissible]

No. 12. Scaly Metal (Case)

In classifying scaly metal cartridges, due consideration must be given to the depth as well as the area of the scale.



[---------- Major --------] [Permissible]

No. 13. No Chamfer on Head (Rim)

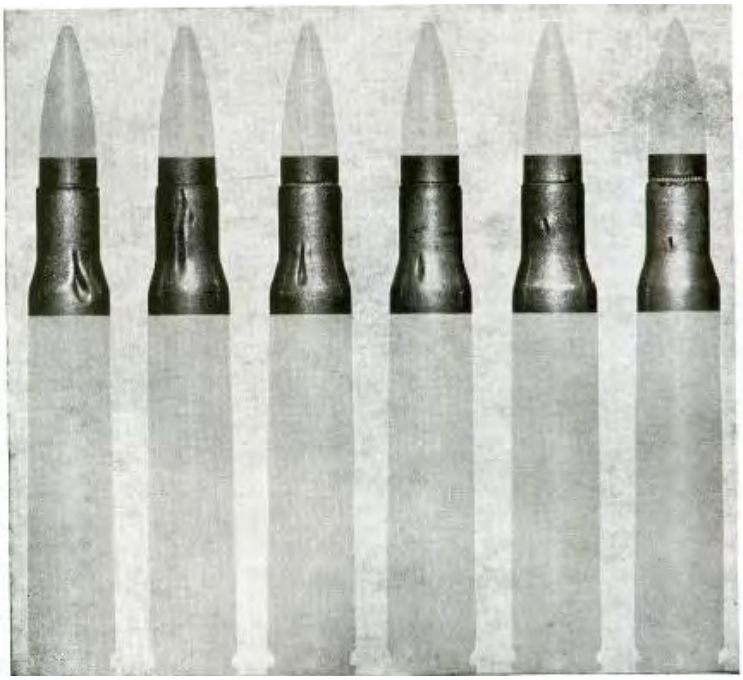
[---------- Major ----------] [-- Permissible --]

No. 13. No Chamfer on Head (Rim) (twice normal size)

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

[---------- Major ----------]

No. 13. No Chamfer on Head (Rim) (twice normal size, inclined view)



[------ Minor ------] [---------- Permissible ----------]

No. 14. Fold

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

[---------- Minor ---------] [Permissible]

No. 15. Wrinkle

[---------- Minor ----------] [Permissible]

No. 16. Buckle

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

[---------- Permissible ----------]

No. 17. Bulge

Not Illustrated

No. 18. Illegible or Missing Head Stamp

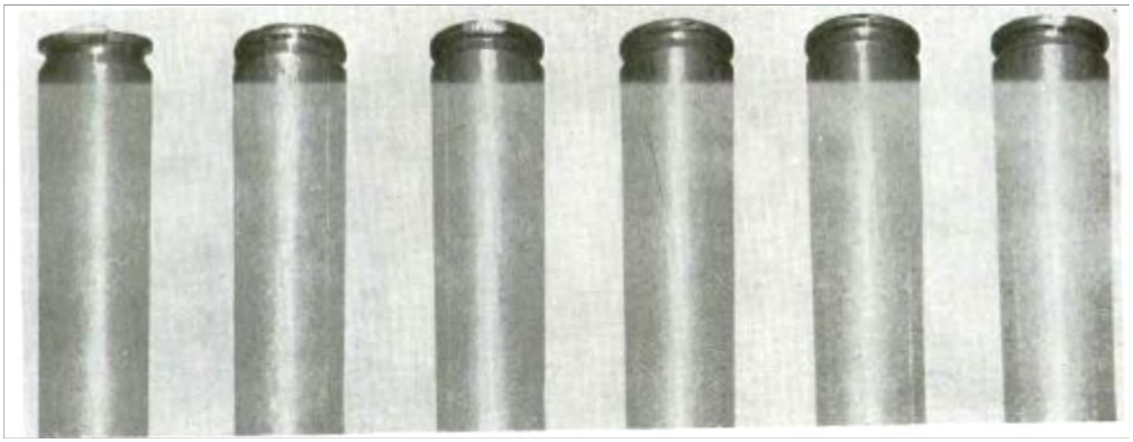
[---------- Minor ----------] [--------- Permissible ---------]

No. 19. Defective Head

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

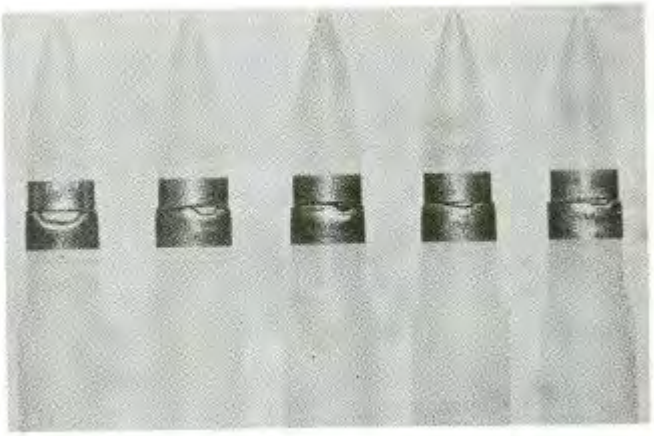
[---------- Minor ----------] [----- Permissible -----]

No. 19. Defective Head



[---------- --- Minor ------- ----------] [------- Permissible -------]

No. 19. Defective Head



[-------- Minor -------] [---------- Permissible ----------]

No. 20. Defective Mouth

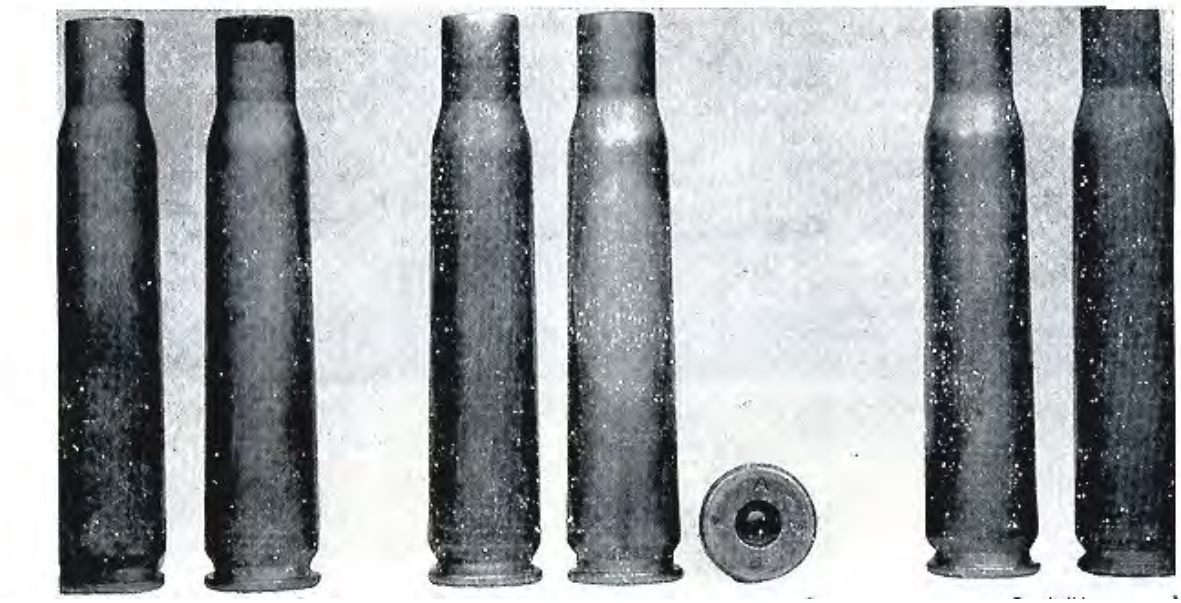
6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

[------- Major ------] [---- Permissible ----]

No. 21. No Visible Evidence of Mouth Anneal

Case Mouth and Neck Annealed Case, No Oxide Film Apparent – Major
Induction Mouth and Neck Annealed Case, No Visible Iris – Major

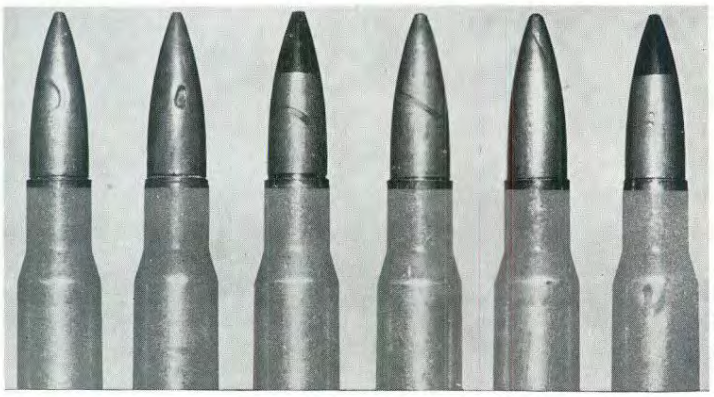
Suspect cases to be tested with approved test equipment and method. Absence of visible iris shall be considered a major defect if this hardness, when compared with the hardness taken on cartridges assembled with cases having visible evidence of mouth anneal, shows conclusively that the case has not been annealed.



[---------- Major ---------] [----------------- Minor ----------------] [----- Permissible ----]

No. 21a. Defective Protective Finish, 12.7mm Steel Case

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS



[---------- Major ----------] [- Minor -]

No. 22. Dent (Bullet)

[--------- Major ---------] [-- Minor --]

No. 23. Scratch (Bullet)

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

[---------- Major ----------]

No. 24. Split Bullet Jacket

A cartridge is to be counted as defective because of a split bullet jacket if the jacket shows a definite separation of the metal so as to expose the core or slug.

Not Illustrated

No. 25. Loose Bullet

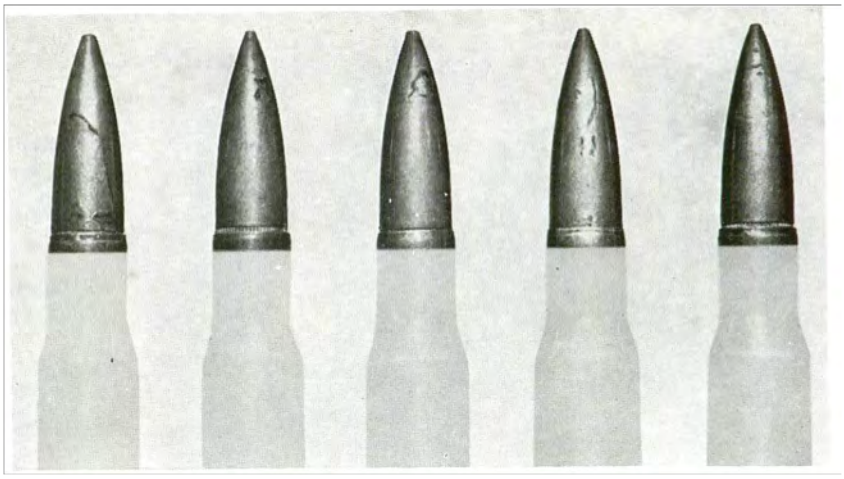
A cartridge is to be counted as a defect because of a loose bullet if the bullet can be moved relative to the case by twisting, pushing or pulling while the cartridge is held in the hand

Not Illustrated

No. 26. Missing Cannelure

The defect, missing cannelure, may be determined by pulling the bullet. However, the cartridge in question must not contain defect No. 11 – Case Mouth not crimped in Cannelure, wherein the case mouth is located above the cannelure.

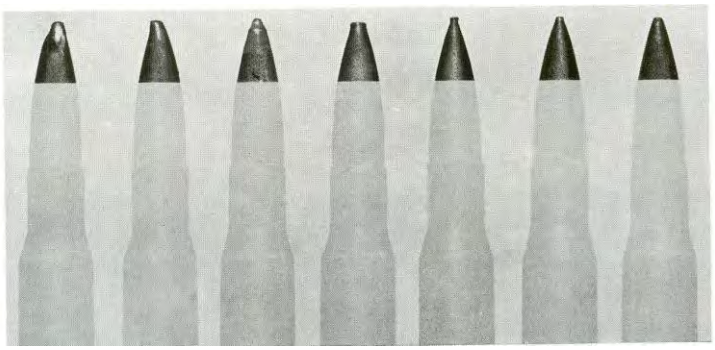
6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS



[--- Major --] [---------- Minor ---------] [----- Permissible -----]

No. 27. Scaly Metal (Bullet)

In classifying scaly metal cartridges, due consideration must be given to the depth as well as the area of the scale.



[---------- Minor ----------] [- Permissible -]

No. 28. Upset (Crooked) Point

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

[---------- Minor ----------]

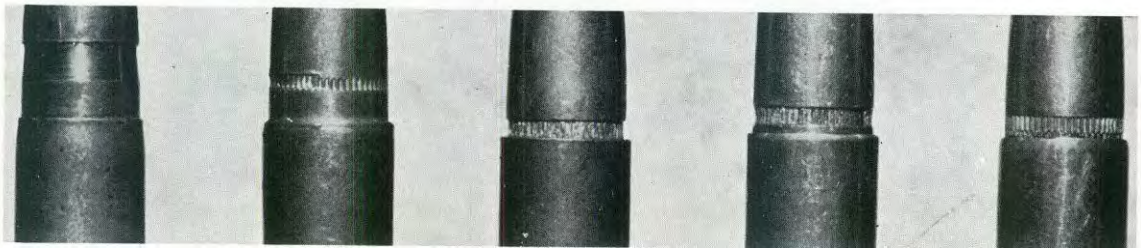
No. 29. Exposed Steel (Clad Jacket)

[----------Permissible ----------]

No. 30. Blunt Point

A cartridge is to be counted as a minor defect if point bluntness or flatness exceeds what is shown.

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS



a **b** **c** **d** **e**

[---------- Minor ----------]

No. 31. Defective Cannelure

a) Deformed Cannelure, b) Misplaced Cannelure, c) Deep and Misplaced Cannelure, d) Misplaced Cannelure, e) Double Cannelure

[Critical] [---------- Critical ----------] [Critical]

No. 32. No Primer **No. 33. Cocked Primer** **No. 34. Inverted Primer**

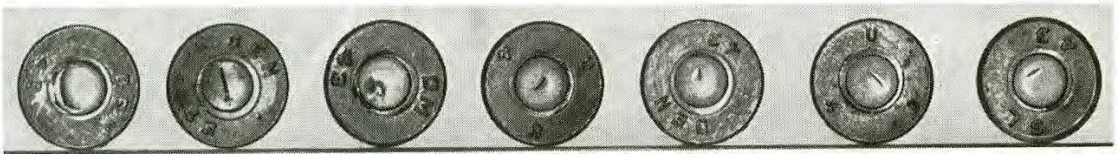
An obvious cocked primer, or a suspected cocked primer that fails to ignite the propellant is a critical defect. A suspected cocked primer that ignites the propellant is to be counted as a major defect.

Not Illustrated

No. 35. Loose Primer
Major

A cartridge is to be counted as defective because of a loose primer if the primer can be moved within the primer pocket or if the primer can be shaken or jarred from the pocket.

6.C.1 4.6mm, 5.56mm, 5.7mm, 7.62mm and 12.7mm VISUAL DEFECTS

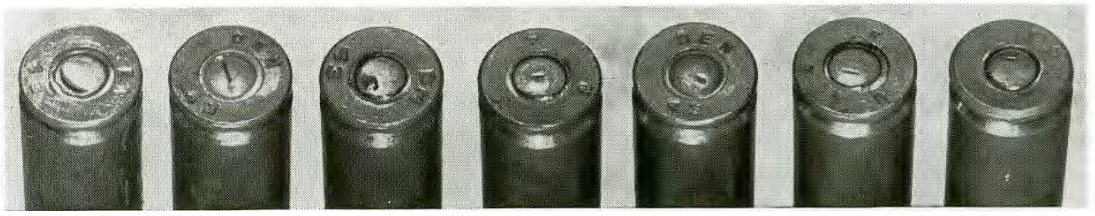


a **b** **c** **d** **e** **f** **g**

[---------- Minor ----------] [----- Permissible -----]

No. 36. Nicked or Dented Primer

a) Deformed Primer, b) Deformed Primer, c) Nicks, Extending to Edge of Primer Cup, d) Nicks in Center of Primer, e) Nicks in Center of Primer, f) Small Nicks, g) Dents



a **b** **c** **d** **e** **f** **g**

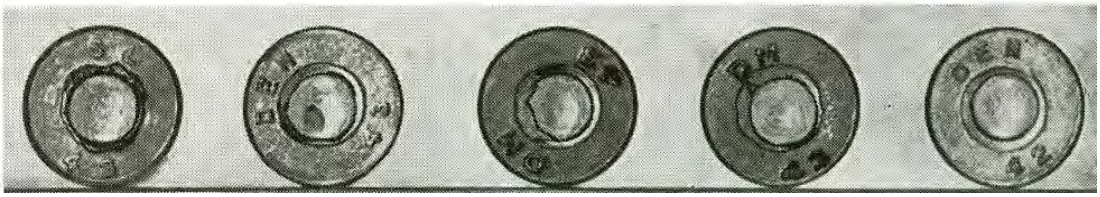
[---------- Minor ----------] [------ Permissible ------]

No. 36. Nicked or Dented Primer

a) Deformed Primer, b) Deformed Primer, c) Nicks, Extending to Edge of Primer Cup, d) Nicks in Center of Primer, e) Nicks in Center of Primer, f) Small Nicks, g) Dents

[------- Minor ------] [---------- Permissible ----------]

No. 37. No Waterproofing (Primer Pocket Joint)



[---------- Minor ----------] [---------- Permissible ----------]

No. 38. Defective Crimp

6.C.2 9mm VISUAL DEFECTS

No. 1. No Requirement

[Major] [--------- Permissible ---------]

No. 2. Corroded or Stained

Where etching appears in stained areas, local or general, the cartridges will be classified as a major defect.

Not Illustrated

No. 3. Mixed Ammunition Types (Cartridge Type, incorrect)

Critical or Major depending on cartridge specification. (Also includes incorrect or poor identification)

[---------- Major ----------] [Permissible]

No. 4. Round Head

Cartridges having excessive head chamfers at any point on the circumference of the head are to be counted as Round Heads.

6.C.2 9mm VISUAL DEFECTS

[----- Major ----] [Minor] [Permissible]

No. 5. Dent (Case)

[------- Major ------]

No. 6. Split Case

A cartridge is to be counted as defective because of a split case if the cartridge case shows a definite separation of the metal entirely through the case wall.

No. 7. No Requirement

[- Major -] [---------- Minor ----------] [Permissible]

No. 8. Draw Scratch

The seriousness of a draw scratch is to be determined by the depth, location, and shape of the scratch. Draw scratches which cannot be detected by the finger nail are permissible.

No. 9. No Requirement

6.C.2 9mm VISUAL DEFECTS

[-- Major --] [Permissible]

No. 10a. Beveled Underside of Head

[-- Major --] [Permissible]

No. 10b. Beveled Underside of Head

Not Illustrated

No. 11. Mouth Not Properly Coned

[--------- Major -------] [- Minor -] [Permissible]

No. 12. Scaly Metal (Case)

In classifying scaly metal cartridges, due consideration must be given to the depth as well as the area of the scale.

[------------------------- Major ----------------------] [-- Permissible --]

No. 13a. No Chamfer on Head (rim) (twice normal size)

6.C.2 9mm VISUAL DEFECTS

[---- Major ----] [---- Minor ----] [- Permissible -]

No. 13b. No Chamfer on Head (Rim) (twice normal size, inclined view)

[- Major -]

No. 24. Split Bullet Jacket

A cartridge is to be counted as defective because of a split bullet jacket if the jacket shows a definite separation of the metal so as to expose the core or slug.

Not Illustrated

No. 25. Loose Bullet

A cartridge is to be counted as a defect because of a loose bullet if the bullet can be moved relative to the case by twisting, pushing or pulling while the cartridge is held in the hand

No. 26. No Requirement

[------- Major ------] [------- Minor ------] [Permissible]

No. 27. Scaly Metal (Bullet)

In classifying scaly metal cartridges, due consideration must be given to the depth as well as the area of the scale.

6.C.2 9mm VISUAL DEFECTS

[Critical] [---------- Critical ----------] [Critical]

No. 32.
No Primer

No. 33.
Cocked Primer

No. 34.
Inverted Primer

An obvious cocked primer, or a suspected cocked primer that fails to ignite the propellant is a critical defect. A suspected cocked primer that ignites the propellant is to be counted as a major defect.

Not Illustrated

No. 35. Loose Primer
Major

A cartridge is to be counted as defective because of a loose primer if the primer can be moved within the primer pocket or if the primer can be shaken or jarred from the pocket.

No. 36. No Requirement

No. 37. No Requirement

No. 38. No Requirement

Not Illustrated

No. 39. Double Primer
Critical

A cartridge with two primers is to be classified as a critical defect.

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 7

SENTENCING OF DEFECTS AND INCIDENTS OCCURRING IN TESTS OTHER THAN FUNCTION AND CASUALTY

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

7.1 Applicability

This volume is to be used for the sentencing of defects and incidents, categorized in AEP-97, Volume 11 – Classification of Defects And Incidents, that have occurred in tests other than Function & Casualty during Qualification Approval, Production and Surveillance testing.

7.2 NATO Requirements

In the event that firing defects are observed in any test(s) other than the Function and Casualty Test, the following procedure shall be observed:

7.2.1 If the defect(s) observed is/are entirely classified within Category 2, Category 3 and/or Category 4, as defined in AEP-97, Volume 11, then the quantity and type(s) of such defects shall be recorded under “Remarks” on the report form for the test(s) in which the defect(s) occurred. Such defect(s) shall not constitute a basis for sentencing or retesting.

7.2.2 If any firing defect(s) observed is/are classified as a Category 1 defect, as defined in AEP-97, Volume 11, then the quantity and type(s) of such defects shall be recorded under “Remarks” on the report form for the test(s) in which the defect(s) occurred. Such defect(s) shall fail the test sample with no retest permitted.

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 8

NATO REFERENCE AMMUNITION

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

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NATO STANDARDIZATION OFFICE (NSO)

8.1 Applicability

The NATO Reference Ammunition shall meet all the requirements of this manual and the relevant standard listed in paragraph 1.1 of AEP-97. The NATO Reference Ammunition shall be used when conducting NATO Qualification Approval, Production and Surveillance Tests as listed below:

a. To establish the EPVAT ballistic and equipment corrections and confirm barrel/test set-up validity.

b. To validate barrel velocity for the Precision and Terminal Effects Tests.

c. To provide the datum point for Trajectory Match Test.

d. For weapon testing in the event of stoppages during the Function & Casualty test.

e. As a comparator for the Smoke and Flash test.

f. For investigating or checking the performance of equipment when doubt arises over the equipment performance.

In addition, the current NATO Reference Ammunition shall be used as one of the ammunition lots for testing the suitability of a proposed new or upgraded NATO Nominated Weapons in accordance with AEP-97, Volume 9.

8.1.1 Main Purpose of NATO Reference Ammunition

NATO Reference Ammunition is the baseline datum against which all ammunition submitted to NATO is standardised.

a. For EPVAT testing, the main purpose of the NATO Reference Ammunition is to allow for the correction of the results obtained during testing of ammunition in different day to day climatic conditions, through test barrels of various states of wear, back to a known datum. The known datum is the assessed values obtained from the NATO Reference Ammunition Assessment conducted with six (6) test barrels with a minimum of 500[1] cartridges fired.

b. For precision testing, the main purpose of the NATO Reference Ammunition is to check the test barrel validity back to a known datum in the event of a test failure. The known datum is the assessed values obtained from the NATO Reference Ammunition Assessment conducted with six (6) test barrels with a minimum of 500[1] cartridges fired.

Note 1: The purpose of the 500 minimum cartridges fired of the Master Assessment test barrels is to prolong the use of ordinary, non-master test barrels by ensuring that the velocity tolerance limit is not exceeded too early in the life of the barrel. This can arise due to the ballistic corrections being too large when firing a worn barrel and correcting with data established in a brand new barrel.

c. For Function and Casualty testing, the main purpose of the NATO Reference Ammunition is to determine the condition/serviceability of the weapon barrel in

the event of a defect or incident which might be attributable to the condition of the weapon barrel.

d. For Barrel Erosion testing, the main purpose of the NATO Reference Ammunition is as a comparison standard to the test ammunition if the ammunition under test is determined to produce excessive smoke, flash or fouling.

e. For Smoke and Flash testing, the main purpose of the NATO Reference Ammunition is as a comparison standard to the test ammunition for the relative amount/degree of smoke or flash produced.

f. For Trajectory Match testing, the main purpose of the NATO Reference Ammunition is as a comparison standard for the trajectory (mean point of impact on the target) of the test ammunition.

g. For Terminal Effects testing, the main purpose of the NATO Reference Ammunition is to qualify the test weapon back to a known datum. The known datum is the velocity assessment value obtained from the precision weapon.

8.1.2 Unauthorised Use of NATO Reference Ammunition

NATO Reference Ammunition shall **NOT** be used for national or contractor production control. Individual ammunition producers shall use their own reference ammunition for this purpose and only use the NATO Reference Ammunition to monitor the performance of their own reference ammunition or as a final check prior to submitting ammunition for NATO Qualification Approval or Production testing. This is particularly relevant when NATO Reference Ammunition is available free of charge.

8.1.2 Supply of NATO Reference Ammunition

The NATO Reference Ammunition will normally be available to NATO nations from the custodian nation on a repayment basis. Where the Regional Test Centre (RTC) is the custodian, and the ammunition is available at no cost, the requesting nation will be responsible for arranging delivery and payment of all relevant costs. Details of the custodian of the current NATO Reference Ammunition for each calibre are available from either RTC Superintendent. For the supply of NATO Reference Ammunition that is held by the RTC and supplied free of charge (except shipping and handling costs), all requests must be endorsed by the National Delegate to AC/225(LCGDSS-SG/1), of the requesting nation.

8.1.3 Replacement of NATO Reference Ammunition

When the current NATO Reference Ammunition stocks are running low, or the NATO Reference Ammunition is showing signs of deterioration, SG/1 will ask for one Nation to volunteer to produce a new NATO Reference Ammunition Lot in accordance with the relevant NATO Reference Ammunition Cardinal Point Specification located in Annex 8-A. Final acceptance of the ammunition by SG/1 will take place after satisfactory testing by both RTCs. As the RTCs receive no funding from NATO, each RTC will need to be supplied free of charge with a quantity of NATO Reference Ammunition sufficient to last

for the anticipated life of the NATO Reference Ammunition. The current method of achieving this situation is for the cost of the NATO Reference Ammunition to be amortised across the remainder of the quantity set aside for sales to NATO countries and other potential users. Agreement on the exact methods of supply and purchase payments will be informally agreed by members of SG/1 with formal declarations of intent to purchase being sent by individual procuring nations and contractors, direct to the NATO Reference Ammunition producer. It must be understood by any producer or supplier of ammunition to be submitted for use as a NATO Reference Ammunition that there can be no restrictions placed on its use when the activity is directly in support of NATO standardisation. This may involve the ammunition being supplied by National Delegates to ammunition producers outside of NATO for final checking of ammunition being procured by NATO countries.

8.1.4 NATO Reference Ammunition Cardinal Point Specification

The relevant specifications used for the production of the current NATO Reference Ammunition Lots are contained in the following annexes:

Annex 8-A 4.6 mm x 30 NATO Reference Ammunition Cardinal Point Specification

Annex 8-B 5.56 mm x 45 NATO Reference Ammunition Cardinal Point Specification

Annex 8-C 5.7 mm x 28 NATO Reference Ammunition Cardinal Point Specification

Annex 8-D 7.62 mm x 51 NATO Reference Ammunition Cardinal Point Specification

Annex 8-E 9 mm x 19 NATO Reference Ammunition Cardinal Point Specification

Annex 8-F 12.7 mm x 99 NATO Reference Ammunition Cardinal Point Specification

8.1.4.1 An additional requirement for any replacement NATO Reference Ammunition Lot (except 9 mm x 19) is for the trajectory to match the existing NATO Reference Ammunition Lot as closely as possible in accordance with the procedural requirements of AEP-97, Volume 20. The decision on the acceptance of a proposed NATO Reference Ammunition that displays a slight difference in matching, will be made by a panel of experts from SG/1 that includes both RTC Superintendents.

8.2 NATO Reference Ammunition - Establishing Assessed Values

The two RTCs will fire an assessment and conduct a statistical analysis on the combined results to establish the following assessed values for the NATO Reference Ammunition:

a. EPVAT Ballistic Data for KIAG (Kistler) Piezo-electric Model 6215 for all calibres and additionally KIAG (Kistler) Piezo-electric Model 6203 for 9 mm x19.

- Average Chamber (Case Mouth) Pressure (MPa)

- Average Port Pressure (MPa) (for 5.56 mm and 7.62 mm only)

- Average Velocity (m/s) at 24 metres for:

  4.6 mm x 30
  5.56 mm x 45
  5.7 mm x 28
  7.62 mm x 51
  12.7 mm x 99

- Average Velocity (m/s) at 16 metres for 9 mm x 19

- Average Action Time (Expected value for information only)

b. Precision statistics (at range) for:

- (550 metres):
  5.56 mm x 45
  7.62 mm x 51
  12.7 mm x 99

- (100 metres)
  4.6 mm x 30
  5.7 mm x 28

- (46 metres)
  9 mm x 19

- Average Velocity (m/s) at 24 metres from muzzle for:

  4.6 mm x 30
  5.56 mm x 45
  5.7 mm x 28
  7.62 mm x 51
  12.7 mm x 99

- Average Velocity (m/s) at 16 metres from muzzle for:

  9 mm x 19

- Horizontal standard deviation of shot distribution

- Vertical standard deviation of shot distribution

8.2.1 NATO Reference Ammunition Assessment Equipment

Required equipment is listed:

a. NATO Reference Ammunition

b. EPVAT and Precision barrels and associated equipment defined by the relevant volumes of AEP-97.

c. Piezo-electric pressure transducers, KIAG (Kistler) Model 6215 for 4.6 mm, 5.56 mm, 5.7 mm, 7.62 mm, 9 mm and 12.7 mm. Additionally, KIAG (Kistler) Model 6203 for 9 mm only.

d. Associated recording instrumentation.

8.2.2 NATO Reference Ammunition Storage Conditions

Upon receipt of NATO Reference Ammunition, the cartridges shall be placed in a dry storage area. Extreme variations in temperature within the storage area shall be held to a minimum.

8.2.3 NATO Reference Ammunition Conditioning

Upon removal from the storage area, NATO Reference Ammunition shall be conditioned at a temperature of approximately +21 °C for a minimum of 24 hours prior to being placed in the constant temperature controlled box for 2 hours at +21 °C ± 3 °C.

8.2.4 NATO Reference Ammunition Master Assessment Barrels

The three (3) EPVAT test barrels and three Precision test barrels used at each RTC for the official assessment of the NATO Reference Ammunition lot shall be defined as the "master assessment" barrels and shall be retained for use only in assessing a new NATO Reference Ammunition lot or re-assessing the original lot if its values are significantly changing.

8.3 Method of Conducting the Test

8.3.1 Conducting the EPVAT Assessment

The data for establishing the assessed values for EPVAT (Chamber Pressure, Port Pressure, Velocity and Action Time) shall be obtained by firing thirty (30)-cartridges through the three (3) Master EPVAT barrels and repeating the test on the two succeeding days producing a total of 270 results. This firing is to be conducted at each RTC.

8.3.1.1 The equipment to be used, and the method of conducting the test, shall be the same as that defined in the EPVAT Test Procedure, AEP-97, Volume 12, but with the addition that the same Port and Chamber transducers should be used in the same location and in the same test barrel on each of the three (3) days.

8.3.1.2 From the first days firing the Chamber Pressure, Port Pressure (5.56 mm and 7.62 mm only), Velocity and Action Time shall be recorded.

8.3.1.3 If the average velocity of any test barrel assembly deviates from the average of the three (3) test barrels by more than six (6) metres per second, or if the standard

deviation for any individual test barrel exceeds ten (10) metres per second, that test barrel shall be replaced with another test barrel and firing repeated with the new test barrel only and a new average calculated. This requirement monitors the consistency of the test barrels selected to conduct the NATO Reference Ammunition assessment. This test barrel replacement only applies to the first day of testing. If it is necessary to replace a test barrel on days two or three it will be necessary to restart testing completely. The average daily velocity for all three barrels shall be calculated for each of the three days. After the third day of the assessment, if the difference between the highest average daily velocity and lowest average daily velocity exceeds four (4) metres per second, the assessment may be considered invalid dependent upon data review. This requirement monitors the consistency of the proposed NATO Reference Ammunition lot over the three day period.

8.3.1.4 For 9 mm, the EPVAT assessment shall be conducted with both the KIAG (Kistler) Model 6203 and Model 6215 transducers unless agreed otherwise by SG/1. For 4.6 mm, 5.56 mm, 5.7 mm, 7.62 mm & 12.7 mm, the assessment shall be conducted only with the KIAG (Kistler) Model 6215 transducer.

8.3.2 Conducting the Precision Assessment

The horizontal and vertical standard deviations of precision shall be obtained by firing thirty (30)-cartridges through each of three (3) Master barrels and repeating the test on the two succeeding days producing a total of 270 results. This firing is to be conducted at each RTC. The velocity at 24 metres (16 metres for 9 mm)[2] of the precision barrel is to be recorded simultaneously in order to produce an assessed value for use in qualifying other precision barrels when required by AEP-97.

8.3.2.1 The equipment to be used shall be the same as that listed in the Precision Test Procedure, AEP-97, Volume 18, with the addition of velocity measuring equipment. The method of conducting the test shall be the same as that specified in paragraph 18.6 (AEP-97, Volume 18) with the addition that the velocity shall be recorded and matched with each shot on target.

8.3.2.2 The assessment shall be conducted on three (3) successive days. However, if the weather conditions are unsuitable for conducting the test on the succeeding two (2) days it shall be conducted at the earliest opportunity. From the first days firing, the horizontal and vertical standard deviations for each of the three precision targets shall be calculated along with the average velocity at 24 metres (16 metres for 9 mm).

8.3.2.3 If the average velocity of any test barrel assembly deviates from the average of the three (3) test barrels by more than six (6) metres per second, or if the standard deviation for any individual barrel exceeds ten (10) metres per second, that test barrel shall be replaced with another test barrel and the firing repeated with the new test barrel only and a new average calculated. The assessment procedure shall be repeated on each of two (2) succeeding days subject to satisfactory weather conditions.

Note 2: The individual velocities shall be matched with each shot during the assessment.

8.4 Recording and Evaluation of results

Upon completion of the tests, the results from both RTCs are to be aggregated. The average EPVAT velocity, case mouth and port pressures, action time and the precision statistics (including the velocity) for the entire series shall be computed.

8.4.1 Publication of Official Assessed Values

The RTC Superintendents will supply the LCGDSS Secretary with the assessed values and precision information for publication as an official NATO document. Currently the assessed values are included with the published list of NATO Qualified Design numbers.

8.4.2 Review of Assessed Values

The Superintendents of each RTC will monitor the assessed values of the NATO Reference Ammunition lot in the following manner:

a. The data from all firings of the NATO Reference Ammunition conducted at each RTC during a calendar year will be maintained. As an alternative the RTC may dedicate barrels specifically for keeping a check on performance of the NATO Reference Ammunition. If this method is used then firings must take place regularly throughout the year.

b. For each reporting period, test results from NATO Reference Ammunition at each Regional Test Centre shall be compiled, detailing the average values obtained (mean, standard deviation and extreme variation for each parameter of the EPVAT test). The most recent reporting period of NATO Reference Ammunition results shall be compared to the assessed values and to the NATO Reference Ammunition results from the previous reporting period for each NATO Reference Ammunition lot. All results shall be reported by the RTC Superintendents at each SG/1 meeting and significant changes shall be drawn to the attention of SG/1. If deemed necessary by SG/1 an investigation shall be conducted.

ANNEX 8-A

NATO 4.6 mm x 30 REFERENCE AMMUNITION CARDINAL POINT SPECIFICATION

TO BE ESTABLISHED

ANNEX 8-B

NATO 5.56 mm x 45 REFERENCE AMMUNITION
CARDINAL POINT SPECIFICATION

Parameter	Cardinal Point Specification
Precision	The pooled mean of the vertical standard deviations and pooled mean of the horizontal standard deviations of 90 cartridges (30 cartridges from each of 3 different barrels) must be ≤120mm, at a distance of 550m through master barrels.
Bullet Extraction	The force required to extract the bullet from an assembled cartridge must not be less than 200 Newtons
Case Mouth Pressure	All pressure measurements are to utilise the Kistler 6215 transducer. At +21° C the maximum mean case mouth pressure +5 SD must not exceed 445 MPa; the average case mouth pressure must not exceed 405 MPa.
Port Pressure	All pressure measurements are to utilise the Kistler 6215 transducer. At +21° C the minimum port pressure -5 SD must not be less than 103 MPa.
Velocity	At +21° C the velocity standard deviation must be less than <6 m/s with a desirable target of <5 m/s.
Action Time	At +21° C, the average action time +5SD must be ≤1.5 ms For info only: At -54° C maximum mean action time + 5 SD must be ≤3 ms.
Trajectory Match	At +21° C the velocity standard deviation must be less than <6 m/s with a desirable target of <5 m/s. Horizontal and vertical difference between the current NATO Reference MPI and the proposed new NATO Reference Ammunition must be ≤ 40mm @ 300m and ≤ 80mm @ 550m.

Terminal Effects	An inert projectile must completely penetrate a 3.5mm thick mild steel plate (10 gauge), at 570m from the muzzle at 0° obliquity (normal to the line of fire). At least one fragment must perforate a 0.5mm aluminium witness plate positioned 300mm behind the target plate. No less than 90% of the sample must meet these requirements. Mild steel plate defined in SAE1010 or SAE1020, with a Rockwell hardness of minimum B55 and maximum B70. Air density to be < 1.270Kg/m^3
Muzzle Energy	At 21° C, the minimum energy must be ≥ 1564 Joules (1480 Joules 24m from the muzzle). For information only.
Primer Sensitivity	Primer sensitivity must be evaluated by conducting a critical height method (run-down) test. The requirements are: H +5 SD ≤ 450mm and H -2 SD ≥ 75mm when using a ball of mass 111.7g.
Smoke and Flash	The proposed new NATO Reference Ammunition must be subjected to this test if the results of the F&C testing highlight an issue. In accordance with the requirements of STANAG 4172, ammunition must not produce excessive smoke or flash in comparison with the current NATO Reference ammunition.
Function and Casualty	The ammunition must perform satisfactorily in all NATO Nominated Weapons when fired in accordance with the test requirements defined in the Function & Casualty, Volume 14, AEP-97. The firing defects during F&C testing must not exceed the permitted number defined in the relevant MCMOPI table for any NATO nominated weapon type. For information only: Record rate of fire and before and after photographs of each of the NNW.
Barrel Erosion	No requirement see F&C.
Waterproof	Complete cartridges, immersed in water of sufficient depth to cover them by at least 50mm, must be able to withstand an applied vacuum of 50 Kpa for at least 30 seconds without releasing bubbles from either the primer annulus or the case mouth/bullet interface.

Environmental Requirements - Temperature	The case mouth pressure for samples measured at +52° C and -54° C must be within the range +55 MPa and -110 MPa of the mean case mouth pressure measured at +21°C. The corrected mean case mouth pressure for samples measured at +52° C and -54° C must be ≤455 MPa. The port pressure for samples measured at +52° C and -54° C must be within the range ±15 MPa of the mean port pressure measured at +21° C. The corrected mean port pressure -3 SD measured at +52° C must be ≥103 MPa. The corrected mean port pressure measured at -54° C must be ≥103 MPa. The velocity difference for samples measured at +52° C and -54° C must be within the range +50 m/s and -80 m/s of the mean velocity measured at +21° C.
Fouling	No requirement see F&C.
Residual Stress	No brass cartridge case shall show splits when subjected to Mercurous Nitrate Test.
Workmanship	Double Statistical Samples will be used during manufacture.
Component Parts	Homogeneous lots for component parts will be used. One production line will manufacture the ammunition. Documentation will be as AEP-97, Volume 2.

ANNEX 8-C

NATO 5.7mm x 28 REFERENCE AMMUNITION CARDINAL POINT SPECIFICATION

TO BE ESTABLISHED

ANNEX 8-D

**NATO 7.62 mm x 51 REFERENCE AMMUNITION
CARDINAL POINT SPECIFICATION**

Parameter	Cardinal Point Specification
Precision	The pooled mean of the vertical standard deviations and pooled mean of the horizontal standard deviations of 90 cartridges (30 cartridges from each of 3 different barrels) must be ≤120mm, at a distance of 550m through master barrels.
Bullet Extraction	The force required to extract the bullet from an assembled cartridge must not be less than 265 Newtons.
Case Mouth Pressure	All Pressure measurements are to utilise the Kistler 6215 transducer. At +21° C the mean case mouth pressure +5 SD shall not exceed 445 MPa; the mean case mouth pressure must not exceed 405 MPa.
Port Pressure	All Pressure measurements are to utilise the Kistler 6215 transducer. At +21° C the corrected mean port pressure -5 SD shall be greater than 56 MPa.
Velocity	At +21° C the velocity standard deviation shall be less than <6 m/s.
Action Time	At +21° C the maximum individual action time shall be < 4 3 ms.
Trajectory Match	At +21 ° C the velocity standard deviation shall be less than <6 m/s. Horizontal and vertical difference between the current NATO Reference Ammunition MPI and the proposed new NATO Reference Ammunition must be ≤ 40mm @ 300m and ≤ 80mm @ 550m.
Terminal Effects	An inert projectile must completely penetrate a 3.5mm thick mild steel plate (10 gauge), at 550m from the muzzle at 0° obliquity (normal to the line of fire). At least one fragment must perforate a 0.5mm aluminium witness plate positioned 300mm behind the target plate. No less than 90% of the sample must meet these requirements. Mild steel plate defined in SAE1010 or SAE1020, with a Rockwell hardness of minimum B55 and maximum B70.

Muzzle Energy	At +21° C the minimum energy must be ≥ 2931 Joules (2756 Joules 24m from the muzzle). For information only.
Primer Sensitivity	Primer sensitivity must be evaluated by conducting a critical height method (run-down) test. The requirements are: H +5 SD ≤ 500mm and H -2 SD ≥ 75mm when using a ball of mass 111.7g.
Smoke and Flash	The proposed new NATO Reference Ammunition must be subjected to this test if the results of the F&C testing highlight an issue. In accordance with the requirements of STANAG 2310, ammunition must not produce excessive smoke or flash in comparison with the current NATO Reference Ammunition.
Function and Casualty	The ammunition must perform satisfactorily in all NATO Nominated Weapons when fired in accordance with the test requirements defined in the Function & Casualty, Volume 14, AEP-97. The firing defects during F&C testing must not exceed the permitted number defined in the relevant MCMOPI table for any NATO nominated weapon type.
Barrel Erosion	No requirement see F&C.
Waterproof	Complete cartridges, immersed in water of sufficient depth to cover them by at least 50mm, must be able to withstand an applied vacuum of 50 Kpa for at least 30 seconds without releasing bubbles from either the primer annulus or the case mouth/bullet interface.
Environmental Requirements - Temperature	The case mouth pressure for samples measured at +52° C and -54° C must be within the range +55 MPa and -110 MPa of the mean case mouth pressure measured at +21° C. The corrected mean case mouth pressure for samples measured at +52° C and -54° C must be ≤460MPa. The velocity difference for samples measured at +52°C and -54°C must be within the range +45 m/s and -75 m/s of the mean velocity measured at +21° C.
Fouling	No requirement see F&C.
Residual Stress	No brass cartridge case shall show splits when subjected to Mercurous Nitrate Test.

Workmanship	Double Statistical Samples will be used during manufacture.
Component Parts	Homogeneous lots for component parts will be used. a. Cartridge cases from one unchanged process and from one manufacturer. b. Bullets from one unchanged process and from one manufacturer. c. Primers from one lot interfix number and from one manufacturer. d. Propellant from no more than one lot. One production line will manufacture the ammunition. Documentation will be as AEP-97, Volume 2.
Climatic Storage	Ammunition with a NATO Design Number (NDN); • The requirement is waived if the design has been subjected to a successful NATO Production Test within the last 24 months. Ammunition that does not have an NDN. • Selection will be based on an assessment of the sequential safety and suitability test results covering the storage, transport and use of the ammunition, world-wide, giving a shelf life in good storage conditions of 10 years (Ref STANAG 4297, AOP 15, AOP 48) Note: LCG/1-SG/1 will make the final design on the selection of a new NATO Reference Ammunition. However, the Procuring Nation reserves the right to ask for full disclosure of test results.

ANNEX 8-E

NATO 9 mm x 19 REFERENCE AMMUNITION
CARDINAL POINT SPECIFICATION

Parameter	Cardinal Point Specification
Precision	The pooled mean of the vertical standard deviations and pooled mean of the horizontal standard deviations of 90 cartridges (30 cartridges from each of 3 different barrels) shall be ≤ 25 mm at a distance of 46 m.
Bullet Extraction	The force required to extract the bullet from an assembled cartridge must not be less than 200 newtons.
Bullet Mass and Muzzle Energy	Minimum of 7.0 grams to a Maximum of 8.3 grams, with a tolerance of ± 0.1 grams. 6203 Transducer - Muzzle Energy (+21° C) Between 542 and 814 Joules for bullet mass between 7 and 8.3 grams (482 and 704 Joules at 16 metres from the muzzle). 6215 Transducer - Muzzle Energy (+21° C) Between 551 and 823 Joules for bullet mass between 7 and 8.3 grams (491 and 713 Joules at 16 metres from the muzzle).
Case Mouth Pressure	Case Mouth Pressure at +21° C: 6203 Transducer The maximum mean case mouth pressure + 5SD for ammunition conditioned to +21° C shall be 265 MPa; the average case mouth pressure must not exceed 215 MPa. 6215 Transducer The maximum mean case mouth pressure + 5SD for ammunition conditioned to +21° C shall be 285 MPa; the average case mouth pressure must not exceed 235 MPa. Case Mouth Pressures at +52° C and -54° C The maximum pressure difference between ammunition conditioned to +21° C and ammunition conditioned to +52° C or -54° C shall be ± 30 MPa.

Parameter	Cardinal Point Specification
Velocity	At +21º C the standard deviation must be less than 4 m/s. Velocity at +52° C and -54° C The maximum velocity difference between ammunition conditioned to + 21 °C and ammunition conditioned to + 52 °C or - 54 °C shall be ± 25 m/s.
Action Time	The maximum individual action time for ammunition conditioned to + 21 °C shall be 1.5 ms.
Climatic Storage	Ammunition with a NATO Design Number (NDN); • The requirement is waived if the design has been subjected to a successful NATO Production Test within the last 24 months. Ammunition that does not have an NDN. • Selection will be based on an assessment of the sequential safety and suitability test results covering the storage, transport and use of the ammunition, world-wide, giving a shelf life in good storage conditions of 10 years (Ref STANAG 4297, AOP 15, AOP 48) Note: LCG/1-SG/1 will make the final decision on the selection of a new NATO Reference Ammunition. However, the Procuring Nation (in this case, the UK) reserves the right to ask for full disclosure of test results which may be assessed by the UK competent Authority, the Defence Ordnance Safety Group (DOSG).
Function and Casualty	The ammunition must perform satisfactorily in all NATO Nominated Weapons (AEP 97 MCMOPI SECT10) when fired in accordance with the test requirements defined in the Function & Casualty, Volume 14, AEP-97. The firing defects during F & C testing must not exceed the permitted number defined in the Sentencing Tables. Reference: AEP-97, Volume 11 – Classification of Defects.
Primer Sensitivity	Primer sensitivity must be evaluated by conducting a critical height method (run-down) test. The requirements are: $H + 5SD \leq 350$ mm and $H - 2SD \geq 75$ mm when using a ball of mass 55 grams.
Residual Stress	No brass cartridge case shall show splits when subjected to the Mercurous Nitrate Test.

Parameter	Cardinal Point Specification
Terminal Effects	Terminal Effects are considered met if bullet mass and muzzle energy meet the requirements of STANAG 4090.
Waterproof	Complete cartridges, immersed in water of sufficient depth to cover them by at least 50 mm, must be able to withstand an applied vacuum of 50 kPa for at least 30 seconds without releasing bubbles from either the primer annulus or the case mouth/bullet interface. Failure rate ≤ 15%.
Smoke, Flash and Fouling	Smoke, flash and fouling should be kept to a minimum. Ammunition shall not produce excessive smoke or flash in comparison with the current NATO Reference Ammunition.
Corrosive Effects	The cartridge shall be free of corrosion, stains, discoloration, dirt, oil and smears of lacquer.
Component Parts	Homogeneous lots for component parts will be used. One production line will manufacture the ammunition. Documentation will be as defined in AEP-97, Volume 2.

ANNEX 8-F

NATO 12.7 mm x 99 REFERENCE AMMUNITION CARDINAL POINT SPECIFICATION

TO BE ESTABLISHED

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 9

NATO NOMINATED WEAPON GUIDELINES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

9.1 Introduction of NATO Nominated Weapon (NNW)

The NATO Nominated Weapon (NNW) is one of the most important aspects of the NATO Small Arms Ammunition Interchangeability program. These weapons, provided by NATO Member nations, are utilized for the Function and Casualty Test which provides the direct evidence that ammunition designs qualified by NATO Member nations will **ALL** safely and satisfactorily function in another nation's weapon to confirm that the ammunition can be interchanged on the battlefield.

It is imperative that all NATO Member nations ensure that the weapons fielded by their Armed Forces are represented (by sponsorship or fielding of a similar NNW) in the family of NATO Nominated Weapons per the applicable calibre.

9.1.1 NATO Member/Interoperability Platform nations that propose to sponsor the introduction of a national fielded weapon as a NNW need to advise the RTC Superintendents as soon as possible in order to ensure that ammunition testing samples are allocated in advance of the NNW evaluation (this may entail other nations to submit NATO Production Test Samples of dormant or passive NATO Qualified Ammunition Designs to ensure that they are available for the NNW evaluation (see Annex 9-A). The sponsoring nation will also be required to meet the following conditions:

a. Previously ratified and implemented the relevant NATO ammunition standard.

b. Certify that the sponsoring nation's armed forces have fielded the proposed weapon for use and that the design is final and meets the acceptance criteria of the nation (including NATO standard requirements).

c. The sponsoring nation maintains a NATO Qualified Ammunition Design for the given calibre of the weapon nominated for evaluation. In some cases, a nation may not have submitted a NATO Qualified Ammunition Design but is procuring the same NATO Qualified Ammunition Design submitted by another nation. This information should be highlighted to SG/1 and the RTC Superintendents along with the nomination of the weapon.

d. Submit in writing complete design data and specifications and national acceptance test results for consideration by the Superintendents of the Regional Test Centres (RTCs) (assisted by a Team of Experts (ToE) if required) to determine if the proposed weapon has significant physical and performance differences in relation to existing NNWs. If deemed necessary by the Superintendents of the RTCs, the sponsoring country shall make the weapons available for inspection. If this involves travel and accommodation costs these shall be met by the sponsoring nation.

9.1.2 If, on the recommendation of the Superintendents of the RTCs, the members of AC/225 (LCGDSS-SG/1) agree that the weapon is suitable for evaluation as a NNW, the SG/1 Head of Delegation of the sponsoring nation will ensure that the following actions are taken:

a. Provide to each RTC, at no cost, the number of weapons, spare parts, gauges, related equipment and technical manuals (in English) required for the completion of the approved testing and evaluation program detailed in Annex A.

b. Pay the RTC for any incremental costs incurred during completion of the program, subject to any prepayment or other fiscal requirement imposed by the national authority governing the operation of each RTC.

c. In case of a failure attributed to a weapon, AC/225 (LCGDSS-SG/1) may authorise a retest based on the recommendations of the Superintendents of the RTC. The sponsoring nation will, however, be liable for all additional costs.

9.1.3 At the completion of the testing and evaluation programme conducted at the RTC, the Superintendents will jointly submit results and recommendations to AC/225 (LCGDSS-SG/1) for consideration. If, in the general opinion of the members, the weapon is acceptable as a NNW, the SG/1 Head of Delegation of the sponsoring nation will ensure that the following actions are taken:

a. Provide the members of AC/225 (LCGDSS-SG/1) in writing with detailed information necessary to purchase the NATO Nominated Weapons for NATO National Test Centres and ammunition manufacturers.

b. Act as a liaison[1], if necessary, between the weapon manufacturer /supplier and member nations NTCs to assist with procurement and/or supply of the weapons, gauges/gauge drawings, spare parts, lists and manuals.

c. Provide configuration control data information at SG/1 meetings to certify that the characteristics of weapons and related equipment supplied to RTCs, NTCs, and member nations are the same as the original nominated weapon configuration as noted in the appropriate annex in AEP-97, Volume 10.

d. Except for paragraph 9.1.4 below, provide each RTC, at no cost, spare parts or other equipment required anytime during the life of the nominated weapon for repair and maintenance.

Note 1: The SG/1 Head of Delegation of the sponsoring nation is only obliged to act as liaison and assist in supply of NNWs and related equipment if the NTC has been certified by NATO for that particular calibre.

9.1.4 It would be advisable for any NTC purchasing NNWs to ensure that the contract contains a clause insisting on free replacement or modifications if the NNW model is replaced or amended within a stipulated time frame. This is to avoid a difficult situation which may arise if a sponsor nation replaces it with a new or modified model within a short time.

9.2 Replacement/Upgrade of Existing NNW

9.2.1 When a sponsoring nation proposes to replace or upgrade an existing NNW, the SG/1 Head of Delegation will make a written request to AC/225 (LCGDSS-SG/1) outlining the rationale for the change. The rationale will contain a full description of any technical changes to the weapon and its operating characteristics. If the Superintendents of the RTC (assisted by a ToE if required) recommend that the new weapon or replacement part(s) is suitable for evaluation as a NNW and members of AC/225 (LCGDSS-SG/1) agree, the SG/1 Head of Delegation of the sponsoring nation will ensure that the following actions are taken:

a. Provide certification as in paragraph 9.1.1b.

b. Send required equipment for testing to each RTC, as in paragraph 9.1.2.a above.

c. Pay the RTC as in paragraph 9.1.2.c above.

d. In case of a weapon or part failure, act as in paragraph 9.1.2.c above.

9.2.2 If, on completion of the assessment program by the RTC, SG/1 members agree that weapon or replacement part(s) is acceptable, the AC/225(LCGDSS-SG/1) Head of Delegation of the sponsoring nation will ensure that the following actions are taken:

a. Complete the actions detailed in paragraph 9.1.3.b above.

9.3 Withdrawal of Existing NNW

9.3.1 The withdrawal of a NNW from general use by the armed forces of the sponsoring nation will normally result in the withdrawal of the weapon as a NNW for interchangeability testing. If the NNW is withdrawn from general use by the armed forces of the sponsoring nation, the SG/1 Head of Delegation of the sponsoring nation will immediately inform SG/1 in writing of the reasons for its withdrawal.

9.3.2 When the continuing utilisation of any current NNW is questioned due to technical or logistical reasons, or as the result of a national decision, the Superintendents of the RTC (assisted by a ToE, if required) will make a recommendation to AC/225 (LCGDSS-SG/1). If, in the opinion of the members, the weapon is to be withdrawn, each of the following actions will apply:

a. RTC and NTC will cease any NATO testing in the withdrawn NNW on the date agreed by AC/225 (LCGDSS-SG/1).

b. The SG/1 Head of Delegation of the sponsoring nation will provide disposal instructions (return, retain or destroy) to each holder of the NNW.

c. If destruction of the NNW is requested and carried out, the holder of the NNW will provide the SG/1 Head of Delegation of the sponsoring nation or his designated representative with a certificate of disposal prepared by the appropriate national authority.

9.3.3 Nations that have purchased NNWs that are being withdrawn may dispose of these according to national regulations or retain them. However, the sponsoring nation will have no further obligation to provide information in order to support for the weapons.

9.4 Amendments to AEP-97

9.4.1 In all instances of introduction, replacement/upgrading or withdrawal of NNW approved by AC/225 (LCGDSS-SG/1), the SG/1 member (USA) responsible for AEP-97 will amend the listing of weapons and technical data in AEP-97, Volume 10. The SG/1 Head of Delegation of the sponsoring nation is responsible for providing to the SG/1

member responsible (USA) for AEP-97 the technical information necessary for the production of the amendment.

9.4.2 NATO Publications Regarding NNW

When directed by AC/225 (LCGDSS-SG/1), the Secretary of AC/225 (LCGDSS) will publish a NATO publication announcing in appropriate detail the introduction, replacement/upgrading or withdrawal of NNW.

9.4.3 New Weapon Systems

The foregoing text is applicable primarily to weapons of basic designs such as rifles, pistols and machine guns. If conventional weapons are replaced by more sophisticated equipment, such as advanced weapons equipped with fire control systems or electric driven machine guns.

9.5 Continuous Availability of NNW

Throughout the period of applicability of the relevant ammunition standards, and until such time as the NNW is withdrawn, the sponsoring nation shall ensure continued availability of the approved weapon model and spare parts. Failure to supply the RTCs with replacement weapons or spare parts within a reasonable time-frame or NATO certified NTCs with the information to obtain replacement weapons or spare parts, may lead to the suspension or withdrawal by SG/1 of the weapon as a NNW.

9.6 Approval of Modifications Made to NNWs

Any subsequent supply to the RTC of weapons or spare parts that have been modified (other than minor cosmetic, non-functional modifications) as compared with the approved model, must be approved by SG/1 and will be subject to the conditions defined in paragraph 9.2.1.

9.7 Continuous Performance Requirements of National Nominated Weapons

The percentage of malfunctions due to the weapon shall be limited as listed and it shall vary with the category of malfunction but shall not exceed the percentages listed below.

a. Minor malfunctions: 0.3 % for ammunition conditioned at + 21 °C and 0.6 % for ammunition conditioned at + 52 °C and - 54 °C. Minor malfunctions are those that do not interrupt firing or that do so only very briefly (a few seconds), simple remedial action by the operator being sufficient.

b. Major malfunctions: 0.1 % for ammunition conditioned at + 21 °C and 0.2 % for ammunition conditioned at + 52 °C and - 54 °C. Major malfunctions are those that interrupt firing and the mission assigned to the weapon (for a few minutes), remedial action being possible with the means available to the operator.

c. Critical malfunctions: 0.02 % for ammunition conditioned at + 21 °C and 0.04 % for ammunition conditioned at + 52 °C and - 54 °C. Critical malfunctions are those that render the weapon unusable, no remedial action being possible by the

operators in the field, or malfunctions that make the weapon dangerous to a friendly personnel.

d. No cook-off shall be allowed.

9.7.1 Weapon Performance below Required Level

If a weapon performance falls below the required level, the RTC Superintendent shall perform any necessary technical investigations and supply a report to SG/1. If appropriate on the evidence provided, SG/1 shall order the withdrawal or suspension (as appropriate) of the weapon as a NATO Nominated Weapon.

ANNEX 9-A

NATO NOMINATED WEAPON TESTS

9.A.1 Applicability

This annex defines the procedure to be followed for the acceptance of a weapon as a NATO Nominated Weapon (NNW).

9.A.1.1 NNW Testing

The evaluation will consist of firing three (3) NNWs at each RTC in accordance with the Function and Casualty (F&C) Test, AEP-97, Volume 14. **Weapon maintenance, lubrication and cleaning requirements must be strictly adhered to for the duration of the test.**

The Superintendents of the RTCs shall produce a test plan which identifies the NATO Qualified Designs to be used for the Nominated Weapon Evaluation. The NATO Qualified Designs identified will be based on samples remaining from previous successful NATO QA or PT submissions that are held at the RTCs for this specific purpose. As this would indicate, most of these designs are only **ACTIVE** and **PASSIVE** NATO Qualified Designs. If a nation has a **DORMANT** NATO Qualified Design, it will NOT be included as part of the NATO Nominated Weapon Evaluation testing and hence there is no recourse if it fails in subsequent NATO Production Testing. It is incumbent that nations ensure that **DORMANT** designs are periodically submitted for PT testing in order to keep them in at least a **PASSIVE** status. In addition, if a specific ammunition design is warranted, the RTC will request the nation of that NATO Qualified Design to submit a sample of the ammunition design for the NNW Evaluation Test.

Tables 9-A-1 through 9-A-4 below represent examples of the ammunition sample sizes needed at each RTC of NATO Reference Ammunition and each NATO qualified ammunition design[1] to evaluate a NNW. Belt length shall be in accordance with the firing procedure for the Function & Casualty Test.

9.A.1.1.1 The firing of these samples sizes demonstrates the agreed upon minimum 80 % probability and 80 % confidence level of subsequent production lots passing the appropriate Function and Casualty Test. This test is designed to demonstrate the system (weapon and ammunition) reliability that is required to pass the appropriate F&C Test and is based on the assumption that the three (3) weapons, tested at each RTC, continue to perform at the demonstrated reliability level and that the subsequent production lots of qualified ammunition have a reliability comparable to that of the lot utilised in this test.

9.A.1.1.2 The probability/confidence level was developed for AQLs of zero (0) where acceptance is based on zero (0) defects and rejection on one (1) defect. Where AQLs in AEP-97, Volume 11 are greater than zero (0), the accept/reject criteria will be recalculated for the firing of the total quantity necessary for each qualified design and applied to each individual qualified design for sentencing purposes. If the weapon passes the test with NATO Reference Ammunition (if applicable) and each currently

qualified and produced NATO ammunition design, it would be the recommendation of the RTC Superintendents that the weapon be accepted as a NNW based upon the reliable performance of all weapons at the RTC.

9.A.1.1.3 In summary, once this test is successfully passed in the six (6) weapons with the NATO Reference Ammunition (if applicable) and all currently produced qualified ammunition natures, countries with qualified ammunition can expect a probability of at least 80 % (80 % confidence level) of subsequent production lots passing that weapon's portion of the F&C Test provided that they maintain their ammunition's demonstrated reliability. It should be noted that the probability could be significantly higher, but the firing of the required number of cartridges in the tables below can only statistically demonstrate at least the 80 % probability/confidence level.

9.A.2.1.4 After completion of the NNW evaluation, a report shall be prepared by the RTC Superintendents. A copy of the report shall be forwarded to all SG/1 members for discussion and decision on acceptance/rejection.

5.56 mm x 45 Weapons				
	Ammunition Temperature	**# of Cartridges Weapon**	**Total Rounds (Three (3) Weapons)**	**Additional Firing Requirements**
Magazine Fed Weapons	+ 21 °C + 52 °C - 54 °C	300 240 240	900 720 720	Full magazines to be used where possible.
Total		**780**	**2340**	
Belt Fed Weapons	+ 21 °C + 52 °C - 54 °C	722 241 241	2166 723 723	None
Total		**1204**	**3612**	

7.62 mm x 51 Weapons				
	Ammunition Temperature	**# of Cartridges Weapon**	**Total Rounds (Three (3) Weapons)**	**Additional Firing Requirements**
Magazine Fed Weapons	+ 21 °C + 52 °C - 54 °C	300 200 200	900 600 600	Full magazines to be used where possible.
Total		**700**	**2100**	
Belt Fed Weapons	+ 21 °C + 52 °C - 54 °C	722 241 241	2166 723 723	None
Total		**1204**	**3612**	

4.6 mm x 30 Weapons 5.7 mm x 28 Weapons 9 mm x 19 Weapons				
	Ammunition Temperature	**# of Cartridges Weapon**	**Total Rounds (Three (3) Weapons)**	**Additional Firing Requirements**
Magazine Fed Weapons	+ 21 °C + 52 °C - 54 °C	300 200 200	900 600 600	Full magazines to be used where possible.
Total		**700**	**2100**	
Sub-Machine Guns	+ 21 °C + 52 °C - 54 °C	480 320 320	1440 960 960	Full magazines to be used where possible.
Total		**1120**	**3360**	

Table 9-A-4 – 12.7 mm x 99 Weapons				
	Ammunition Temperature	**# of Cartridges Weapon**	**Total Rounds (Three (3) Weapons)**	**Additional Firing Requirements**
Belt Fed Weapons	+ 21 °C + 52 °C - 54 °C	722 241 241	2166 723 723	None
Total		**1204**	**3612**	

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 10

LIST OF NATO NOMINATED WEAPONS INCLUDING WEAPON CHARACTERISTICS AND TECHNICAL DETAILS

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

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10.1 General Information

This volume lists the NATO Nominated Weapons currently approved by AC/225 (LCGDSS-SG/1). The weapons are to be used as directed by the relevant volumes of AEP-97, Multi-Calibre Manual of Proof and Inspection (M-CMOPI) unless officially directed otherwise by SG/1. The characteristics of each nominated weapon are listed in the appropriate annex identified below.

10.1.1 Weapon – Performance Baselining

As noted in the Function and Casualty Test Procedure, AEP-97, Volume 14, paragraph 14.5.6 on Barrel Serviceability, a weapon barrel shall be considered unserviceable if reference ammunition has been fired through the barrel within its first 500-rounds (cartridges) of life and current firing of the same reference lot results in an average velocity drop of more than 60 m/s.

Before a new weapon barrel is put into service, it is recommended that twenty (20) NATO Reference rounds be fired, single shot, and measure the velocity of each round at 24 metres (16 metres for 9 mm weapons). The mean velocity of these twenty rounds will be the baseline for future comparison regarding barrel serviceability.

10.2 Current NATO Nominated Weapons (NNW) List:

10.2.1 4.6 mm x 30 NNW List:

a. MP7, 4.6mm, Sub-Machine Gun (Nominated by GERMANY) Annex 10-A1

10.2.2 5.56 mm x 45 NNW List:

a. Minimi, Mk1, Light Machine Gun, 5.56mm (Nominated by BELGIUM) Annex 10-B1

b. AR 70/90, Rifle, 5.56mm (Nominated by ITALY) Annex 10-B2

c. M16A2/A4, Rifle, 5.56mm (Nominated by UNITED STATES) Annex 10-B3

d. G36/A1, Rifle, 5.56mm (Nominated by GERMANY) Annex 10-B4

e. L85A2, Rifle, 5.56mm (Nominated by UNITED KINGDOM) Annex 10-B5

10.2.3 5.7 mm x 28 NNW List:

a. P90, Sub-Machine Gun, 5.7mm (Nominated by BELGIUM) Annex 10-C1

b. Five-seveN Mk2, Pistol, 5.7mm (Nominated by BELGIUM) Annex 10-C2

10.2.4 7.62 mm x 51 NNW List:

a. L7A2, Machine Gun, 7.62mm (Nominated by UNITED KINGDOM) Annex 10-D1

b. M240B, Machine Gun, 7.62mm (Nominated by UNITED STATES) Annex 10-D2

10.2.5 9 mm x 19 NNW List:

a. PM12S/S2, Sub-Machine Gun, 9mm (Nominated by ITALY) Annex 10-E1

b. 92F/FS, Pistol, 9mm (Nominated by ITALY) Annex 10-E2

c. P8A1, Pistol, 9mm (Nominated by GERMANY) Annex 10-E3

10.2.5 12.7 mm x 99 NNW List:

a. M2HB, Machine Gun, 12.7mm (Nominated by UNITED STATES) Annex 10-F1

ANNEX 10-A1

Characteristics of the MP7, Sub-Machine Gun, 4.6mm (Nominated by GERMANY)

10.A1.1	Weapon:		MP7, Sub-Machine Gun, 4.6mm
	Nominating Nation:		Germany
	Manufacturer:		Heckler & Koch (H&K)
	NATO Stock Number (NSN):		1005-12-375-3866
(1)	Mass of weapon		1.89 kg without magazine
(2)	Length of weapon		420/460 mm
(3)	Life of weapon		10,000 rounds

10.A1.2 Weapon Operation

(1)	Operation		Gas-operated
(2)	Gas adjustment		None
(3)	Feed		Magazine
(4)	Regulation of fire		None
(5)	Mechanism position		Fired from closed bolt position
(6)	Ejection		Right hand by spring loaded ejector
(7)	Extraction		By spring loaded extractor
(8)	Nominal rate of fire		950 + 200 rounds/minute
(9)	Practical rate of fire		210 - 240 rounds/minute
(10)	Cyclic rate:		
	Recommended cyclic rate		900 - 950 rounds/minute
	Minimum cyclic rate		800 rounds/minute
	Maximum cyclic rate		1150 rounds/minute
(11)	Trigger pull:	minimum:	30 N
		maximum:	45 N

10.A1.3 Barrel Characteristics

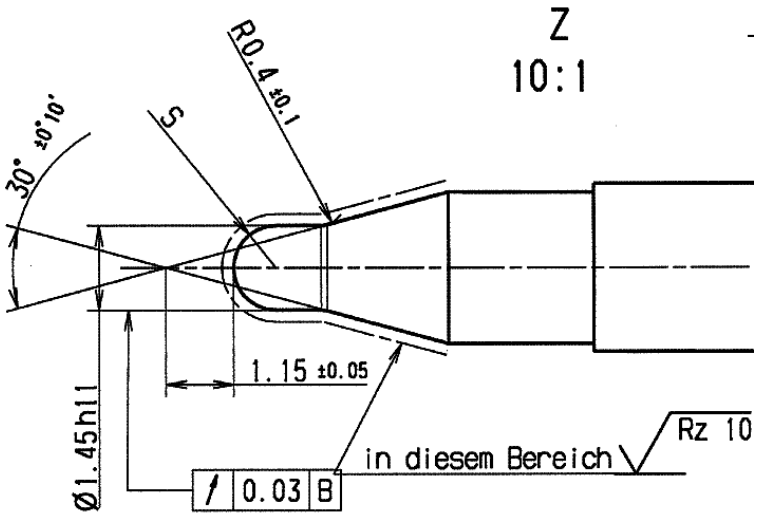
(1)	Length of barrel	180 mm
(2)	Rifling twist	160 mm
(3)	Number of grooves	6 (Polygon)
(4)	Groove width	Polygon
(5)	Diameter across grooves	4.52 – 4.54 mm
(6)	Diameter across bore	4.65 – 4.68 mm
(7)	Barrel life and life of replacement barrels	10,000 rounds minimum
(8)	Criterion for end of barrel service life	Criteria of AC/225-D/14 and / or barrel wear gauge (see gauges)
(9)	Chamber and bore are chromium-plated	

10.A1.4 Bolt Recoil Velocity

(1)	Minimum	6 m/s
(2)	Maximum	8 m/s

10.A1.5 Firing Pin Characteristics

(1)	Firing pin protrusion: minimum: maximum:	0.8 + 0.3 mm Not provided Not provided
(2)	Diameter of firing pin hole in bolt face	1.5 mm H11
(3)	Sketch of firing pin point:	The Test centres shall measure the impression left by the firing pin on a copper cylinder when the weapons are delivered.



10.A1.6 Cartridge Headspace of Weapon

(1)	Cartridge headspace (assembly of weapon)	s = 32.35 + 0.15 mm
(2)	Adjustment of headspace	None
(3)	Free run of bullet	6 - 10 mm

10.A1.7 Sighting System

(1) Mechanical sights

(2) Optical sights possible

10.A1.8 Gauges (drawing numbers respectively identification numbers)

(1)	Cartridge headspace	Go: 32.35 mm (349867) No-Go: 32.5 mm (349976) No-Go: 32.57 mm (349898)
(2)	Firing pin protrusion	349890
(3)	Extractor protrusion	Go: 350723 No-Go: 350724
(4)	Minimum bore diameter	Ø 4.52 mm: 988423
(5)	Maximum bore wear	Ø 4.58 mm: 349889
(6)	Free run of bullet	Does not exist

10.A1.9 Miscellaneous

10.A1.10 Documentation

(1)	Maintenance Manual	984628
(2)	Spare Parts Catalogue	979805
(3)	Brief Description	984626

ANNEX 10-B1

Characteristics of the Minimi, Mk1, Light Machine Gun, 5.56mm (Nominated by BELGIUM)

10.B1.1		Weapon:	Minimi, Mk1, Light Machine Gun, 5.56mm
		Nominating Nation:	Belgium
		Manufacturer:	Fabrique Nationale Herstal (FN)
		NATO Stock Number (NSN):	1005-13-112-8292
	(1)	Mass of weapon	6.875 kg
		Full box of 200 cartridges:	3.160 kg
		Full FN 30 round magazine:	0.600 kg
		Full M16 30 round magazine:	0.490 kg
	(2)	Length of weapon	1.038 m
	(3)	Life of weapon	65,000 rounds

10.B1.2 Weapon Operation

	(1)	Operation	Gas-operated by piston
	(2)	Gas adjustment	Two (2) position selection lever on the barrel normal conditions; adverse conditions, increasing energy supply to moving parts by adjusting the gas escape.
	(3)	Feed	By 200 round belt with M27 disintegrating links in a box which can be fitted to the weapon or by 30 round magazine or by hanging belt
	(4)	Regulation of fire	Full Automatic (in bursts)
	(5)	Mechanism position	Open breech operation
	(6)	Ejection	Forward to right by mobile ejector
	(7)	Extraction	Claw extractor on bolt
	(8)	Nominal rate of fire	Not provided
	(9)	Practical rate of fire	500 rounds in 5 minutes
	(10)	Cyclic rate:	
		Recommended cyclic rate	750 rounds/minute
		Minimum cyclic rate	700 rounds/minute

	Maximum cyclic rate	1000 rounds/minute
(11)	Trigger pull: minimum:	35 N
	maximum:	70 N

10.B1.3 Barrel Characteristics

(1)	Length of barrel	466 mm without attachment or flash concealer
(2)	Rifling twist	177.8 mm (right hand)
(3)	Number of grooves	6
(4)	Groove width	1.98 ± 0.1 mm
(5)	Diameter across grooves	5.685 ± 0.020 mm
(6)	Diameter across bore	5.550 ± 0.025 mm
(7)	Barrel life and life of replacement barrels	15,000 rounds with SS109 ammunition at the rate of 500 rounds in 5 minutes
(8)	Criterion for end of barrel service life	Over 60 m/s drop in velocity or more than 20% ovalization (bullet yaw) in excess of 15°

(9) Chamber and bore are chromium-plated.

(10) As a rough guide, V_o is ~ 915 m/s

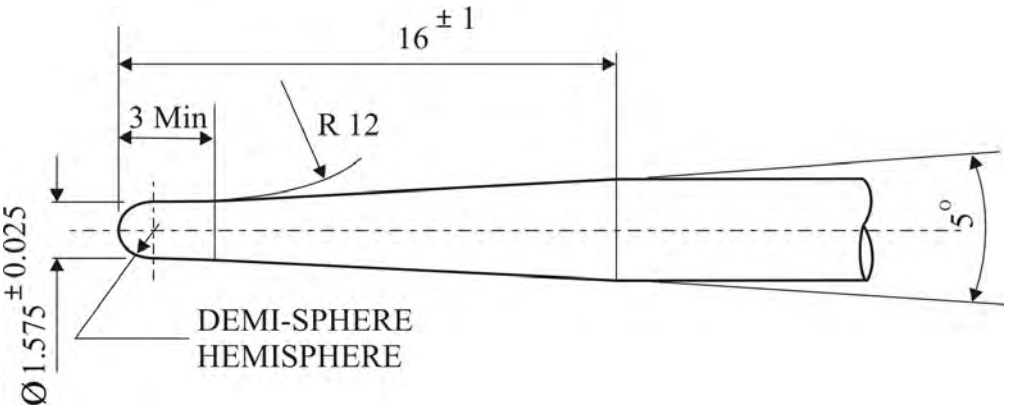
10.B1.4 Bolt Recoil Velocity

(1)	Minimum	7 m/s
(2)	Maximum	9 m/s

10.B1.5 Firing Pin Characteristics

(1)	Firing pin protrusion:	
	minimum:	0.76 mm
	maximum:	1.12 mm
(2)	Diameter of firing pin hole in breech block	1.63 ± 0.02 mm

(3) Sketch of firing pin point: The Test centres shall measure the impression left by the firing pin on a copper cylinder when the weapons are delivered.



10.B1.6 Cartridge Headspace of Weapon

(1)	Cartridge headspace	37.95 to 38.05 mm at the 7.663 mm diameter danger level: 38.15 mm reject level: 38.20 mm
(2)	Adjustment of headspace	Not applicable
(3)	Free run of bullet	3 mm (rough guide)

10.B1.7 Sighting System

(1)	Foresight	Threaded cylinder
(2)	Back sight	Aperture adjustable in height by slider from 300 m to 1,000 m at 100 m intervals plus battle sight
(3)	Sight radius	500 mm

10.B1.8 Gauges (drawing numbers, respectively identification numbers)

(1)	Headspace	Min: 10/37.95/7.663 Max: 10/38.08/7.663
(2)	Firing pin protrusion	0736171606A + 0736171606B

(3)	Extractor protrusion	0739071717
(4)	Minimum bore diameter	5530 AP
(5)	Maximum bore wear	5650 AP + EC 105
(6)	Free run of bullet	CB 259

10.B1.9 Miscellaneous

10.B1.10 Documentation

		FRENCH	ENGLISH
(1)	User's handbook	MO 3610052001	MO 3610054006
(2)	List of spares	CP 3610072005	CP 3610074000
(3)	Technical manual	MT 3610082007	MT 3610084001.

ANNEX 10-B2

Characteristics of the AR 70/90, Rifle, 5.56mm (Nominated by ITALY)

10.B2.1	Weapon:		AR 70/90, Automatic Rifle, 5.56mm
	Nominating Nation:		Italy
	Manufacturer:		Beretta
	NATO Stock Number (NSN):		1005-15-114-7229
(1)	Mass of weapon		4 kg
(2)	Length of weapon		0.995 m
(3)	Life of weapon		Total number of rounds in relation to permitted wear of weapon: 12,000 rounds

10.B2.2 Weapon Operation

(1)	Operation		Gas-operated by piston
(2)	Gas adjustment		Yes
(3)	Feed		Removable magazine seated in the lower middle part
(4)	Regulation of fire		Semi-automatic Full Automatic 3-round burst
(5)	Mechanism position		Selector safety, positioned on both sides of trigger housing
(6)	Ejection		Fixed ejector, right hand expulsion
(7)	Extraction		Extractor on bolt head
(8)	Nominal rate of fire		600 - 740 rounds/minute
(9)	Practical rate of fire		Not provided
(10)	Cyclic rate:		
	Recommended cyclic rate		670 rounds/minute
	Minimum cyclic rate		600 rounds/minute
	Maximum cyclic rate		740 rounds/minute
(11)	Trigger pull:	minimum:	31.4 N
		maximum:	42.2 N

10.B2.3 Barrel Characteristics

(1)	Length of barrel	450 mm
(2)	Rifling twist	177.8 mm (7 in.) (right hand)
(3)	Number of grooves	6
(4)	Groove width	1.80 mm
(5)	Diameter across grooves	5.66 + 0.05 mm
(6)	Diameter across bore	5.525 + 0.05 mm
(7)	Barrel life and life of replacement barrels	12,000 rounds
(8)	Criterion for end of barrel service life	see para. 10.B2.8 (5)

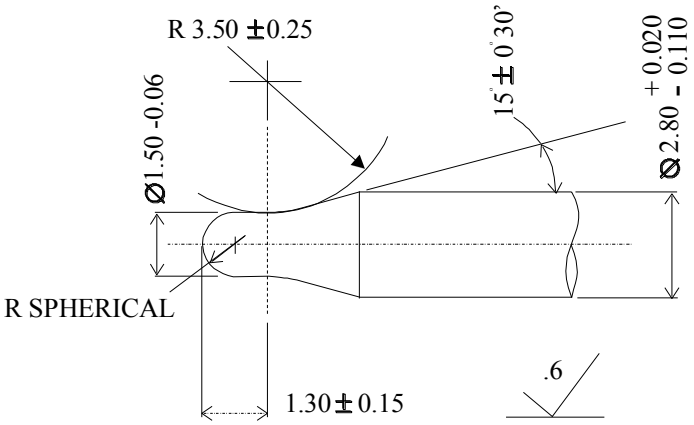
(9) Chamber and bore are chromium-plated.

10.B2.4 Bolt Recoil Velocity

(1)	Minimum	5 m/s
(2)	Maximum	8 m/s

10.B2.5 Firing Pin Characteristics

(1)	Firing pin protrusion: minimum: maximum:	0.725 + 0.25 mm Not provided Not provided
(2)	Diameter of firing pin hole in breech block	1.60 ± 0.10 mm
(3)	Sketch of firing pin point:	The Test centres shall measure the impression left by the firing pin on a copper cylinder when the weapons are delivered.



10.B2.6 Cartridge Headspace of Weapon

(1)	Cartridge headspace	Min: 37.10 mm at Ø of 8.38 Max: 37.275 mm at Ø of 8.38
(2)	Adjustment of headspace	Not applicable
(3)	Free run of bullet	3.5 mm

10.B2.7 Sighting System

(1)	Foresight	Adjustable for elevation
(2)	Back sight	Two positions up to 250 m and up to 400 m adjustable for windage
(3)	Sight radius	0.75 mm

10.B2.8 **Gauges** (drawing numbers, respectively identification numbers)

(1) Cartridge Headspace – limits of service

(37.10 mm)	dis. SMAL	N03-619-012/1
	NUC	1305-15-116-2913
(37.35 mm)	dis. SMAL	N03-609-002/9
	NUC	1305-15-008-9734

(2) Firing pin protrusion

(0.7 – 1 mm)	dis. SMAL	N03-619-001
	NUC	4933-15-116-2902

(3) Extractor protrusion

(1.25 – 1.65 mm)	dis. SMAL	N03-609-009
	NUC	1005-15-008-9881

(4) Minimum bore diameter — Ø 5.525 plug

dis SMAL	N03-619-A-10/5
NUC	Does not exist

(5) Maximum bore wear — Max penetration of Ø 5.66 plug 100 mm

dis. SMAL	N03-617-002
NUC	1005-15-005-0161

(6) Free run of bullet

Dis. SMAL	N03-619-004
NUC	4933-15-116-2904

10.B2.9 Miscellaneous

10.B2.10 Documentation

(1) Illustrated pamphlet obtainable from:

P BERETTA Weapon Plant
25063 Gardone Val Trompia (Brescia)
ITALY

ANNEX 10-B3

Characteristics of the M16A2/M16A4, Rifle, 5.56mm (Nominated by UNITED STATES)

10.B3.1	Weapon:		M16A2/M16A4, Rifle, 5.56mm
	Nominating Nation:		United States
	Manufacturer:		FN America, LLC
	NATO Stock Number (NSN):		1005-01-383-2872 (M16A2 or M16A4)
(1)	Mass of weapon		3.40 kg (7.5 lb approx.) 0.4575 kg (1.01 lb filled magazine)
(2)	Length of weapon		1.006 m (39.6 in.)
(3)	Life of weapon		100,000 rounds

10.B3.2 Weapon Operation

(1)	Operation		Gas-operated
(2)	Gas adjustment		None
(3)	Feed		Removable magazine (30 round capacity)
(4)	Regulation of fire		Semi-automatic 3-round burst
(5)	Mechanism position		Fired from closed breech
(6)	Ejection		To the right by spring loaded plunger
(7)	Extraction		Claw extractor on bolt
(8)	Nominal rate of fire		Not provided
(9)	Practical rate of fire		Not provided
(10)	Cyclic rate:		700 - 900 rounds/minute
	Recommended cyclic rate		Not provided
	Minimum cyclic rate		Not provided
	Maximum cyclic rate		Not provided
(11)	Trigger pull:	minimum:	Not provided
		maximum:	Not provided

10.B3.3 Barrel Characteristics

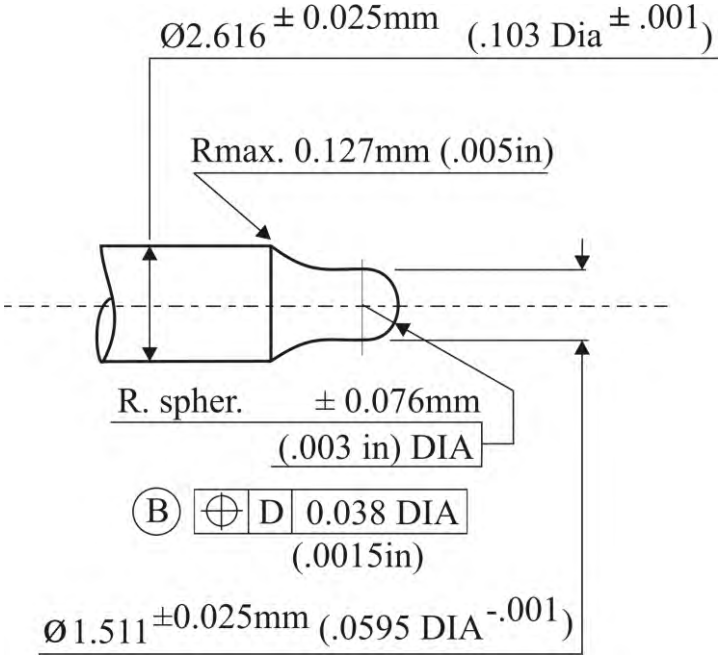
(1)	Length of barrel	505.4 - 0.762 mm (19.899 - 0.030 in.)
(2)	Rifling twist	1 in 177.8 ± 3.048 mm (right hand) (1 in 7 ± 0.120 in.)
(3)	Number of grooves	6
(4)	Groove width	1.87 + 0.102 mm (0.074 + 0.004 in.)
(5)	Diameter across grooves	5.68 + 0.025 mm (0.2235 + 0.001 in.)
(6)	Diameter across bore	5.563 + 0.025 mm (0.219 + 0.001 in.)
(7)	Barrel life and life of replacement barrels	6,000 rounds minimum
(8)	Criterion for end of barrel service life	Not provided

10.B3.4 Bolt Recoil Velocity

(1)	Minimum	Not provided
(2)	Maximum	Not provided

10.B3.5 Firing Pin Characteristics

(2)	Firing pin protrusion: minimum: maximum:	 0.711 mm (0.028 in.) 0.914 mm (0.036 in.)
(2)	Diameter of firing pin hole in breech block	Not provided
(3)	Sketch of firing pin point:	The Test centres shall measure the impression left by the firing pin on a copper cylinder when the weapons are delivered.



10.B3.6 Cartridge Headspace of Weapon

(1)	Cartridge headspace (datum diameter on the first shoulder of the chamber)	Min: 37.125 mm (1.4616 in.) at Ø of 8.382 mm (0.330 in.) Max: 37.353 mm (1.4706 in.) at Ø of 8.382 mm (0.330 in.)
(2)	Adjustment of headspace	Fixed
(3)	Free run of bullet	Not provided

10.B3.7 Sighting System

(1)	Foresight	Square post with vertical screw adjustment for elevation
(2)	Back sight	Aperture, fully adjustable for windage and elevation out to 800 m
(3)	Sight radius	501.65 mm

10.B3.8 Gauges (drawing numbers, respectively identification numbers)

(1)	Headspace	Maximum: 37.353 mm (1.4706 in.) Minimum: 37.1245 mm (1.4616 in.) See drawings C8439667 and C8439668
(2)	Firing pin protrusion	Not provided
(3)	Extractor protrusion	Not provided
(4)	Minimum bore diameter	Not provided
(5)	Maximum bore wear	Not provided
(6)	Free run of bullet	Not provided

10.B3.9 Miscellaneous

(1)	Bayonet knife	M7, with scabbard
(2)	Bipod, rifle	M3, with carrying case
(3)	Launcher, grenade, detachable	40mm , M320

10.B3.10 Documentation

(1)	Rifle, 5.56 mm M16 A2/A4	Operator Manual: (TM 9-1005-319-10) Technical Manual: (TM 9-1005-319-23&P)

ANNEX 10-B4

Characteristics of the G36/G36A1, Rifle, 5.56mm (Nominated by GERMANY)

10.B4.1	Weapon:		G36/G36A1, Rifle, 5.56mm
	Nominating Nation:		Germany
	Manufacturer:		Heckler & Koch (H&K)
	NATO Stock Number (NSN):		1005-12-336-3195 (G36) 1005-12-353-5176 (G36A1)
(1)	Mass of weapon		3,63 kg without magazine
(2)	Length of weapon		1.000 m
(3)	Life of weapon		10,000 rounds

10.B4.2 Weapon Operation

(1)	Operation		Gas-operated
(2)	Gas adjustment		None
(3)	Feed		Magazine
(4)	Regulation of fire		Full automatic Semi-automatic
(5)	Mechanism position		Fired from closed bolt position
(6)	Ejection		Right hand by spring loaded ejector
(7)	Extraction		By spring loaded extractor
(8)	Nominal rate of fire		750 rounds/minute
(9)	Practical rate of fire		210-240 rounds/minute
(10)	Cyclic rate:		
	Recommended cyclic rate		800 - 820 rounds/minute
	Minimum cyclic rate		700 rounds/minute
	Maximum cyclic rate		900 rounds/minute
(11)	Trigger pull:	minimum:	25 N
		maximum:	55 N

10.B4.3 Barrel Characteristics

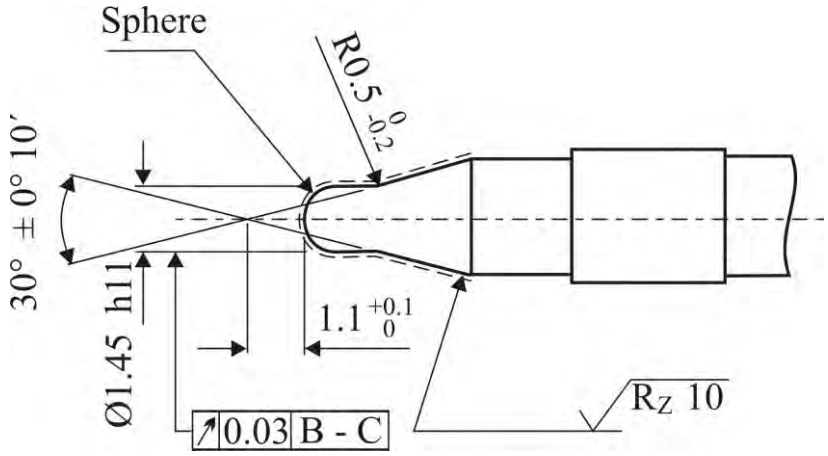
(1)	Length of barrel	480 mm
(2)	Rifling twist	178 mm
(3)	Number of grooves	6
(4)	Groove width	1.95 mm
(5)	Diameter across grooves	5.68 – 5.77 mm
(6)	Diameter across bore	5.55 – 5.62 mm
(7)	Barrel life and life of replacement barrels	10,000 rounds minimum
(8)	Criterion for end of barrel service life	Criteria of AC/225-D/14 and/or barrel wear gauge (see gauges)

10.B4.4 Bolt Recoil Velocity

(1)	Minimum	5 m/s
(2)	Maximum	6 m/s

10.B4.5 Firing Pin Characteristics

(1)	Firing pin protrusion: minimum: maximum:	0.9 + 0.2 mm Not provided Not provided
(2)	Diameter of firing pin hole in breech block	1.5 mm h11
(3)	Sketch of firing pin point:	The Test centres shall measure the impression left by the firing pin on a copper cylinder when the weapons are delivered.



10.B4.6 Cartridge Headspace of Weapon

(1)	Cartridge headspace (assembly value)	s = 47.05 + 0.17 mm
(2)	Adjustment of headspace	None
(3)	Free run of bullet	Approx. 7 - 9 mm

10.B4.7 Sighting System

(1) No mechanical sights except an emergency sight on the carrying grip

(2)	Two optical sights:	Red point sight (up to 150 meters) 3 x telescopic sight (up to 800 meters)

10.B4.8 **Gauges** (drawing numbers, respectively identification numbers)

(1)	Cartridge headspace	Go: 347 069 (47.05mm) No-Go: 346 051 (47.23mm)
(2)	Firing pin protrusion	346 280
(3)	Extractor protrusion	Go: 346 968 No-Go: 347 076
(4)	Minimum bore diameter	Ø 5.55 mm: 340 840
(5)	Maximum bore wear	Ø 5.64 mm: 340 854 (80 mm in front of barrel mouth)
(6)	Free run of bullet	Does not exist

10.B4.9 Miscellaneous

10.B4.10 Documentation

(1)	Maintenance Manual	986835
(2)	Spare Parts Catalogue	987442
(3)	Brief Description	986832

ANNEX 10-B5

Characteristics of the L85A2, Rifle, 5.56mm (Nominated by UNITED KINGDOM)

10.B5.1		Weapon: Nominating Nation: Manufacturer: NATO Stock Number (NSN):	L85A2, Rifle, 5.56mm United Kingdom Heckler & Koch (H&K) (TMH still IPR with Royal Ordnance (STSP) 1005-12-336-3195 (G36) 1005-12-353-5176 (G36A1)
	(1)	Mass of weapon	3.7 kg without magazine or sights 0.61 kg filled magazine only
	(2)	Length of weapon	0.773 m
	(3)	Life of weapon	Unspecified (Weapon is inspected and repaired during unit maintenance, this maintains the life of the weapon during its in service life)
10.B5.2		**Weapon Operation**	
	(1)	Operation	Gas-operated by short stroke piston
	(2)	Gas adjustment	None
	(3)	Feed	Magazine (30 rounds)
	(4)	Regulation of fire	Full Automatic Semi-automatic
	(5)	Mechanism position	Fired from closed bolt position
	(6)	Locking	Forward locking rotating bolt
	(7)	Ejection	Rearward to right, plunger located in breech bolt
	(8)	Extraction	Claw extractor on breech bolt
	(9)	Nominal rate of fire	Not provided
	(10)	Practical rate of fire	Not provided
	(11)	Cyclic rate: Recommended cyclic rate Minimum cyclic rate	700 -900 rounds/minute Not provided Not provided

	Maximum cyclic rate	Not provided
(12)	Trigger pull: minimum:	Not provided
	maximum:	Not provided

10.B5.3 Barrel Characteristics

(1)	Length of barrel	495 mm
(2)	Rifling twist	1 in 180 mm (right hand)
(3)	Number of grooves	6
(4)	Groove width	Not provided
	Land width	0.97 + 0.10 mm
(5)	Diameter across grooves	5.66 + 0.03 mm
(6)	Diameter across bore	5.54 + 0.03 mm
(7)	Barrel life and life of replacement barrels	10,000 rounds
(8)	Criterion for end of barrel service life	Not provided

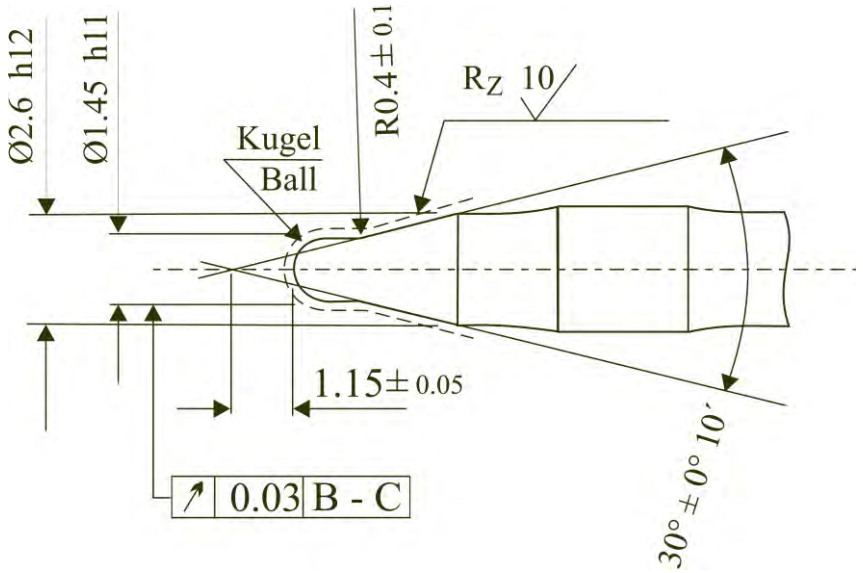
(9) Chamber and bore are chromium plated.

10.B5.4 Bolt Recoil Velocity

(1)	Minimum	2 m/s
(2)	Maximum	5 m/s

10.B5.5 Firing Pin Characteristics

(1)	Firing pin protrusion:	0.9 + 0.2 mm
	minimum:	Not provided
	maximum:	Not provided
(2)	Diameter of firing pin hole in breech block	Ø 1.50 ± 0.02 mm
(3)	Sketch of firing pin point:	The Test centres shall measure the impression left by the firing pin on a copper cylinder when the weapons are delivered.



10.B5.6 Cartridge Headspace of Weapon[1]

(1)	Headspace	38.08 to 38.39 mm (to 7.66 mm diameter datum) including service wear limits
(2)	Adjustment of headspace	Not provided
(3)	Free run of bullet	Not provided
(4)	Depth of chamber	34.715 ± 0.075 mm from rear face of barrel to 7.66 mm diameter datum
(5)	Extractor claw space	1.28 ± 0.2 mm The extractor claw space is the space between the claw and the bolt head space.

Note[1]: Tolerances/measurements are for 'in-service'

10.B5.7 Sighting System

(1)	Primary sight[1] L12A1 (B4/1240-99-967-0947)	Sight unit small arms – Trilux (SUSAT) optical sight 4x magnification. Range adjustable 300 800 m in 100 m steps.
(2)	Secondary sight[2]	Fixed post type, vertical foresight, zeroing adjustment Backsight fixed hinge, 2 position leaf type with azimuth zeroing adjustment Sight base variable 316 ± 20 mm

(3)	Emergency battlesight	Mounted on top of SUSAT

Safety Note[1]: Contains a 4.7 GBq nuclear lamp (a glass phial containing Tritium gas) for illuminating the tip of the pointer.
Safety Note[2]: The foresight contains a trilux light source of 333 Mbg.

10.B5.8 Gauges (drawing numbers, respectively identification numbers)

(1)	Cartridge headspace	Accept: 38.08 mm Gauge, Cartridge Headspace SM 1022 B4/5220-99-967-0933 Reject: 38.39 mm Gauge, Cartridge Headspace SM 1021 B4/5220-99-967-0932
(2)	Firing pin protrusion	0.90 - 1.10 mm Gauge, Armourers Firing Pin Protrusion 350102 B4/5220-99-967-0926
(3)	Extractor protrusion	Not provided
(4)	Minimum bore diameter	Not provided
(5)	Maximum bore wear	Not provided
(6)	Free run of bullet	Not provided
(7)	Bore gauge	5.53 mm Gauge Plug Plain, SM 1015 B4/5220-99-967-0926

10.B5.9 Miscellaneous

(1)	Width of weapon (maximum)	70 mm (projection on front end of handguard)
(2)	Removable bayonet	Muzzle cap, carrying sling, cleaning kit supplied

(3) Interchangeable mechanisms will be available for use with training ammunition.

(4) Secondary sight doubles as carrying handle.

10.B5.10 Documentation

Relevant handbook to be issued.

(1) Rifle 5.56mm, L85A2 and Derivatives:

Purpose and Planning Information	AESP 1005-L-202-101
Equipment Support Policy Directives	AESP 1005-L-202-111
Operating Information	AESP 1005-L-202-201
Repair Instructions	AESP 1005-L-202-522
Base Repair Instructions	AESP 1005-L-202-524
Inspection Standards	AESP 1005-L-202-532
Maintenance Schedules	AESP 1005-L-202-601
Illustrated Parts Catalogue	AESP 1005-L-202-711
Complete Equipment Schedule, Service Edition	AESP 1005-L-202-741
Modification Instructions	AESP 1005-L-202-811
General Instruction and Index	AESP 1005-L-202-821

ANNEX 10-C1

Characteristics of the P90, Sub-Machine Gun, 5.7mm (Nominated by BELGIUM)

10.C1.1		Weapon: Nominating Nation: Manufacturer: NATO Stock Number (NSN):	P90, Sub-Machine Gun, 5.7mm Belgium Fabrique Natoinale (FN) Herstal 1005-13-119-0888 (Tactical without laser)
	(1)	Mass of weapon	2.5 kg without magazine 2.7 kg with empty magazine 3.0 kg with fully-loaded magazine
	(2)	Length of weapon	0.502 m
	(3)	Life of weapon	20,000 rounds (barrel, frame, breech block and breech block guide)
10.C1.2		**Weapon Operation**	
	(1)	Operation	Blowback mechanism
	(2)	Gas adjustment	None
	(3)	Feed	Magazine (50 rounds)
	(3)	Regulation of fire	Semi-automatic (bursts) Single shot
	(5)	Mechanism position	Fired from closed breech
	(6)	Ejection	Downwards by mobile ejector
	(7)	Extraction	Claw extractor on bolt
	(8)	Nominal rate of fire	Not provided
	(9)	Practical rate of fire	Not provided
	(10)	Cyclic rate: Recommended cyclic rate Minimum cyclic rate Maximum cyclic rate	850 - 1100 rounds/minute (initial) Not provided Not provided Not provided
	(11)	Trigger pull: minimum: maximum:	Not provided Not provided

10.C1.3 Barrel Characteristics

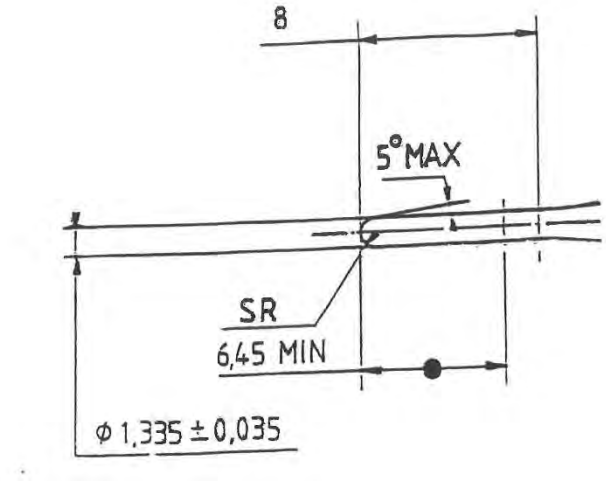
(1)	Length of barrel	264 mm (without flash hider)
(2)	Rifling twist	231 ± 3 mm (right hand)
(3)	Number of grooves	8
(4)	Groove width	1.63 + 0.1 mm
(5)	Diameter across grooves	5.64 ± 0.02 mm
(6)	Diameter across bore	5.56 ± 0.025 mm
(7)	Barrel life and life of replacement barrels	20,000 rounds minimum
(8)	Criterion for end of barrel service life	Not provided

10.C1.4 Bolt Recoil Velocity

(1)	Minimum	6 m/s
(2)	Maximum	9 m/s

10.C1.5 Firing Pin Characteristics

(2)	Firing pin protrusion: minimum: maximum:	1.35 ± 0.18 mm Not provided Not provided
(2)	Diameter of firing pin hole in breech block	1.43 ± 0.05 mm
(3)	Sketch of firing pin point:	The Test centres shall measure the impression left by the firing pin on a copper cylinder when the weapons are delivered.



10.C1.6 Cartridge Headspace of Weapon[1]

(1)	Headspace	Not applicable
(2)	Adjustment of headspace	Not applicable
(3)	Free run of bullet	Not provided
(4)	Depth of chamber	Not provided
(5)	Extractor claw space	Not provided.

10.C1.7 Sighting System

(1) Reflex optical sight without amplification

10.C1.8 Gauges

(1)	Bore gauge, MINI	STD5495AP
(2)	Axial protrusion extractor	0738171114
(3)	Timing sear MAXI	0738171085
(4)	Gauge, bore, warning and reject	0738171117

10.C1.9 Miscellaneous

10.C1.10 Documentation

(1)	Operator’s basic instructions	3810054170
(2)	Catalog of parts and accessories	38100844110
(3)	Maintenance manual	381007410

ANNEX 10-C2

Characteristics of the Five-seveN Mk2, Pistol, 5.7mm (Nominated by BELGIUM)

10.C2.1	Weapon:		Five-seveN Mk2, Pistol, 5.7mm
	Nominating Nation:		Belgium
	Manufacturer:		Fabrique Natoinale (FN) Herstal
	NATO Stock Number (NSN):		1005-13-121-5346
(1)	Mass of weapon		0.66 kg with empty magazine
	Mass of full magazine		Not provided
	Mass of empty magazine		Not provided
(2)	Length of weapon		0.208 m
(3)	Life of weapon		20,000 rounds

10.C2.2 Weapon Operation

(1)	Operation		Delayed blowback mechanism
(2)	Gas adjustment		None
(3)	Feed		Magazine (20 rounds)
(4)	Regulation of fire		Semi-automatic
(5)	Mechanism position		Simple action
(6)	Ejection		Right-hand side, fixed ejector
(7)	Extraction		Claw extractor on slide
(8)	Trigger pull:	minimum:	Not provided
		maximum:	Not provided

10.C2.3 Barrel Characteristics

(1)	Length of barrel	122.5 mm
(2)	Rifling twist	231 ± 3 mm (right hand)
(3)	Number of grooves	8

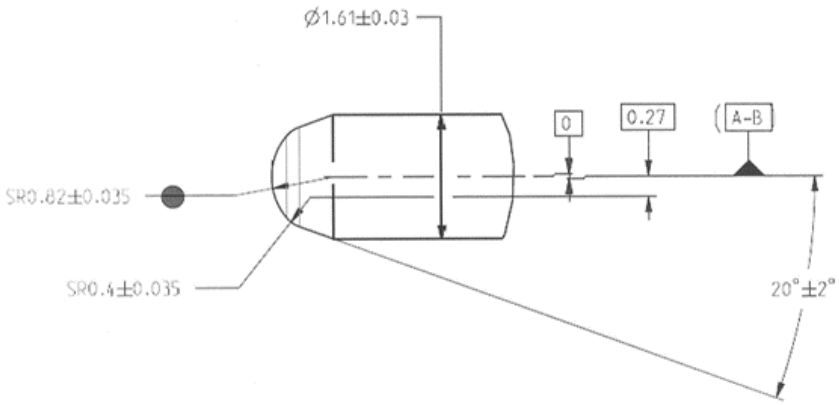
(4)	Groove width	1.63 + 0.1 mm
(5)	Diameter across grooves	5.64 ± 0.02 mm
(6)	Diameter across bore	5.56 ± 0.025 mm
(7)	Barrel life and life of replacement barrels	20,000 rounds minimum
(8)	Criterion for end of barrel service life	Not provided

10.C2.4 Bolt Recoil Velocity

(1)	Minimum	6 m/s
(2)	Maximum	9 m/s

10.C2.5 Firing Pin Characteristics

(1)	Firing pin protrusion: minimum: maximum:	Not applicable NA NA
(2)	Diameter of firing pin hole in breech block	1.72 ± 0.03 mm
(3)	Sketch of firing pin point:	The Test centres shall measure the impression left by the firing pin on a copper cylinder when the weapons are delivered.



10.C2.6 Cartridge Headspace of Weapon[1]

(1)	Headspace	Not applicable
(2)	Adjustment of headspace	Not applicable
(3)	Free run of bullet	Not provided
(4)	Depth of chamber	Not provided
(5)	Extractor claw space	Not provided

10.C2.7 Sighting System

(1) Not provided

10.C2.8 Gauges

(1)	Bore gauge, MINI	STD5495AP
(2)	Gauge, bore, warning and reject	0738171117

10.C2.9 Miscellaneous

10.C2.10 Documentation

(1)	Operator’s basic instructions	3860054160
(2)	Catalog of parts and accessories	3860074080
(3)	Maintenance manual	3860084110

ANNEX 10-D1

Characteristics of the L7A2, General Purpose Machine Gun (GPMG), 7.62mm (Nominated by UNITED KINGDOM)

10.D1.1	Weapon:		L7A2, Machine Gun, 7.62mm
	Nominating Nation:		United Kingdom
	Manufacturer:		Heckler & Koch (H&K)
	NATO Stock Number (NSN):		1005-13-103-2524 (GPMG Bare Weapon) 1005-99-284-6898 (GPMG w/Spare Barrel)
	(1)	Mass of weapon	10.9 kg
	(2)	Length of weapon	1.235 m
	(3)	Life of weapon	Unspecified (Weapon is inspected and repaired during unit maintenance, this maintains the life of the weapon during its in service life)
10.D1.2	**Weapon Operation**		
	(1)	Operation	Gas and recoil buffer
	(2)	Gas adjustment	When the regulator is set at maximum, the rate of fire is approximately 900 rounds per minute and when set at 7, the rate of fire is nominally 750 rounds per minute.
	(3)	Feed	Left to right with belts of M13 disintegrating links
	(4)	Regulation of fire	Full Automatic
	(5)	Mechanism position	The breech block is positively locked before the round is fired.
	(6)	Ejection	Cartridge case is downward, links are to the right.
	(7)	Extraction	Claw extractor on breech face
	(8)	Nominal rate of fire	Not provided
	(9)	Practical rate of fire	Not provided
	(10)	Cyclic rate:	Optimum: 750 - 800 rounds per minute. Adjustable from 600 to 1,000 rounds per

		minute (approx.)
	Recommended cyclic rate	Not provided
	Minimum cyclic rate	Not provided
	Maximum cyclic rate	Not provided
(11)	Trigger pull: minimum:	35.7 N (8 lbs.)
	maximum:	62.4 N (14 lbs.)

10.D1.3 Barrel Characteristics

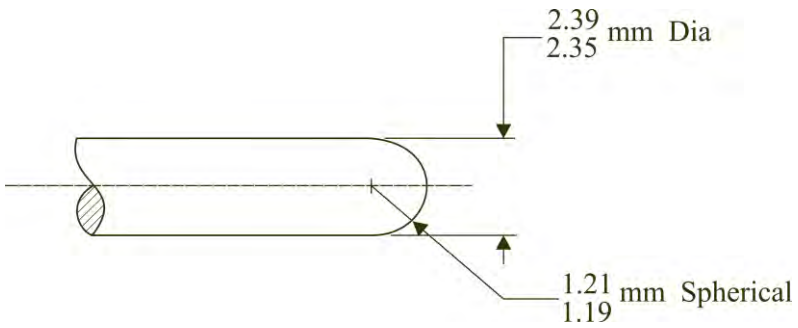
(1)	Length of barrel Barrel (including 51mm handle overhang):	547 mm (21.5 in.) 711mm (28 in.)
(2)	Rifling twist	1 in 304.8 mm (right hand) (1 in 12 in.)
(3)	Number of grooves	4
(4)	Groove width	Not provided
(5)	Diameter across (into) grooves	7.845/7.56 mm (.3089/.3054 in.) at muzzle 7.885/7.805 mm (.3105/.3073 in.) at breech
(6)	Diameter across bore (Lands)	7.655/7.605 mm (.3013/.2994 in.) at breech 7.625/7.52 mm (.3002/.2963 in.) at muzzle
(7)	Barrel life and life of replacement barrels	Not provided *Plug cylindrical 7.493 mm (.295 in.) must always pass through the barrel.* *Plug cylindrical 7.772 mm (.306 in.)must NOT enter the breech end of the barrel more than 101.6 mm (4 ins.) from breech face.*
(8)	Criterion for end of barrel service life	Not provided

10.D1.4 Bolt Recoil Velocity

(1)	Minimum	2 m/s
(2)	Maximum	5 m/s

10.D1.5 Firing Pin Characteristics

(1)	Firing pin protrusion: minimum: maximum:	 0.406 mm (.016 in.) 0.889 mm (.035 in.)
(2)	Diameter of firing pin hole in breech block	2.45 ± 0.020 mm (.095 ± .0008 in.)
(3)	Sketch of firing pin point:	The Test centres shall measure the impression left by the firing pin on a copper cylinder when the weapons are delivered.



10.D1.6 Cartridge Headspace of Weapon

(1)	Headspace minimum: maximum:	 41.275 mm (1.6253 in.) 41.783 mm (1.645 in.)
(2)	Adjustment of headspace	None
	Headspace measurement	The breech must close with the 41.275 mm (1.6253 in.) gauge in chamber. The breech must not close with the 41.783 mm (1.645 in.) gage in chamber.
(3)	Free run of bullet	Not provided
(4)	Depth of chamber	Not provided
(5)	Extractor claw space	Not provided

10.D1.7 Sighting System

(1)	Foresight	Blade
(2)	Rear Sight	Aperture
(3)	Sight Radius	851 mm (33.5 in.) rear sight folded (*In the folded position the range settings are from 200 – 800 meters in 100 meter intervals*.) 787 mm (31 in.) rear sight raised (*In the vertical position the sight can be set at 50 meter intervals from 800 – 1800 meters.)*

10.D1.8 Gauges (drawing numbers, respectively identification numbers)

(1)	For Headspace	Min: 41.275 mm (1.6253 in.) Gauge, armourers, cartridge headspace Mk1 NSN: 5220-99-960-5326 Max: 41.783 mm (1.645 in.) Gauge, armourers, cartridge headspace Mk2 NSN: 5220-99-960-4543
(2)	For Barrel	Min: 7.493 mm (.295 in.) Gauge plug plain cylindrical, armourers Mk1: NSN: 5220-99-960-5279 Max: 7.772 mm (.306 in.) Gauge, plug plain cylindrical, armourers NSN: 5220-99-961-8115
(3)	Firing Pin Protrusion	0.889/0.406 mm (.035/.016 in.) No12 Mk1 NSN: 5220-99-960-4542

10.D1.9 Miscellaneous

BEFORE EACH TEST IT IS ESSENTIAL THAT THE WEAPON IS BALANCED CORRECTLY IN ACCORDANCE WITH AESP 1005-N-510-201, CHAPTER 2, PARAGRAPHS 55 to 62, BEFORE OPERATION TO ENSURE CORRECT FUNCTIONING AND AVOIDANCE OF PREMATURE COMPONENT WEAR.

10.D1.10 Documentation

(1) General Purpose Machine Gun 7.62mm, L7A2 and Derivatives:

Purpose and Planning Information	AESP 1005-N-510-101
Equipment Support Policy Directives	AESP 1005-N-510-111

Operating Information	AESP 1005-N-510-201
Installation Instructions	AESP 1005-N-510-412
Maintenance Instructions	AESP 1005-N-510-522
Maintenance Instructions	AESP 1005-N-510-523
Maintenance Instructions	AESP 1005-N-510-524
Inspection Standards	AESP 1005-N-510-532
Inspection Standards	AESP 1005-N-510-533
Maintenance Schedule	AESP 1005-N-510-601
Maintenance Schedule	AESP 1005-N-510-602
Illustrated Parts Catalogue	AESP 1005-N-510-711
Complete Equipment Schedule, Service Edition (Simple Equipment)	AESP 1005-N-510-741
Modification Instructions	AESP 1005-N-510-811
General Instructions, Special Technical Instructions and Servicing Instructions	AESP 1005-N-510-821

ANNEX 10-D2

Characteristics of the M240B, Machine Gun, 7.62mm (Nominated by UNITED STATES)

10.D2.1	Weapon:		M240B, Machine Gun, 7.62mm
	Nominating Nation:		United States
	Manufacturer:		FN America, LLC.
	NATO Stock Number (NSN):		1005-01-412-3129
(1)	Mass of weapon		12.57 kg (27.7 lbs)
(2)	Length of weapon		1.23 m (48.4 in.)
		Buttstock Collapsed	1.13 m (44.5 in.)
		Buttstock Extended	1.21 m (47.6 in.)
(3)	Life of weapon		50,000 rounds minimum
10.D2.2	**Weapon Operation**		
(1)	Operation		Gas and recoil buffer
(2)	Gas adjustment		Single-position gas regulator
(3)	Feed		Left to right with belts of M13 disintegrating links
(4)	Regulation of fire		Full Automatic
(5)	Mechanism position		The breech block is positively locked before the round is fired.
(6)	Ejection		Cartridge case is downward, links are to the right.
(7)	Extraction		Claw extractor on breech face
(8)	Nominal rate of fire		Not provided
(9)	Practical rate of fire		Not provided
(10)	Cyclic rate:		550 – 650 rounds per minute
	Recommended cyclic rate		Not provided
		Minimum cyclic rate	Not provided
		Maximum cyclic rate	Not provided
(11)	Trigger pull:	minimum:	39.2 N (8.8 lbs.)
		maximum:	83.4 N (18.74 lbs.)

10.D2.3 Barrel Characteristics

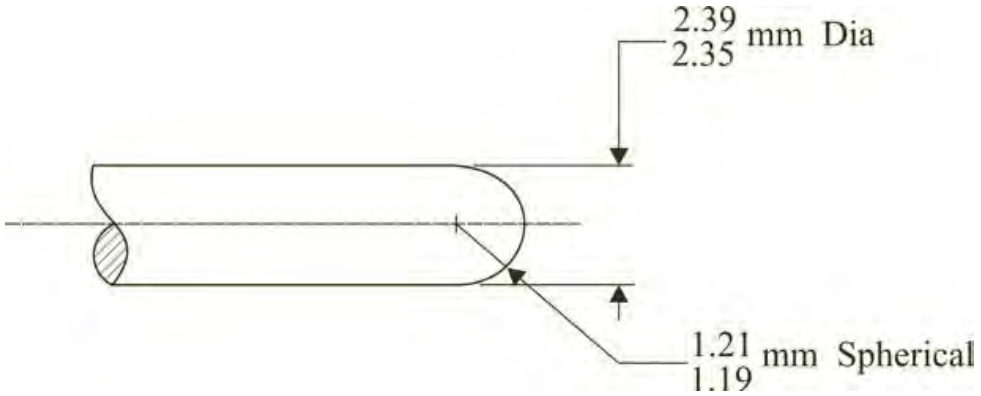
(1)	Length of barrel Without flash suppressor With flash suppressor	 547 mm (21.5 in.) 600.1 mm (23.625 in.)
(2)	Rifling twist	1 in 304.8 mm (right hand) (1 in 12 in.)
(3)	Number of grooves	4
(4)	Groove width	4.14 - 4.49 mm (0.163 - 0.177 in.) at muzzle 4.19 4.49 mm (0.163 - 0.177 in.) at breech
(5)	Diameter across (into) grooves	7.785 - 7.86 mm (0.3065 - 0.3094 in.) at muzzle 7.795 - 7.86 mm (0.3069 - 0.3094 in.) at breech
(6)	Diameter across bore (Lands)	7.585 - 7.65 mm (0.299 - 0.301 in.) at muzzle 7.595 - 7.65 mm (0.299 - 0.301 in.) at breech
(7)	Barrel life and life of replacement barrels	15,000 rounds minimum (see gage list below)
(8)	Criterion for end of barrel service life	Not provided

10.D2.4 Bolt Recoil Velocity

(1)	Minimum	Not provided
(2)	Maximum	Not provided

10.D2.5 Firing Pin Characteristics

(1)	Firing pin protrusion: minimum: maximum:	0.59 - 0.87 mm (0.023 - 0.034 in.) Not provided Not provided
(2)	Diameter of firing pin hole in breech block	2.405 - 2.5 mm (0.095 - 0.099 in.)
(3)	Sketch of firing pin point:	The Test centres shall measure the impression left by the firing pin on a copper cylinder when the weapons are delivered.



10.D2.6 Cartridge Headspace of Weapon

(1)	Headspace	41.284 - 41.494 mm @ 10.16 dia. (1.625 - 1.633 in. @ 0.400 dia).
	minimum:	Not provided
	maximum:	Not provided
(2)	Adjustment of headspace	None
	Headspace measurement	Production Acceptance Minimum: Use P/N 11826302 Maximum: Use P/N 11826303 Field Service Warning: Use P/N 11826299 Reject: Use P/N 11826274.
(3)	Free run of bullet	Not provided
(4)	Depth of chamber	Not provided
(5)	Extractor claw space	Not provided

10.D2.7 Sighting System

(1)	Foresight	Blade
(2)	Rear Sight	Aperture
(3)	Sight Radius	851 mm (33.5 in.) rear sight folded 787 mm (31 in.) rear sight raised

10.D2.8 Gauges (drawing numbers, respectively identification numbers)

(1)	For Headspace	Min: 41.283 mm: Gage, Headspace P/N 11826302 NSN 5220-01-043-8213

		Max: 41.493 mm: Gage, Headspace P/N 11826303 NSN 5220-01-043-9447 Min: 41.653 mm: Gage, Headspace (Field Service) P/N 11826299 NSN 5220-01-043-8211 Max:41.703 mm: Gage, Headspace (Field Service) P/N 11826274 NSN 5220-01-043-8212
(2)	For Barrel	Gage, Breech Bore Erosion (Field Service) P/N 11826298 NSN 5210-01-0820-1714 Gage, Muzzle and Breechbore Wear P/N 11826276 NSN 5220-01-082-5564 Tool, Erosion, Gas Port P/N 13002076 NSN 1005-01-512-9284
(3)	Firing Pin Protrusion	Gage, Firing Pin Protrusion P/N 11826304 NSN 4933-01-043-9450

10.D2.9 Miscellaneous

10.D2.10 Documentation

(1) M240/B/C/D/E1/H/L/N Machine Gun:

Operator's Manual: TM 9-1005-313-10

Field Maintenance: TM 9-1005-313-23&P

ANNEX 10-E1

Characteristics of the PM12S/PM12S2, Sub-machine Gun, 9mm (Nominated by ITALY)

10.E1.1	Weapon:		PM12S/PM12S2, Sub-machine Gun, 9mm
	Nominating Nation:		Italy
	Manufacturer:		Beretta
	NATO Stock Number (NSN):		1005-15-067-9276 (PM12S) 1005-15-148-5930 (PM12S2)
	(1)	Mass of weapon	3.25 kg
	(2)	Mass of full magazine	0.59 kg
	(3)	Mass of empty magazine	0.22 kg
	(4)	Length of weapon	
		Buttstock Collapsed	418 mm
		Buttstock Extended	600 mm
	(5)	Life of weapon	20,000 rounds
10.E1.2	**Weapon Operation**		
	(1)	Operation	Direct action of gas on the head of the bolt, semi-automatic and full automatic
	(2)	Gas adjustment	Not provided
	(3)	Feed	Magazine (32 rounds)
	(4)	Regulation of fire	Full Automatic Semi-automatic
	(5)	Mechanism position	Functions with blowback, bolt open
	(6)	Ejection	Right hand side, fixed ejector
	(7)	Extraction	Fixed on bolt head
	(8)	Nominal rate of fire	Not provided
	(9)	Practical rate of fire	Not provided
	(10)	Cyclic rate:	
		Recommended cyclic rate	Not provided
		Minimum cyclic rate	Not provided
		Maximum cyclic rate	Not provided

(11)	Trigger pull:	minimum:	21.6 N
		maximum:	52 N

10.E1.3 Barrel Characteristics

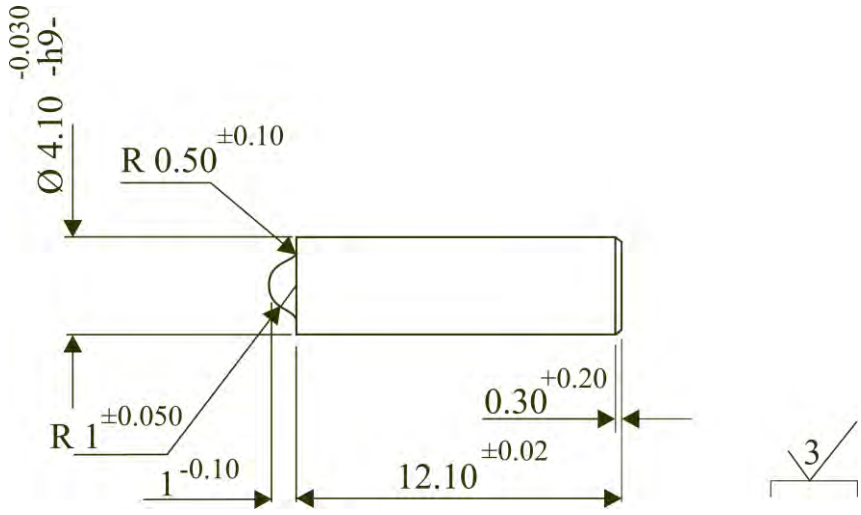
(1)	Length of barrel	206 - 0.5 mm
(2)	Rifling twist	205 mm (right hand)
(3)	Number of grooves	6
(4)	Groove width	3.35 + 0.22 mm
(5)	Diameter across (into) grooves	9.03 + 0.054 mm
(6)	Diameter across bore (Lands)	8.80 + 0.054 mm
(7)	Barrel life and replacement barrel life	Approximately 20,000 rounds
(8)	Criterion for end of barrel service life	The 8.80 mm diameter gauge plug must pass through the bore, the 8.90 mm diameter gauge plug must not pass through the bore and must not be able to enter at the muzzle.

10.E1.4 Bolt Recoil Velocity

(1)	Minimum	Not provided
(2)	Maximum	Not provided

10.E1.5 Firing Pin Characteristics

(1)	Fixed on bolt head		
(2)	Firing pin protrusion:		
		minimum:	0.9 mm
		maximum:	1.1 mm
(3)	Firing pin profile		Semi-spherical with 1 mm radius
(4)	Diameter of firing pin hole at edge of (breech) block		2.0 mm
(5)	Sketch of firing pin point:		The Test centres shall measure the impression left by the firing pin on a copper cylinder when the weapons are delivered.



10.E1.6 Cartridge Headspace of Weapon

(1)	Headspace	As weapon operates by direct action of gas on bolt without locking, control of headspace is not required.
	minimum:	Not provided
	maximum:	Not provided
(2)	Adjustment of headspace	None
(3)	Free run of bullet	Not provided
(4)	Depth of chamber	Not provided
(5)	Extractor claw space	Not provided

10.E1.7 Sighting System

(1) Adjustable for elevation and windage with two positions for 100 m and 200 m.

(2)	Sight length	285 mm

10.E1.8 **Gauges** (drawing numbers, respectively identification numbers)

(1)	Firing pin protrusion	Drawing No. 759005
(2)	Extractor longitudinal catching	Drawing No. 759001
(3)	Extractor radial catching	Drawing No. 759002
(4)	Magazine spring minimum length	Drawing No. 759016

(5)	Barrel maximum internal diameter	Drawing No. 759000
(6)	Barrel maximum chamber depth	Drawing No. 759003 (Gauge) + 759004 (Master)
(7)	Recoil spring minimum length	Drawing No. 759017

10.E1.9 Miscellaneous

(1) Spare parts:

Bolt assembly	Drawing No. 88972
Butt plate pin snap ring	Drawing No. 50016
Rear sight pin snap ring	Drawing No. 97030
Selector-safety snap ring	Drawing No. 97017
Grip screw	Drawing No. 57847
Recoil spring	Drawing No. 54422
Rear cup assembly	Drawing No. 86864
32 round magazine	Drawing No. 86142

10.E1.10 Documentation

(1) Illustrated pamphlet obtainable from:

P BERETTA Weapon Plant
25063 Gardone Val Trompia (Brescia)
ITALY

ANNEX 10-E2

Characteristics of the 92F/92FS, Pistol, 9mm (Nominated by ITALY)

10.E2.1	Weapon:	92F/92FS, Pistol, 9mm
	Nominating Nation:	Italy
	Manufacturer:	Beretta
	NATO Stock Number (NSN):	1005-13-100-3445 (92F) 1005-15-117-9299 (92FS)
(1)	Mass of weapon	0.960 kg with empty magazine
(2)	Mass of full magazine	Not provided
(3)	Mass of empty magazine	Not provided
(4)	Length of weapon	217 mm
(5)	Life of weapon	15,000 - 20,000 rounds

10.E2.2 Weapon Operation

(1)	Operation	Short recoil of barrel
(2)	Gas adjustment	None
(3)	Feed	Magazine (15 rounds)
(4)	Regulation of fire	Semi-automatic
(5)	Mechanism position	Functions with breech closed
(6)	Ejection	Right hand side, fixed ejector
(7)	Extraction	Extractor hinged in the slide, spring loaded
(8)	Trigger pull:	Double action: minimum: 35.3 N maximum: 71.6 N Single action: minimum: 17.7 N maximum: 28.4 N

10.E2.3 Barrel Characteristics

(1)	Length of barrel	125 mm
(2)	Rifling twist	205 mm (right hand)
(3)	Number of grooves	6
(4)	Groove width	2.55 + 0.20 mm
(5)	Diameter across (into) grooves	9.03 + 0.07 mm
(6)	Diameter across bore (Lands)	8.82 + 0.05 mm
(7)	Barrel life and replacement barrel life	Over 20,000 rounds
(8)	Criterion for end of barrel service life	The 8.82 mm diameter gauge plug must pass through the bore, the 8.93 mm diameter gauge plug must not pass through the bore and must not be able to enter at the muzzle.

10.E2.4 Bolt Recoil Velocity

(1)	Minimum	Not provided
(2)	Maximum	Not provided

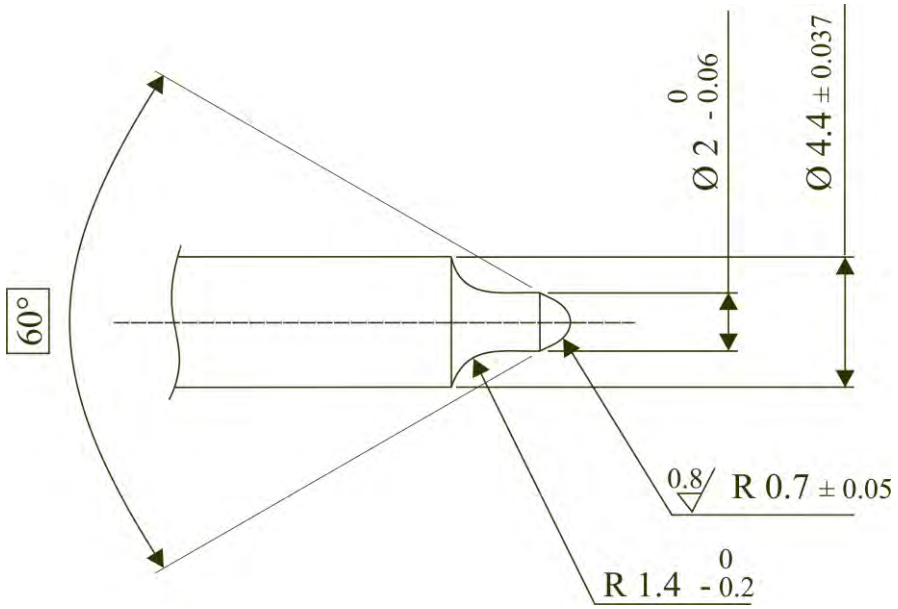
10.E2.5 Firing Pin Characteristics

(1)	Plunger firing pin	
(2)	Firing pin protrusion: minimum: maximum:	1.50 + 0.45 mm Not provided Not provided
(3)	Firing pin profile	Not provided
(4)	Diameter of firing pin hole diameter and contour	Firing pin diameter and firing pin hole limits are prescribed in the relative drawing and checked during manufacture of the pistol. These dimensions are not subject to noticeable wear during the pistol life.

(5) The firing pin indent on a copper crusher is 0.30mm.

(6)	Sketch of firing pin point:	The Test centres shall measure the impression left by the firing pin on a

copper cylinder when the weapons are delivered.



10.E2.6 Cartridge Headspace of Weapon

(1)	Cartridge Headspace	19.1 to 19.35 mm
	minimum:	Not provided
	maximum:	Not provided
(2)	Adjustment of headspace	None
(3)	Free run of bullet	Not provided
(4)	Depth of chamber	Not provided
(5)	Extractor claw space	Not provided
(6)	Adjustment of bolt-head rim	//

10.E2.7 Sighting System

(1) Blade integral with slide notched bar, dovetailed

(2)	Length of line of sight	158 mm nominal

10.E2.8 Gauges

(1)	Barrels maximum internal	cod. 759065

diameter gauge

(2) Head-space gauge — cod. 759009

(3) Cartridge chamber depth gauge — cod. 759010

10.E2.9 Miscellaneous

(1) Safety devices — Manual safety-decocking lever, automatic firing pin safety, half-cock position of the hammer

(3) Spare parts:

Barrel	cod. 67591
Locking block	cod. 50654
Recoil spring	cod. 90198
Hammer	cod. 51273
Sear	cod. 53167
Firing pin	cod. 54793
Disassembling latch	cod. 51722
Disassembling latch release button	cod. 56007
Trigger bar	cod. 53103
Firing pin catch lever	cod. 53019
Extractor	cod. 52258
Extractor spring	cod. 90224
Magazine	cod. 85987
Slide catch	cod. 53070

10.E2.10 Documentation

(2) Illustrated pamphlet obtainable from:

P BERETTA Weapon Plant
25063 Gardone Val Trompia (Brescia)
ITALY

ANNEX 10-E3

Characteristics of the P8A1, Pistol, 9mm (Nominated by GERMANY)

10.E3.1	Weapon:		P8A1, Pistol, 9mm
	Nominating Nation:		Germany
	Manufacturer:		Heckler & Koch (H&K)
	NATO Stock Number (NSN):		1005-12-377-3755 (with accessories) 1005-12-377-3775 (without accessories)
(1)	Mass of weapon		0.770 kg with empty magazine
(2)	Mass of full magazine		Not provided
(3)	Mass of empty magazine		Not provided
(4)	Length of weapon		194 mm
(5)	Life of weapon		10,000 rounds (guaranteed with DM51 ammo)

10.E3.2 Weapon Operation

(1)	Operation		recoil operated
(2)	Gas adjustment		None
(3)	Feed		Magazine (15 rounds)
(4)	Regulation of fire		Semi-automatic
(5)	Mechanism position		Fires from closed bolt
(6)	Ejection		Right hand side, fixed ejector
(7)	Extraction		Extractor hinged in the slide, spring loaded
(8)	Trigger pull:		Double action:
		minimum:	45 N
		maximum:	65 N
			Single action:
		minimum:	21 N
		maximum:	27 N

10.E3.3 Barrel Characteristics

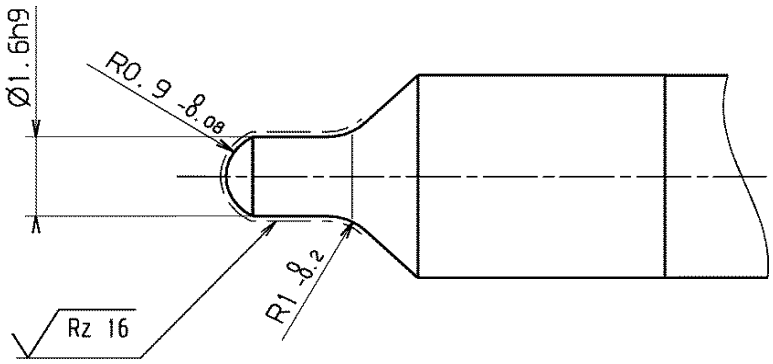
(1)	Length of barrel	108 mm
(2)	Rifling twist	205 mm (right hand)
(3)	Number of grooves	6
(4)	Groove width	2.50 + 0.20 mm
(5)	Diameter across (into) grooves	9.05 + 0.04 mm
(6)	Diameter across bore (Lands)	8.82 + 0.04 mm
(7)	Barrel life and replacement barrel life	10,000 rounds
(8)	Criterion for end of barrel	The barrel is worn out when it is possible to pass 8.9mm plug gauge through the barrel from the rear end, or if it possible to push this plug gauge a certain distance into the barrel from the muzzle end.

10.E3.4 Bolt Recoil Velocity

(1)	Minimum	Not provided
(2)	Maximum	Not provided

10.E3.5 Firing Pin Characteristics

(1)	Plunger firing pin	
(2)	Firing pin protrusion: minimum: maximum:	1.45 + 0.45 mm Not provided Not provided
(3)	Firing pin profile	Not provided
(4)	Diameter of firing pin hole diameter and contour	Firing pin diameter and firing pin hole diameter are defined in the respective drawings. Both dimensions are checked during manufacture of the pistol. These dimensions are subject to noticeable wear during the pistol life.
(5)	Sketch of firing pin point:	The Test centres shall measure the impression left by the firing pin on a copper cylinder when the weapons are delivered.



10.E3.6 Cartridge Headspace of Weapon

(1)	Cartridge Headspace minimum: maximum:	19.15 to 19.45 mm Not provided Not provided
(2)	Adjustment of headspace	None
(3)	Free run of bullet	Not provided
(4)	Depth of chamber	Not provided
(5)	Extractor claw space	Not provided
(6)	Adjustment of bolt-head rim	//

10.E3.7 Sighting System

(1) Drift adjustable sight (horizontal).

(2) Rectangular frontpost, u-shaped rear sight.

(3) Length of line of sight 158 mm nominal

10.E3.8 Gauges

(1) Barrels maximum internal diameter gauge 346347

(2) Headspace gauge 350994

(3) Cartridge chamber depth gauge 346166

10.E3.9 Miscellaneous

(1) Safety devices — Manual safety decocking lever, automatic firing pin safety, and automatic hammer safety

(2) Spare parts:

Barrel	223 123
Recoil spring	214 151
Hammer	214 825
Firing pin	214 189
Trigger bar	214 176
Firing pin catch lever	214 191 (Drop safety)
Extractor	214 187
Extractor spring	214 188
Magazine	214 689
Slide catch	214 181

10.E3.10 Documentation

ANNEX 10-F1

Characteristics of the M2 Heavy Barrel (HB), Machine Gun, 12.7mm (Nominated by UNITED STATES)

10.F1.1	Weapon:		M2 Heavy Barrel (HB), Machine Gun, 12.7mm
	Nominating Nation:		United States
	Manufacturer:		GD-OTS
	NATO Stock Number (NSN):		1005-00-322-9715
(1)	Mass of weapon		38.1 kg (84 lbs)
(2)	Length of weapon		1.65 m (65 in.)
(3)	Life of weapon		100,000 rounds

10.F1.2 Weapon Operation

(1)	Operation		Recoil Operated
(2)	Gas adjustment		Not provided.
(3)	Feed		Right to left with linked belts of M9 disintegrating links
(4)	Regulation of fire		Full Automatic
(5)	Mechanism position		Fired from closed bolt
(6)	Ejection		Cartridge case is ejected from the bottom of the receiver, links are to the right.
(7)	Extraction		Claw extractor on breech face
(8)	Nominal rate of fire		Not provided
(9)	Practical rate of fire		Not provided
(10)	Cyclic rate:		450 – 600 rounds per minute
	Recommended cyclic rate		Not provided
	Minimum cyclic rate		Not provided
	Maximum cyclic rate		Not provided
(11)	Trigger pull:	maximum:	169 N (38 lbs.) (sear slide)
		maximum:	115.7 N (14 lbs.) (sear)

10.F1.3 Barrel Characteristics

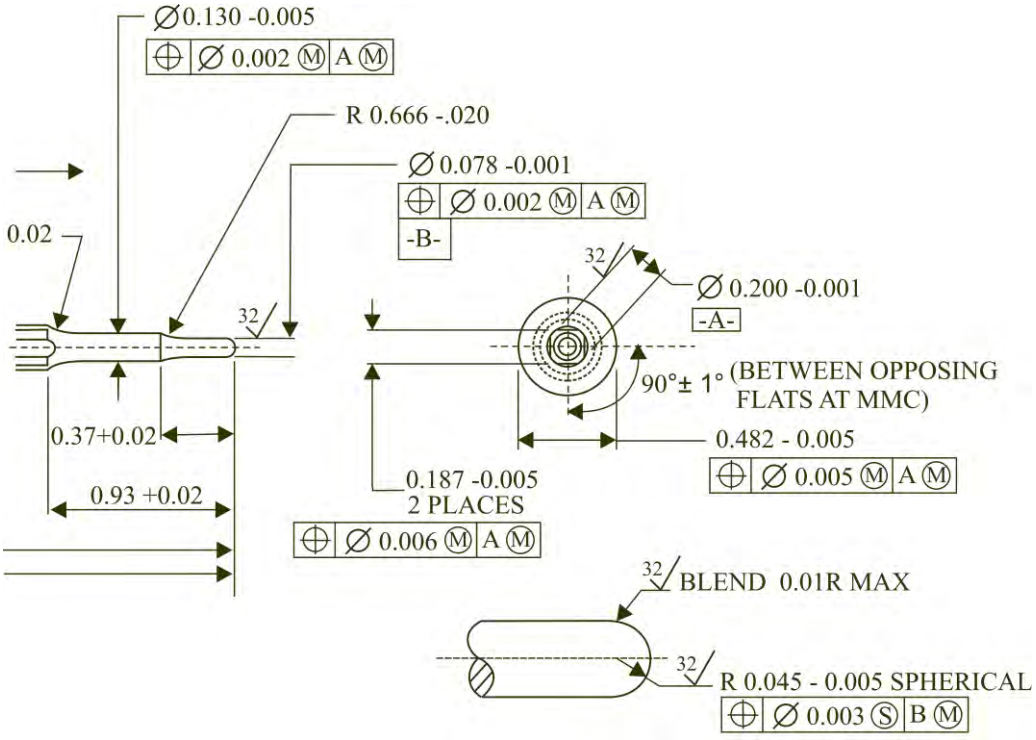
(1)	Length of barrel	1.14 m (45 in.)
(2)	Rifling twist	1 in 381 mm (1 in 15 in.) (right hand)
(3)	Number of grooves	8
(4)	Groove width	3.43 + 0.127 mm (0.135 + 0.005 in.)
(5)	Diameter across (into) grooves	12.93 + 0.102 mm (0.509 + 0.004in.)
(6)	Diameter across bore (Lands)	12.66 + 0.006 mm (0.4985 + 0.0025 in.)
(7)	Barrel life and life of replacement barrels	10,000 rounds minimum
(8)	Criterion for end of barrel service life	Not provided

10.F1.4 Bolt Recoil Velocity

(1)	Minimum	5.18 m/s (206 inches per sec)
(2)	Maximum	5.64 m/s (222 inches per sec)

10.F1.5 Firing Pin Characteristics

(1)	Firing pin protrusion: minimum: maximum:	1.83 + 0.178 mm (0.072 + 0.007 in.) Not provided Not provided
(2)	Diameter of firing pin hole in recoil plate	2.03 + 0.025 mm (0.080 + 0.001in.)
(3)	Sketch of firing pin point:	The Test centres shall measure the impression left by the firing pin on a copper cylinder when the weapons are delivered.



DETAILS OF FIRING PIN NOSE

10.F1.6 Cartridge Headspace of Weapon

(1)	Headspace from rear face of barrel to bolt face	
	minimum:	5.13 mm (0.202 in.)
	maximum:	5.23 mm (0.206 in.)
(2)	Adjustment of headspace	Yes, per gauge below
(3)	Adjustment of timing	Yes, per gauge below.

Timing: Gun shall not fire when the gap between the barrel extension and the trunnion block exceeds 2.95 mm (0.116 in.).

(4)	Free run of bullet	2 mm (rough slide)
(5)	Depth of chamber	Not provided
(6)	Extractor claw space	Not provided

10.F1.7 Sighting System

(1)	Foresight	Semi-fixed blade type with cover
(2)	Rear Sight	Leaf-type graduated in yards and mils

	Range 100 - 2600 yards	0-62 mils. A windage knob permits deflection changes of 5 mils right or left of centre.
(3)	Sight Diameter	0.305 + 0.127 mm (0.012 + 0.005 in.)

10.F1.8 Gauges

(1)	Headspace Gauge	12003958
(2)	Timing Gauge	12003959

10.F1.9 Miscellaneous

10.F1.10 Documentation

(1)	Technical Manual	TM 9-1005-213-25
(2)	Field Manual	FM 23-65
(3)	Operator's Manual	TM 9-1005-213-10

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 11

CLASSIFICATION OF DEFECTS AND INCIDENTS

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

11.1 Applicability

Ammunition submitted for NATO Qualification Approval, Production or Surveillance Testing shall be subjected to the requirements of AEP-97, Volume 11 when referenced by other volumes within AEP-97.

11.2 NATO Requirements

Ammunition that is presented for NATO testing is to function correctly and safely in the NATO Nominated Weapons and test apparatus under all prescribed temperature and firing conditions. This volume is used in conjunction with the Function and Casualty Test (AEP-97, Volume 14) for sentencing purposes.

11.2.1 Defects and Incidents Occurring In Other Tests

If defects or incidents occur in tests other than Function & Casualty, the ammunition shall be subjected to sentencing and if necessary, additional testing, as prescribed by AEP-97, Volume 7.

11.3 Table of Defects and Incidents and Their Classification

The table contained in this volume at Annex 11-A gives the categories into which all defects and incidents shall be classified. It is understood that some of these defects or incidents may never occur but they have been included in an attempt to cover all possibilities. Additionally, defects or incidents can occur because of weapon failure or poor condition. These defects must **NOT** be counted against the ammunition. If a specific defect occurs that is not listed in Annex 11-A, but is deemed to be caused by the ammunition then it is to be included under “other defects” in the appropriate category and fully explained on the test report. Any defect or incident that occurs that is attributed to the ammunition or link under test is to be placed in the lowest possible category for sentencing purposes. Appendix 1 to Annex 11-A provides a graphical representation of the location on the cartridge case for splits and ruptures/separations.

11.4 Defect and Incident Codes and Definitions Used For Reporting

A reference list of Defect and Incidents Codes to be used for reporting is contained in this volume at Annex 11-B. Detailed descriptions of all the Defect and Incident Codes are contained in Appendix 1 to Annex 11-B.

11.5 Feeding, Firing, Extracting and Ejection Cycle

General guidance of the problems that can be encountered during the complete cycle of feeding, firing, extracting and ejecting through a small arms weapon is contained in this volume at Annex 11-C.

11.6 Cross Reference Table of Defects

A list of the defects cross referenced by category is contained in this volume at Annex 11-D.

ANNEX 11-A

CLASSIFICATION OF DEFECTS AND INCIDENTS

CATEGORY 1 - CRITICAL DEFECTS: **May cause death or major injury or loss of capability. Remedial action by the user cannot be accomplished within 30 seconds without special tools[1] or improvisation. Evidence of critical quality problems with the ammunition.[2]**

Bullet remaining In Bore
In Bore Explosion (Explosive or Multi-Purpose Projectiles)
Breech Explosion
Failure to Extract, extraction not achievable within 30 seconds
Failure to Eject, ejection not achievable within 30 seconds
Failure to Feed, clearing the weapon and re-feeding not achievable within 30 seconds
Weapon Stoppage Attributable to Link that takes longer than 30 seconds to clear by the user (Link pack ammunition only)
Split case at "K", "L" or "M" location
(Refer to Appendix 1 of Annex 11-A)
Partial Circumferential Rupture at "K" or "L" location
(Refer to Appendix 1 of Annex 11-A)
Complete Circumferential Rupture at "J/K/L" or "S" location
(Refer to Appendix 1 of Annex 11-A)
Blown Primer
Primer Punch out
Loose Primer which falls out of pocket
Piled Up Metal (Flowback) that causes a weapon stoppage that cannot be cleared within 30 seconds by the user
Uncontrolled Firing
Cook Off in a weapon that has been fired at the prescribed cadence without over heating
Audible Hangfire
Other defects that correspond with the category definition

Note[1]: The timings are a judgement made by the Test Centre on time that would have been taken by an experienced user to clear the stoppage. It is not necessarily the time taken by the Test Centre who would take longer due to test centre constraints and evaluation of the cause of the stoppage which may involve photography or video.

Note[2]: Included in the categories are defects that are not time related but are indicative of quality problems with the ammunition.

11.A.2 CATEGORY 2 - CLASSIFICATION OF DEFECTS AND INCIDENTS

CATEGORY 2 DEFECTS:

May cause minor injury and/or remedial action by the user can be accomplished between 10 and 30 seconds without special tools[1] or improvisation. Evidence of serious quality problems with the ammunition.[2]

Failure to Extract, extraction achievable between 10 and 30 seconds
Failure to Eject, ejection achievable between 10 and 30 seconds
Failure to Feed, clearing the weapon and re-feeding achievable between 10 and 30 seconds
Partial Circumferential Rupture at "J" or "S" location
(Refer to Appendix 1 of Annex 11-A)
Bullet Integrity/Stripping[3]
Split Case at "J" & "S" location
(Refer to Appendix 1 of Annex 11-A)
Misfire
Piled Up Metal (Flowback) that causes a weapon stoppage that can be cleared within 30 seconds by the user
Weapon Stoppage Attributable to Link that can be cleared within 30 seconds by the user (Link pack ammunition only)
Bullet Yaw in excess of 15° at 40 ± 5 metres
Other defects that correspond with the category definition

Note[1]: The timings are a judgement made by the Test Centre on time that would have been taken by an experienced user to clear the stoppage. It is not necessarily the time taken by the Test Centre who would take longer due to test centre constraints and evaluation of the cause of the stoppage which may involve photography or video.

Note[2]: Included in the categories are defects that are not time related but are indicative of quality problems with the ammunition.

11.A.3 CATEGORY 3 - CLASSIFICATION OF DEFECTS AND INCIDENTS

CATEGORY 3 DEFECTS:

Does not cause injury to the user and/or remedial action by the user can be accomplished within 10 seconds without special tools[1] or improvisation. May compromise the user by giving away the user's position on the battlefield or reduce night vision capability. Evidence of quality problems with the ammunition.[2]

Failure to Extract that can be cleared within 10 seconds by the user
Failure to Eject that can be cleared within 10 seconds by the user
Failure to Feed that can be cleared within 10 seconds by the user
Weapon Stoppage Attributable to Link that can be cleared within 10 seconds by the user (Tactical pack ammunition only)
Split case at "l" location
(Refer to Appendix 1 of Annex 11-A)
Light Strike
Distorted base
Piled Up metal (Flowback) that causes a weapon stoppage that can be cleared within 10 seconds by the user
Gas escape around more than 50% of primer periphery
Early Trace (Tracer ammunition) - tracing before 13 metres (Applicable to 5.56 mm & 7.62 mm only)
Gas Escape through primer other than primer pierced by firing pin
Belt separation
Other defects that correspond with the category definition

Note[1]: The timings are a judgement made by the Test Centre on time that would have been taken by an experienced user to clear the stoppage. It is not necessarily the time taken by the Test Centre who would take longer due to test centre constraints and evaluation of the cause of the stoppage which may involve photography or video.

Note[2]: Included in the categories are defects that are not time related but are indicative of quality problems with the ammunition.

11.A.4 CATEGORY 4 - CLASSIFICATION OF DEFECTS AND INCIDENTS

CATEGORY 4 DEFECTS:

Does not cause injury to the user and does not adversely affect proper functioning but may in the long term cause accelerated deterioration of the weapon or may have the potential to cause stoppages. Evidence of minor quality problems with the ammunition.[2]

Gas Escape around less than 50% of primer periphery
Loose primer which does not fall out of pocket
Piled Up metal (Flowback)
Other defects that correspond with the category definition
Primer Pierced (by firing pin) [4]

Note[1]: The timings are a judgement made by the Test Centre on time that would have been taken by an experienced user to clear the stoppage. It is not necessarily the time taken by the Test Centre who would take longer due to test centre constraints and evaluation of the cause of the stoppage which may involve photography or video.

Note[2]: Included in the categories are defects that are not time related but are indicative of quality problems with the ammunition.

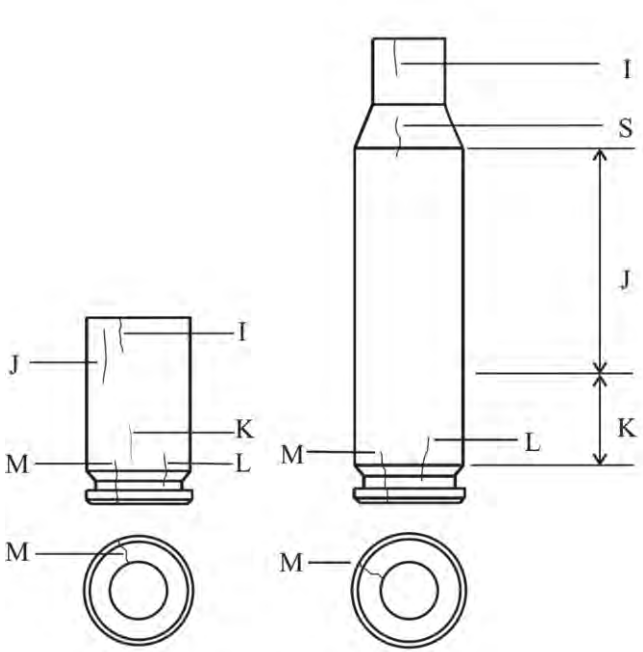
Note[3]: Due to the difficulty in establishing which bullets the debris originated from, each numbered firing serial shall be treated separately. Evidence found shall be recorded as follows:

1-3 fragments and/or perforations* on the witness screen = 1 defect
4-6 fragments and/or perforations* on the witness screen = 2 defects
7 or more fragments and/or perforations* on the witness screen = 3 defects

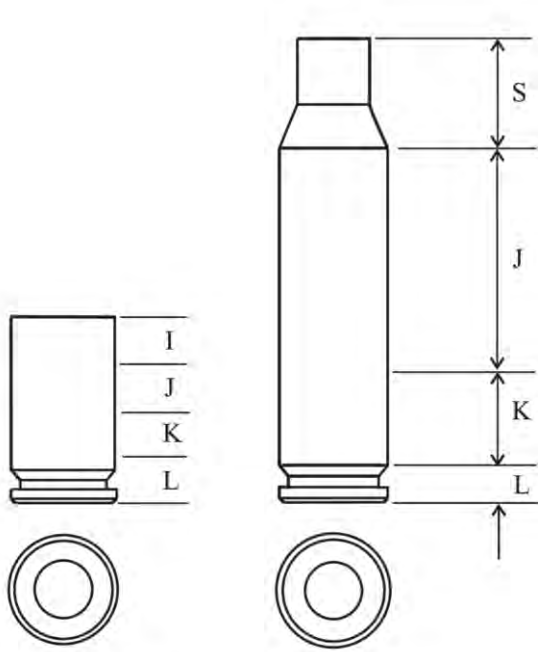
***Fragments and/or perforations from un-burnt propellant, case mouth waterproofing material, etc. shall not be counted as defects. Additionally, fragments and/perforations from base closure material separations (from tracer cartridge designs only) shall not be counted as defects.**

Note[4]: The pierced primer defect is normally a Category 4 defect with an AQL of 1.0. For the 5.56mm, Minimi, Mk1, Machine Gun only, the pierced primer defect has an AQL of 1.5.

SPLITS



RUPTURES / SEPARATIONS



I - Mouth or neck
J - In upper 2/3 body section
K - In lower 1/3 body section above extractor groove
L - In sidewall extending into extractor groove
M - In sidewall extending into primer pocket
S - In sidewall of shoulder

S - Neck and shoulder
J - In upper 2/3 body section
K - In lower 1/3 body section above extractor groove
L - In head and in extractor groove

Note: If a split extends through the upper 2/3 body section at it shall be classified J provided the split does not extend through the mouth. If the mouth of the case is split and the split is within the upper 1/3 of the body, it shall be classified I; However, if the mouth is split and the split is longer than 1/3 of the body length it, it shall be classified IJ. If defects occur in multiple areas on a cartridge case, the defect shall be categorised against the most severe category.

ANNEX 11-B

DEFECTS AND INCIDENTS CODES

Note: The following abbreviations are to be used for reporting and quick reference. Full definitions of these abbreviations are contained in Appendix 1 to this Annex 11-B. More detailed definitions for many of the following abbreviations are shown on the following pages. This list of definitions has been produced to suit several calibres and consequently some detail might not be applicable to the calibre being tested. Additionally some defects or incidents that can occur because of weapon failure or poor condition have been included. If a specific defect occurs that is not listed in Annex 11-A, but is deemed to be caused by the ammunition, then it is to be included under "other defects" in the appropriate category and fully explained in the report.

BB ( )	**Bullet in Bore** **(**The distance in millimetres, measured from the breech face to the base of the bullet, is to be included in brackets.**)**
BC	**Bulged Case**
BEC	**Breech Explosion (Closed)**
BEO	**Breech Explosion (Open)**
BF	**Breech Flash**
BI/S	**Bullet Integrity/Stripping**
BP	**Blown Primer**
BS	**Belt Separation**
BY	**Bullet Yaw**
CCR ( )	**Complete Circumferential Rupture** (Position to be indicated: see Annexes 11-A, 11-B & 11-C)
CO	**Cook Off**
DB	**Distorted Base**
ES	**Excessive Smoke**
ET	**Early Trace**
FBR	**Failure** of **Bolt** to Remain at the **Rear**
FEJ ( )	**Failure** to **Eject** (Sub code as listed in definition including the position of the cartridge in the magazine/belt) **TFC: Trapped Fired Case**
FEX	**Failure** to **Extract**

11.B.1 DEFECTS AND INCIDENTS CODES

FFD ( )	**Failure to Feed** (Sub code as listed in definition including the position of the cartridge in the magazine/belt) **BOB**: **Bolt Over** rides the **Base** **BUB**: **Bolt Under** rides the **Base** **COEC**: C**losed On Empty Chamber** **FS: Failure** to **Strip** **DF: Double Feed** **SR: Stubbed Round**
FP	**Flattened Primer**
FTL	**Failure to lock**
GE+	**Gas Escape** around Primer **in excess of 50 %** of circumference
GE-	**Gas Escape** around Primer **of less than 50 %** of circumference
GETP	**Gas Escape Through Primer**
HF	**Hangfire**
HSB	**Hard Set Back**
IBE	**In Bore Explosion (**Bullet**)**
LS	**Light Strike**
MF	**Misfire**
MFL	**Muzzle Flash**
MS	**Muzzle Sparks**
PCR ( )	**Partial Circumferential Rupture** (Position to be indicated: see Annexes 11-A, 11-B & 11-C)
PL	**Primer Loose** – Stays in Pocket
PM	**Piled** up **Metal** (Flowback)
PO	**Primer/Cap Out** or **Loose Primer/Cap** which falls out of pocket
PP	**Pierced Primer**
PPO	**Primer Punch Out**
PS	**Primer Setback**
RN ( )	**Reformed Neck** (Length of case neck in millimetres after reformation to be included)
SB	**Spin Back**
SC (SV)	**Stretched Case (Severe)**
SC	**Stretched Case**

11.B.1 DEFECTS AND INCIDENTS CODES

SC (SL)	**Stretched Case (Slight)**
SPC ( )	**Split Case** (Position to be indicated: see Annexes 11-A, 11-B & 11-C)
UF	**Uncontrolled Firing**
WM	**Weapon Malfunction**
WSL	**Weapon Stoppage** Attributable to **Link**

ANNEX 11-B - APPENDIX 1

DEFECTS AND INCIDENTS CODES – DEFINITIONS AND EXPLANATIONS

BB ( ) **Bullet in Bore**

(The distance in millimetres, measured from the breech face to the base of the bullet, is to be included in brackets.**)**

Bullets lodged at the commencement of rifling are often caused by very low or no charge and will usually result in difficulty of chambering the next cartridge. The pressure generated by the primer can be sufficient in some circumstances to push the bullet out, or part way out, of the case and into the commencement of rifling. Bullets lodged part way down the barrel can be caused by low or no propellant charge, excessive fouling or obstructions.

BC **Bulged Case**

This is normally a fault of the weapon, where the chamber is worn and/or incorrectly shaped. The case expands to fit the chamber profile. This case casualty will normally result in a Failure to Extract (FEX) or a Failure to Eject (FEJ) stoppage. The fault may be confirmed by rolling the case on a flat surface, where the case will be seen to roll eccentrically.

BEC/ **Breech Explosion (Closed)**

Failure of the cartridge case, primer, and closed breech to prevent the high pressure, hot gasses produced after initiation of the cartridge exiting other than through the case mouth. Variations will occur between different types of weapons and the severity will vary between the event being unnoticed by the firer to excessive weapon damage and severe personal injury.

Note: The code BEC is to be used in conjunction with the code from the most appropriate of the definitions contained in this annex. If there is no suitable definition then a full explanation of the Breech Explosion must be given.

BEO/ **Breech Explosion (Open)**

Failure of the cartridge case, primer, to prevent the high pressure, hot gasses produced after initiation of the cartridge exiting other than through the case mouth due to it being unsupported by the breech block/bolt and possibly not fully chambered. The severity of this type of breech explosion often depends upon the amount of cartridge case that has been left unsupported. This can result in severe personal injury to firer and adjacent personnel.

Note: The code BEO is to be used in conjunction with the code from the most appropriate of the definitions contained in this annex. If there is no suitable definition then a full explanation of the Breech Explosion must be given.

BF **Breech Flash**

Hot flame being omitted from the breech area. This can cause personal injury and if excessive could reveal position when firing at night.

BI/S **Bullet Integrity/Stripping**
Parts of the bullet jacket detaching from the bullet. Stripping is usually caused by some defect inherent in the ammunition, of such nature as to cause the bullet jacket to fail to withstand the stresses to which it is subjected during passage through the throating and bore of the barrel. Soft bullet jackets or soft gilding metal can also be a cause of stripping, particularly with ammunition that has been subjected to high temperature storage. When a cartridge is fired, the base of the bullet is subjected to high pressure, frequently exceeding 400MPa. If construction of the bullet is such that the expanding powder gases can find entry between the bullet jacket and the bullet core, either because of improper base seal or lack of snugness in bullet assembly, the jacket, or parts thereof, may be ripped off the core. The high rate of spin which is imparted to the bullet by the rifling tends to separate the jacket and core, due to the centrifugal force involved, unless all bullet components are snug and symmetrical and rotate as an entity. If the sidewall of the bullet jacket is too thin and it splits during engraving by the lands, or it is cut during passage through the bore, or it is deformed by the entry of propellant gasses between the jacket wall and core, the rotational spin of the bullet will separate or strip the jacket from the core, upon emergence of the bullet from the muzzle of the weapon, as soon as the confining influence of the bore is removed. Evidence of base closure separations (in tracer designs only) shall be noted for information only. The location of all perforations on the witness screen shall be noted. Small perforations caused by un-burnt propellant or waterproofing material may be identified on the front witness screen. In this situation, perforations caused by either material may be noted on the test form, but detailing the number and location of the perforations is not necessary.

BOB **B**olt **O**verrides the **B**ase of the case in magazine fed weapons.
This is a Sub-code used with Failure to Feed **(FFD)**.

BP **Blown Primer**
Primer missing from primer chamber after firing and base of cartridge case and/or primer chamber enlarged and distorted (determined visually).

BS **Belt Separation**
Belt separation can occur during testing through belt fed weapons in either NATO Chute testing, free hanging belt testing, or supported belt testing during normal Function & Casualty testing. Each separation is to be counted as a separate defect.

BUB **Bolt Under** rides **Base**.
Bolt Under rides the Base of the case in link fed weapons.
This is a Sub-code used with Failure to Feed **(FFD)**.

BY **Bullet Yaw**
Yaw is defined as the angle between the axis of the bullet at any point in its flight and the tangent to the trajectory at that point. The degree of yaw ranges from a slightly non circular hole in the target to a complete profile impression of the bullet, i.e. keyholing.

CCR ( ) **Complete Circumferential Rupture**
(Position to be indicated: see Annexes 11-A, 11-B & 11-C**)**
This occurs when a portion of the fired case is left in the chamber, the remainder being extracted normally. Usually the succeeding cartridge will fail to fully enter the chamber and the breech block will fail to close. If only a small amount of separated case has been left in the chamber it is possible for some weapon types to be closed by force with a resulting breech explosion when the cartridge is fired.

CO **Cook Off**
The initiation of a cartridge by heat transmission from its surrounding environment. Although it can occur in other weapons it is the most common cause of a Breech Explosion in Machine Guns. It most often occurs in machine guns that have been subjected to high rates of fire and then encountered a stoppage leaving a cartridge in a partially unchambered position with an unlocked breech.

COEC **Closed On Empty Chamber**
Bolt or breech Block closes on an empty chamber. This sub code of **FFD** will only be used if it is established that **BOB or BUB** is not applicable.

DB **Distorted Base**
This defect can be caused by a soft case due to over annealing, excessive headspace, excessive pressure caused by a blocked bore or overfilled cartridge case. The symptoms can include severe swelling of the cartridge case into the unsupported headspace area, strong impression of the bolt face on the cartridge case base, primer/cap missing, primer pocket enlarged and distorted. Sometimes a portion of the case adjacent to the extractor may be detached. These are classic symptoms of a closed bolt breech explosion. Cartridge cases that have accidently been annealed upside down during production, or over-annealed in the correct attitude, are a common cause of this problem.

ES **Excessive Smoke**
Smoke in excess of that produced when firing the NATO Reference Ammunition.

ET **Early Trace**
The bright trace begins before 13 m (only for 5.56 mm and 7.62 mm ammunition).

FBR **Failure** of **Bolt** to Remain at the **Rear**
This defect applies to weapons which are designed to have the bolt assembly remain at the rear after firing the last cartridge in the magazine. Failure of the bolt assembly to remain at the rear after firing the last cartridge can be caused by short recoil due to low energy ammunition, hard extraction, clogged gas system, weapon or magazine fault.

FEJ **Failure to Eject**

(Sub code as listed below and the position of the cartridge in the magazine/belt should be included in brackets after the stoppage code.)

This occurs when the cartridge is correctly fired and the fired case is extracted from the chamber but not thrown clear of the weapon. Extraction and ejection are closely related since one follows the other. Failure of the extractor and breech face to control the fired case or complete cartridge until ejection occurs may cause an ejection failure. In order to differentiate between the two stoppages, inspect cartridge cases for signs of ejection marks on the base and extractor marks on the rim. A change in the usual marks may signify that loss of control occurred before ejection.

TFC: Trapped Fired Case - This occurs when the fired case is correctly extracted but on ejection the fired case rebounds into the mechanism and is trapped between some portion of the moving parts (usually the breech block) and the body of the weapon.

FEX **Failure to Extract**

Failure to Extract is defined as the failure of removal of the fired case or unfired cartridge from the chamber of the weapon. Extraction begins with the completion of unlocking (where applicable) and is terminated when the case or complete cartridge is in a position to be ejected.

Examples of this defect are:

1. The bolt remains in a closed position and fails to extract the case. There may be evidence of damage to the case rim from the extractor.

2. The extractor over rides the fired cartridge case and the breech block moves to the rear and attempts to continue with normal operation. There would normally be evidence of damage to the case rim from the extractor in a weapon with a serviceable extractor and extractor spring. If there is no evidence of damage the extractor and extractor spring should be checked for condition and replaced if necessary.

FFD **Failure to Feed**

(Sub code as listed below and the position of the cartridge in the magazine/belt should be included in brackets after the stoppage code.)

A complete failure of the breech block to properly engage the base of the cartridge. Feeding is defined as the appropriate action required to properly position each succeeding cartridge in position so that the weapons bolt can strip the cartridge from the magazine/belt. The feeding portion of the cycle of operation stops once the cartridge leaves control of the magazine/link and receives control by other weapon components (e.g., bolt or barrel chamber). If a cartridge leaves control of the magazine and a stoppage occurs before the cartridge is controlled by other weapon components, the stoppage is assessed as a feeding failure. This can be caused by short recoil due to low energy ammunition, hard extraction, and clogged gas system, weapon or magazine/link fault. The various degrees of **Failure to Feed** are as follows:

BOB: Bolt Over rides the **Base** of the case in magazine fed weapons.
BUB: Bolt Under rides the **Base** of the case in link fed weapons

COEC: Closed On Empty Chamber. Bolt or breech Block closes on an empty chamber.
FS: Failure to completely **Strip** cartridge from the magazine/link. This is normally caused by a defective weapon or magazine or damaged/improperly dimensioned ammunition, tight links
DF: Double Feed - Two cartridges are simultaneously fed from the magazine. This can be caused by a defective magazine, frozen ammunition/magazines, or other adverse environments.
SR: Stubbed Round - This occurs when the cartridge has been misaligned with the chamber. Examples are cartridges that have been stubbed into the front of the magazine wall or barrel extension

FP **Flattened Primer**
A flattened primer is flush with the head of the case and the primer cup radius is squared off. This can be caused by high pressure, soft primer cup or a combination of the two.

FS **Failure** to completely **Strip** the cartridge from the magazine/link.
This is normally caused by a defective weapon or magazine or damaged/improperly dimensioned ammunition, tight links

FTL **Failure to Lock**
Locking is defined as the securing of the weapon's breeching components to prevent opening during high pressure generation at the time of firing. For hand-held weapons, locking may be affected by manual closure of the breech. The use of advanced primer ignition as the bolt is moving forward is not uncommon with automatic weapons operating on the blowback principle.
Locking begins with the completion of chambering and terminates upon full engagement of the lock components with their mating surfaces. Some weapons additionally required a small amount of forward free travel in the locked position before firing can occur. This complete return to battery is the terminus point of counter recoil. It is sometimes difficult to differentiate between an FTL and an FFR (failure to fire) because of this additional movement of components after full locking has occurred. One indicator of the failure to lock under this situation is a light or non-existent firing pin indent in the cartridge primer. If a judgemental call is necessary, provide enough narrative to describe the occurrence so that later analysis can possibly reveal the true classification and cause. **Failure to Lock** can be caused by incorrect headspace, excessive weapon fouling, foreign material, incorrectly dimensioned ammunition.

GE+ **Gas Escape** around Primer **in excess of 50 %** of circumference
Blackening of the base of the fired case, and/or the annular groove between primer and case. This defect is caused by small or misshapen primer, large or misshapen primer cavity, soft or weak cartridge head which allows the primer cavity to expand, incorrect annular crimp or staking pressure: a combination of any of these defects may be present in the same cartridge. Gas escape is an indication that the ammunition is defective and a series of gas escapes can cause erosion of the bolt/breech block face of the weapon.

GE- **Gas Escape** around Primer **of less than 50 %** of circumference
This is a less severe occurrence of the above defect.

GETP **Gas Escape Through Primer**
Gas escape through any part of the primer other than a primer pierced by the firing pin. This would normally be as a result of a production defect.

HF **HangFire**
An audible, obvious delay between release of trigger and initiation of cartridge in comparison with other cartridges. The term Action Time is used when the time between strike and initiation is measured electronically (e.g. EPVAT testing). Normal Action Times are instantaneous and not detectable by the human ear. Action times that are long enough to be detected by the human ear are deemed to be Hangfires. Hangfires occurring with ammunition being fired through electrically driven guns can be a serious problem as ignition of the cartridge during the unlock cycle can occur leading to an open Breech Explosion. Some electrically driven guns begin the unlock cycle as early as 12 milliseconds after primer strike.

HSB **Hard Set Back**
Although not categorised as a defect this can be a symptom of high pressure causing an impression of the bolt face on the base of the cartridge case, i.e. the case starts to extrude rearward into the ejector hole and extractor recess.

IBE **In Bore Explosion**
Often referred to as an inboard prem (premature). This applies to the In Bore Explosion of the Projectile and is not to be confused with a Breech Explosion –see **BEO** and **BEC.** The effect can range from no damage, through a slight bulge in the barrel to catastrophic with serious injury to the firer and/or adjacent personnel.

LS **Light Strike**
This will only be apparent on cartridges that have not been fired. The cause is usually through poorly maintained equipment, e.g. worn firing pin, excessive headspace, excessive fouling, foreign material but is also possible with defective ammunition, i.e. length from base to crush datum too small and/or primer set down too far into primer pocket. Ammunition should be full form gauged and primer set down measurements checked to confirm correctness of the ammunition. This is only counted as an ammunition defect if it is confirmed that the ammunition dimensions or material are at fault.

MF **MisFire**
This occurs when the primer has been correctly struck but fails to ignite either the primer composition and/or the propellant charge and fire the cartridge. Possible causes are missing or defective primer composition, inverted anvil, anvil missing or low anvil, fire/vent hole(s) omitted, low propellant, no propellant charge. It should be noted that this may result in a bullet lodged in the bore which is a more serious defect.

MFL **Muzzle Flash**
If excessive, flash from the muzzle can give away the position of the firer at night. Flash is regarded as being excessive if it is greater than the flash produced by the NATO Reference Ammunition.

MS **Muzzle Sparks**
Sparking from the barrel is often caused by particles of ignited propellant being emitted from the barrel in the wake of the bullet. Particles of tracer composition can cause the same effect. Barrels with a stellite liner have been known to aggravate this problem.

PCR( ) **Partial Circumferential Rupture**
(Position to be indicated: see Annexes 11-A, 11-B & 11-C**)**
The case is extracted from the chamber in one piece but the case has nearly separated. It may show signs of a circumferential crack, or of gas escape at that part of the case that has stretched.

PL **Primer Loose**
After firing, the primer is loose but still retained in its pocket. This defect is usually associated with gas escape around the primer (GE+).

PM **Piled** Up **Metal** (Flowback)
The extrusion of, or a ridge around, the impression of the firing pin on the primer. The material appears to have flowed around the firing pin and into the firing pin hole. This defect can be caused by worn or oversize firing pin holes, malformed firing pin/striker point, excessive pressure, oversize fire/vent hole(s) in the cartridge case, thin primer shells, weak cap/primer shell material or a combination of any of these conditions. A thorough check of the weapon will be need to establish whether it is the cause of the problem. In some weapons the extraction/ejection cycle can scrape off some of the raised material and cause it to accumulate in the weapon mechanism where it has the potential to jam the mechanism. This can be a major problem in some Pistols where it tends to jam the slide.

PO **Primer Out**
After firing, the primer is sufficiently loose so that it is either already out of the case when the case is examined, or easily falls out of the pocket. This situation can be caused by numerous conditions some of which are: Incorrect interference fit in primer pocket, excessive pressure, fire/vent hole(s) missing from cartridge case, slightly excessive pressure accompanied by poor weapon support to primer immediately after ignition. This defect can have serious consequences. If the primer remains jammed on the bolt face as it may cause premature functioning of the following cartridge as it is being fed into the chamber. If the loose primer falls into the weapon mechanism it may cause it to jam leading to mission failure. This defect is usually associated with gas escape around the primer (GE+).

PP **Primer Pierced**
The piercing of a primer by the point of the firing pin or the blowing out of the portion the cap/primer that has been struck by the firing pin. The most likely causes of pierced cap/primer are defective cap material, thin dome, high anvil or excessive pressure. It can also be caused by excessive striker protrusion, incorrect striker profile, incorrect headspace or worn/oversize firing pin hole.

PPO **Primer Punch Out** (Blown Dome)
Punch Out is the removal of metal in the dome of the primer. This is basically the base of the primer becoming detached from the side wall. It is possible for the detached part to become lodged on the bolt face, possibly leading to a breech explosion of the following cartridge by the detached part remaining jammed on the bolt face and initiating the next cartridge during closure but before full locking of the breech. Subsequent jamming of the weapon mechanism can also be caused by this failure.

PS **Primer Setback**
Identified as a primer protruding slightly above the base of the cartridge case which can be detected either visually or by a finger or thumb nail. The cause is likely to be a less severe condition than causes a primer to come completely out or become loose in the pocket. It is becoming more common with the use of lead free primer compositions which tend to create higher pressures within the primer. The primer shell material also tends to be slightly thinner to accommodate the less sensitive nature of the composition. These combined conditions result in a less physically strong primer which is not so easy to retain. Providing the primer is not loose in the pocket, there is no evidence of gas escape around the periphery of the primer and the setback does not affect weapon functioning or cause damage, then this situation should not be counted as an ammunition defect. This situation can often be seen in an exaggerated form during primer sensitivity testing with the NATO type holder. This is due to the NATO type holder having a sprung loaded top which gives less support to the base of the cartridge case.

RN ( ) **Reformed Neck**
(Length of case neck in millimetres after reformation to be included in brackets**)**
This can occur when either a short case is fired or a normal case is fired in a weapon with excessive headspace. The case shoulders are not correctly seated on the cone at the front of the chamber, therefore the case shoulder/neck expands into the shape of the chamber. On inspection the cartridge may look normal except that the neck is shorter.

SB **Spin Back**
A fired case properly ejects from the receiver and re-enters the working parts of the weapon causing a weapon stoppage. This could occur from the fired case rebounding from an external weapon part (e.g. cocking handle) or case catcher that is located too close, or other external equipment. This would not normally be counted as an ammunition fault unless a distinct pattern of ejection occurs causing rebounds off an actual weapon part.

SC (SV) Stretched Case (Severe)
SC Stretched Case
SC (SL) Stretched Case (Slight)

This defect can be caused by several different defects or combination of defects. A common place for this defect to occur is at the base of the case around the unsupported area although it does sometimes occur in other positions. Severely stretched cases are a precursor to Ruptures/Separations and should be studied carefully. Possible causes are incorrect hardness gradient (annealing) along the length of the case, excessive cartridge headspace/space. Very slight necking in the unsupported area is a common occurrence with worn weapons, even on good cases, and should be reported as a minor. A person experienced in cartridge case examination will be needed to decide if the stretching is of an unacceptable level.

Severely Stretched - Case exterior shows obvious sign of strain. Case interior shows a reduction in wall thickness concentrated into a groove visible to the eye and able to be felt with a pointed probe. Other symptoms sometimes seen are a slight necking at the point of stretch accompanied by a slightly brighter colour at that point. The degree of necking, which usually occurs around the unsupported area at the base of the case, can be seen more clearly by placing a straight edge against the case and viewing it against the light.

Stretched - Case exterior shows sign of strain. Case interior shows a visible reduction in wall thickness over a relatively wide band.

Slightly Stretched - Case exterior shows a change in sheen. Case interior shows sign of strain, but no visible reduction in wall thickness.

SPC ( ) Split Case

(Position to be indicated, in brackets, along with length of split: see Annexes 11-A, 11-B & 11-C**)**

The term "Split Case" is to be applied to longitudinal splits or fissures that show a definite separation of the metal entirely through the case wall. Splits are generally in a longitudinal direction along the case wall although the term is still to be applied to cracks that are through the case head. Splits are not to be confused with ruptures/separations and partial ruptures/separations which are circumferential.

UF ( ) Uncontrolled Firing Rifles/SMGs

When a weapon is set to fire a specific number of cartridges, one or more additional cartridges are fired.

SMGs/Machine Guns - When a serviceable gun is set to full automatic, additional cartridges are fired after release of the trigger. Each additional cartridge fired unintentionally is an additional defect and is to be included in brackets after the code. When in serviceable condition this defect is only possible with certain types of weapons and is usually a symptom of low energy ammunition.

WM **Weapon Malfunction**
This code indicates that the weapon has suffered a mechanical failure which has either resulted in a stoppage or is likely to. Rectification of the mechanical failure is normally beyond the scope of the firer. This code may be used in addition to any stoppage code by way of explanation as to the cause of the stoppage and will normally be accompanied by a more detailed report on the type of failure.

WSL **Weapon Stoppage Attributable to Link**
This stoppage can occur due to defective links or incorrectly assembled belts.

ANNEX 11-C

FEEDING, FIRING, EXTRACTING AND EJECTION CYCLE

11.C.1 Purpose

This annex gives general guidance of the problems that can be encountered during the complete cycle of feeding, firing, extracting and ejecting through a small arms weapon system. Some of the information will not be applicable to all types of small arms as there are many different operating mechanisms. Some examples are: gas operated, blow-back, delayed blow-back, recoil operated, electric chain driven, manual operation etc.

11.C.2 Weapon Operating Cycle - Possible Failures

Failure to Feed - A complete failure of the breech block/bolt/mechanism to properly engage the base of the cartridge. Feeding is defined as the appropriate action required to properly position each succeeding cartridge in position so that the weapon mechanism can strip the cartridge from the magazine/link. The feeding portion of the cycle of operation stops once the cartridge leaves control of the magazine/link. Failure to feed can be caused by short recoil due to low energy ammunition, hard extraction, and clogged gas system, weapon or magazine/link fault. Various causes of Failure to Feed are as follows:

Bolt Over rides the **Base** of the case in magazine fed weapons. This is normally caused by a defective weapon or magazine or damaged/improperly dimensioned ammunition

Bolt Under rides the **Base** of the case in link fed weapons. This is normally caused by damaged/improperly dimensioned ammunition, tight links or defective feed cover/tray components

Closed On Empty Chamber after successful ejection of previously fired cartridge

Double Feed is where two cartridges are simultaneously fed from the magazine. This can be caused by a defective magazine, frozen ammunition/magazines, or other adverse environments.

Stubbed Round occurs when the cartridge has been misaligned with the chamber. Examples are cartridges that have been stubbed into the front of the magazine wall or barrel extension

Failure To Chamber - Chambering is defined as the placement of a cartridge of ammunition in the barrel chamber of the weapon. Chambering starts after completion of feeding, and is completed upon full insertion of the cartridge in the chamber. In some weapons, the projectile nose enters the breech end of the chamber before the feeding portion of the cycle has been completed by release of the cartridge from the magazine's feed lips. If a stoppage occurs at that location, the stoppage is defined as a FFD, not a

FTC. Other causes that can prevent chambering are: insufficient counter recoil force, barrel, chamber damage, obstruction in the chamber and bore such as dirt, mud, ice and ruptured cartridge cases; and broken/deformed parts that prevent or restrict forward movement of the breeching components, incorrectly dimensioned ammunition.

Failure To Lock - Locking is defined as the securing of the weapon's breeching components to prevent opening during high pressure generation at the time of firing. For hand-held weapons, locking may be affected by manual closure of the breech. The use of advanced primer ignition as the bolt is moving forward is not uncommon with automatic weapons operating on the blowback principle. Locking begins with the completion of chambering and terminates upon full engagement of the lock components with their mating surfaces. Some weapons additionally require a small amount of forward bolt mechanism free travel in the locked position before firing can occur. This complete return to battery is the terminal point of counter recoil. It is sometimes difficult to differentiate between an FTL and an FFR (failure to fire) because of this additional movement of components after full locking has occurred. One indicator of the failure to lock under this situation is a light or non-existent firing pin indent in the cartridge primer. If a judgemental call is necessary, provide enough narrative to describe the occurrence so that later analysis can possibly reveal the true classification and cause. Failure to Lock can be caused by incorrect headspace, excessive weapon fouling, foreign material, bullet in bore from previous cartridge, incorrectly dimensioned ammunition.

Failure to Fire - Firing is defined as the action created by release of the striker/hammer which causes the striker/firing pin to function the cartridge primer. The firing sequence starts upon completion of locking and is terminated upon satisfactory strike of the primer and ignition of the propellant. Failures to fire are caused by two basic problems: defective ammunition or defective weapon. Within each of these two problem areas are several causes. Examples of ammunition related causes are: primer, propellant, or cartridge case defects. Examples of weapon related causes are: defective parts or dimensional mismatches (i.e., bolt bounce to the rear at the time of firing which prevents firing due to being unlocked). Since the symptoms of light/non-existent firing pin indent of the primer are the same if the gun either fails to lock or is unlocked at the instant of firing pin/striker release, other signs of the cause must be noted. Such things as deformation of the headspacing shoulder (case mouth on straight walled cases) or case body marks, may give additional evidence about the location of breeching components at the time of actual incident. There may be some overlapping of causes in the determination of Failures to Fire.

Failure to Unlock - Unlocking is defined as the action taken either manually or automatically by the weapon when fired to release the breeching components so that extraction can take place. Unlocking begins with the completion of firing (or manual retraction of the bolt/slide from the battery position) and is completed upon rearward movement of the bolt, at the point of separation of the bolt from the barrel (in instances when the barrel and breeching components recoil together in a locked position for a short distance before separation). This can be caused by low energy ammunition, hard extraction, clogged gas system, foreign material or weapon fault. Excessive force may be required to unlock the weapon.

Failure to Extract - Extraction is defined as the removal of the fired case from the chamber of the weapon. Extraction begins with the completion of unlocking and is

terminated when the fired case is in a position to be ejected. This ejection position varies with the weapon design (fixed or spring-loaded ejector). Determination of extraction failures is complicated by short recoil of the breeching components. Extraction failures may be caused by: soft cartridge case, rough chamber wall, broken parts, and external contamination such as dirt, mud, snow, ice and corrosion that prevents bolt movement after firing, but may allow the breeching components to return to battery. Dimensional problems with the case rim thickness and angle, and chamber pressure also contribute to extraction problems. Examples of this defect are:

1. The bolt remains in a forward position with the extractor in continuous contact with the case. There may be evidence of damage to the case rim from the extractor.

2. The bolt begins its rearward movement with the extractor in continuous contact with the case, the case is partially withdrawn from the chamber and the case is returned to the forward position. There may be evidence of case stretch or longitudinal scratch marks on the case.

3. The extractor over rides the fired cartridge case and the breech block moves rearward and attempts to continue with normal operation. There would normally be evidence of damage to the case rim from the extractor in a weapon with a serviceable extractor and extractor spring. If there is no evidence of damage the extractor and extractor spring should be checked for condition and replaced if necessary. In some cases the bolt recoils rearward part way and returns forward engaging the case once again. In other cases the recoiling bolt attempts to feed the next live cartridge form the magazine/link and stubs into the still chambered case form the previous cartridge.

Failure to Eject - Ejection is defined as the complete removal of a fired case from contact with the weapon. Ejection starts after extraction and is completed upon expulsion from the weapon. Extraction and ejection are closely related since one follows the other. Failure of the extractor and breech face to control the fired case until ejection occurs would normally cause an ejection failure. In order to differentiate between the two stoppages, inspect cartridge cases for signs of ejector/extractor marks on the base of the case. A change in the usual marks may signify that loss of control occurred before ejection. Case sidewall indentation will also help identify ejection failures. Residual gas pressure, acting upon the fired case and breeching components, may be enough to allow case extraction when the weapon has a broken extractor, but not ejection. The correct assessment of the malfunction type will be an FEX, not an FEJ. When short recoil is coupled with fixed ejector design, the fired case may be returned to the chamber. This would first appear to be a failure to unlock or extract. If the fired case can be manually extracted and ejected, the stoppage should be classified as an ejection failure if there are no other indicators of the type of stoppage and its cause. If this condition persists, high speed photography may be necessary to isolate the cause of the problem. Examples of this defect are:

1. The case remains on the bolt face and attempts to re-chamber, stubs into the barrel extension or elsewhere in the receiver.

2. The case falls off the bolt face and remains inside the receiver.

3. The case partially ejects and jams against the ejection opening, usually mouth outwards.

Failure of Bolt to Remain at the Rear - This defect applies to weapons which are designed to have the bolt assembly remain at the rear after firing the last cartridge in the magazine. Failure of the bolt assembly to remain at the rear after firing the last cartridge can be caused by short recoil due to low energy ammunition, hard extraction, clogged gas system, weapon or magazine fault.

ANNEX 11-D

CROSS REFERENCE OF DEFECTS and INCIDENTS CAUSED BY AMMUNITION

Note 1: Defects and Incidents caused by weapon problems are not included in this table.

Note 2: Some Defects and Incidents can fall in to more than one category. A judgement has to be made by the test operator as to which category should be applied using the category definitions contained in Annex 11-A.

Codes	Defects and Incidents	Categories			
		1	2	3	4
BB ( )	**Bullet in Bore (**distance from chamber**)**	X			
BEC	**Breech Explosion (Closed)**	X			
BEO	**Breech Explosion (Open)**	X			
BF	**Breech Flash**	See Smoke and Flash AEP-97, Volume 17			
BI/S	**Bullet Integrity/Stripping**		X		
BP	**Blown Primer**	X			
BS	**Belt Separation**			X	
BY	**Bullet Yaw**		X		
CCR ( )	**Complete Circumferential Rupture**	X			
CO	**Cook Off**	X			
DB	**Distorted Base**			X	
ES	**Excessive Smoke**	See Smoke and Flash AEP-97, Volume 17			
ET	**Early Trace**			X	
FEJ ( )	**Failure to Eject**	X	X	X	
FEX	**Failure to Extract**	X	X	X	
FFD ( )	**Failure to Feed**	X	X	X	
FP	**Flattened Primer**	Information Only			
GE+	**Gas Escape** around Primer **in excess of 50%** of circumference			X	
GE-	**Gas Escape** around Primer **of less than 50%** of circumference				X
GETP	**Gas Escape Through Primer**			X	
HF	**Hangfire (Audible)**	X			
IBE	**In Bore Explosion** (Bullet)	X			
LS	**Light Strike**			X	

Codes	Defects and Incidents	Categories			
		1	**2**	**3**	**4**
MF	**Misfire**		X		
MFL	**Muzzle Flash**	See Smoke and Flash AEP-97, Volume 17			
MS	**Muzzle Sparks**	See Smoke and Flash AEP-97, Volume 17			
PCR ( )	**Partial Circumferential Rupture (**position to be indicated**)**	X	X		
PL	**Primer Loose** – Stays in Pocket				X
PM	**Piled** Up **Metal** (Flowback)	X	X	X	X
PO	**Primer/Cap Out or Loose Primer/Cap** which falls out of pocket	X			
PP	**Pierced Primer**(3)				X
PPO	**Primer Punch Out**	X			
PS	**Primer Setback**	Information only			
SPC ( )	**Split Case (**position to be indicated: see Annexes 11-A, 11-B & 11-C**)**	X	X	X	
UF	**Uncontrolled Firing**	X			
WSL	**Weapon Stoppage** Attributable to **Link**	X	X	X	

Note 3: The pierced primer defect is normally a Category 4 defect with an AQL of 1.0. For the 5.56mm, Minimi, Mk1, Machine Gun only, the pierced primer defect has an AQL of 1.5.

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 12

COMBINATION ELECTRONIC PRESSURE, VELOCITY AND ACTION TIME (EPVAT) TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

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12.1 Applicability

Ammunition for calibres 4.6 mm, 5.56 mm, 5.7 mm, 7.62 mm, 9 mm and 12.7 mm submitted for Qualification Approval, Production Testing and Surveillance Testing shall be subjected to the Electronic Pressure, Velocity and Action Time (EPVAT) Test Procedure defined in this volume.

12.2 NATO Requirements

The testing of ammunition for EPVAT at the specified barrel position(s) shall be performed simultaneously using piezo-electric pressure transducers and associated equipment as defined in this volume. All requirements are for test ammunition conditioned and fired at the specified temperatures.

12.2.1 Transducer Type to Be Used

a. For calibres; 4.6 mm, 5.56 mm, 5.7 mm, 7.62 mm, 9 mm and 12.7 mm, all testing will be conducted using the Kistler Model 6215 Transducer or HPI Model GP6 Transducer.

b. For 9 mm, designs that were NATO Qualified using the Kistler Model 6203 transducer will continue to be Production Tested using the Kistler Model 6203 transducer. New 9 mm ammunition designs submitted for Qualification Approval Testing will be tested using either the Kistler Model 6215 transducer or HPI Model GP6 transducer. All 9 mm designs that were NATO Qualified with either the Kistler Model 6215 transducer or the HPI Model GP6 transducer will subsequently be NATO Production Tested using either the Kistler Model 6215 transducer or HPI Model GP6 transducer.

12.2.2 EPVAT Requirement – NATO Qualification Approval and NATO Production Tests

The performance requirements for the Electronic Pressure, Velocity and Action Time (EPVAT) for the NATO Qualification Approval and Production Tests are presented in the table below.

Calibre	4.6 mm	5.56 mm	5.7 mm	7.62 mm	9 mm	9 mm	12.7 mm
Transducer	**6215/GP6**	**6215/GP6**	**6215/GP6**	**6215/GP6**	**6203**	**6215/GP6**	**6215/GP6**
Maximum Corrected Mean Case Mouth Pressure for +21 °C sample	400 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Maximum Corrected Mean Case Mouth Pressure + 3 SD for +21 °C sample	460 MPa	445 MPa	370 MPa	445 MPa	265 MPa	285 MPa	450 MPa
Maximum Mean Case Mouth Pressure Difference between +52 °C sample and +21 °C sample	+ 60 MPa to - 60 MPa	+ 55 MPa to - 110 MPa	+ 40 MPa to - 40 MPa	+ 55 MPa to - 110 MPa	+ 65 MPa to - 65 MPa	+ 65 MPa to - 65 MPa	No Require-ment
Maximum Mean Case Mouth Pressure Difference between -54 °C sample and +21 °C sample	+ 60 MPa to - 60 MPa	+ 55 MPa to - 110 MPa	+ 40 MPa to - 40 MPa	+ 55 MPa to - 110 MPa	+ 65 MPa to - 65 MPa	+ 65 MPa to - 65 MPa	No Require-ment
Maximum Corrected Mean Case Mouth Pressure for +52 °C sample	No Require-ment	455 MPa	No Require-ment	460 MPa	No Require-ment	No Require-ment	No Require-ment
Maximum Corrected Mean Case Mouth Pressure for -54 °C sample	No Require-ment	455 MPa	No Require-ment	460 MPa	No Require-ment	No Require-ment	No Require-ment
Maximum Corrected Mean Case Mouth Pressure + 3 SD for +52 °C sample	500 MPa	No Require-ment	370 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Maximum Corrected Mean Case Mouth Pressure + 3 SD for -54 °C sample	500 MPa	No Require-ment	370 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Maximum Corrected Individual Case Mouth Pressure for +52 °C sample	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	450 MPa
Maximum Corrected Individual Case Mouth Pressure for -54 °C sample	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	450 MPa

Calibre	4.6 mm	5.56 mm	5.7 mm	7.62 mm	9 mm	9 mm	12.7 mm
Transducer	6215/GP6	6215/GP6	6215/GP6	6215/GP6	6203	6215/GP6	6215/GP6
Minimum Corrected Mean Port Pressure – 3 SD for +21 °C sample	No Require-ment	103 MPa	No Require-ment	56 MPa	No Require-ment	No Require-ment	No Require-ment
Maximum Mean Port Pressure Difference between +52 °C sample and +21 °C sample	No Require-ment	+ 15 MPa to - 15 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Maximum Mean Port Pressure Difference between -54 °C sample and +21 °C sample	No Require-ment	+ 15 MPa to - 15 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Minimum Corrected Mean Port Pressure – 3 SD for +52 °C sample	No Require-ment	103 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Minimum Corrected Mean Port Pressure for -54 °C sample	No Require-ment	103 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Maximum Mean Velocity Difference between +52 °C sample and +21 °C sample	+ 50 m/s To - 50 m/s	+ 50 m/s To - 80 m/s	+ 30 m/s To - 30 m/s	+ 45 m/s to - 75 m/s	+ 30 m/s To - 30 m/s	+ 30 m/s To - 30 m/s	No Require-ment
Maximum Mean Velocity Difference between -54 °C sample and +21 °C sample	+ 50 m/s To - 50 m/s	+ 50 m/s To - 80 m/s	+ 30 m/s To - 30 m/s	+ 45 m/s to - 75 m/s	+ 30 m/s To - 30 m/s	+ 30 m/s To - 30 m/s	No Require-ment
Maximum Individual Action Time for +21 °C sample	No Require-ment	No Require-ment	No Require-ment	4 ms	3 ms	3 ms	No Require-ment
Maximum Mean Action Time + 5 SD for -54 °C sample	2 ms	3 ms	2 ms	No Require-ment	No Require-ment	No Require-ment	4.5 ms

Calibre	4.6 mm	5.56 mm	5.7 mm	7.62 mm	9 mm	9 mm	12.7 mm
Transducer	**6215/GP6**	**6215/GP6**	**6215/GP6**	**6215/GP6**	**6203**	**6215/GP6**	**6215/GP6**
Muzzle Energy for +21 °C sample	Min: 450J **Note: For Info Only**	Min:1564 J (Min:1480 J at 24 metres from the muzzle) **Note: For Info Only**	Min:430 J (Min:381 J at 24 metres from the muzzle) **Note: For Info Only**	Min:2931 J (Min:2756 J at 24 metres from the muzzle) **Note: For Info Only**	Min:542 J Max:814 J (Min:482 J Max:704 J at 16 metres from the muzzle)	Min:551 J Max:823 J (Min:491 J Max:713 J at 16 metres from the muzzle)	No Require-ment

12.2.3 EPVAT Requirement - NATO Surveillance Test

The EPVAT sentencing requirements for Surveillance Testing are contained in Volume 4.

12.3 Ammunition Quantity

Type	+21 ºC	+52 ºC	-54 ºC
NATO Reference Ammunition	30	--	--
Test Ammunition	30	30	30

Note: The quantity in the table above is the minimum quantity for the number of results required. Additional cartridges will be required for use as warmers. Additional cartridges at the various temperature conditions may also be required as replacement cartridges if it is necessary to disregard any results due to equipment problems. However, unused cartridges conditioned at either + 52 ºC or - 54 ºC, shall be disposed of at the end of the test to avoid the possibility of them being re-conditioned as new test ammunition in other tests.

12.4 Equipment

a. Electronic Pressure, Velocity, Action Time Barrel as shown in the drawing appropriate to the ammunition being tested:

Calibre	Drawing Number* for Barrel using	
	6203 Transducer	**6215 / GP6 Transducer**
4.6 mm	Not Applicable	12-(4.6 mm)-3
5.56 mm	Not Applicable	12-(5.56 mm)-3
5.7 mm	Not Applicable	12-(5.7 mm)-3
7.62 mm	Not Applicable	12-(7.62 mm)-2
9 mm	12-(9 mm)-2	12-(9 mm)-3
12.7 mm	Not Applicable	12-(12.7 mm)-2

***Drawings are provided in AEP-97, Volume 6.**

b. Suitable receiver system complete with firing mechanism that is fitted with a device which reliably transmits an electrical signal to initiate timing on a chronograph at the instant of contact between the firing pin and primer. An example of a suitable receiver system is the NATO M2 Universal Receiver as defined in Annex 12-E of this volume. This equipment is mandatory for NATO Regional Test Centres. The equipment shall also include a suitable method of detecting the action time termination signal, based on the location specified in the following table for the applicable calibre:

Action Time Measurement		
Calibre	**Initiation Point**	**Termination Point**
4.6 mm	Firing pin-Primer contact	Muzzle exit[2]
5.56 mm	Firing pin-Primer contact	Port pressure transducer[1]
5.7 mm	Firing pin-Primer contact	Muzzle exit[2]
7.62 mm	Firing pin-Primer contact	Port pressure transducer[1]
9 mm	Firing pin-Primer contact	Muzzle exit[2]
12.7 mm	Firing pin-Primer contact	Muzzle exit[2]

Note 1: The chronograph stop pulse shall be provided by the port pressure transducer. The transducer signal shall be channelled to a signal conditioning unit through the filtered output of the port pressure transducer amplifier. The signal conditioning unit shall not "load down" nor adversely affect the characteristics of the port pressure signal. The signal conditioning unit shall have its triggering threshold adjusted to the voltage equivalent of 14 MPa.

Note 2: The chronograph stop pulse shall be provided by an appropriate device (e.g., electrostatic collector, high sensitive piezoelectric transducer, or photo-cell) that detects the bullet exiting the muzzle. A suitable chronograph shall be used such that the action time measurement error shall not exceed ± 0.2 milliseconds.

c. Pressure Transducer and electronic instrumentation as specified in Annex 12-A.

d. Suitable Test Fixture (example as shown in Figure 12-C-3 in Annex 12-C) appropriate to the ammunition calibre being tested. Example pictures of EPVAT Test set-ups can be in found in Volume 6, Annex 6-B.

e. Velocity measurement equipment capable of maintaining measurement errors of less than ± 1 m/s. The measurement method or base length between sensors (if used) is optional providing the equipment is capable of maintaining measurement errors of less than ± 1 m/s.

f. Constant temperature-controlled container capable of maintaining temperature limits at a tolerance of ± 3 °C.

12.5 Method of Conducting the Test

12.5.1 Use of NATO Reference Ammunition

NATO Reference Ammunition shall be used to establish correct equipment functioning and to establish range and equipment corrections prior to firing any ammunition test lot. Records shall be maintained of the results obtained with each barrel using the NATO Reference Ammunition. The EPVAT barrel assembly shall be withdrawn from service[4] when any of the following performance variations from the assessed values of the NATO Reference Ammunition are exceeded:

Mean Peak Case Mouth Pressure	± 25 MPa
Mean Peak Port Pressure	± 14 MPa
Mean Velocity	± 12 m/s

Note 4: Barrels should be re-tested several times before being finally rejected as out of tolerance.

12.5.2 Use of Pressure Transducer(s)

The described procedure shall be followed:

a. The pressure(s) shall be determined by using an accepted pressure transducer of the type specified in Annex 12-A, and qualified for use as per Annex 12-B.

b. The sensitivity constant for the transducer shall be determined prior to the test and on test completion. No more than 300 cartridges shall be fired before re-determining the sensitivity constant.

c. The transducer shall have its sensitivity determined at the pressure level for which it will be used in the test as specified in the following table:

Calibre	Position	Pressure Level
4.6 mm	Case Mouth	400 MPa
5.56 mm	Case Mouth	350 MPa
5.56 mm	Port	105 MPa
5.7 mm	Case Mouth	300 MPa
7.62 mm	Case Mouth	350 MPa
7.62 mm	Port	75 MPa
9 mm	Case Mouth	250 MPa
12.7 mm	Case Mouth	350 MPa

The method for determining the transducer sensitivity is detailed in Annex 12-B.

d. As stated in paragraph 12.5.2 b, the sensitivity value for each transducer shall be determined at prescribed intervals. Each new value shall be compared to the value of the sensitivity previously obtained. For the first calibration, the comparison value shall be that obtained from the initial Linearity Test (refer to Annex 12-B). If the change in sensitivity at the calibration pressure is greater than ± 2% from the previous calibration, or more than ± 10% from the original calibration, the transducer shall be disqualified from further testing.

e. At an interval of at least every 1000 cartridges fired, a complete linearity calibration shall be performed at the pressure levels specified in Annex 12-B. If a change in transducer linearity in excess of ± 1% of full scale is noted, the transducer shall be disqualified from further testing.

f. If the calibration of the pressure transducer exceeds the change in sensitivity requirements specified in paragraph 12.5.2 d and/or 12.5.2 e above, the test data shall be declared invalid and the test re-fired.

g. The transducer sensitivity to be used for instrumentation scaling shall be as specified in paragraph 12.5.2 c above. A record shall be maintained of the sensitivities obtained as a function of the number of cartridges fired on each transducer.

12.6 Preparation for Firing

The described procedure shall be followed:

12.6.1 Ammunition Conditioning

All ammunition submitted for testing shall be stored for 12 hours at +21 °C ± 5 °C prior to storage and conditioning. The required number of test cartridges shall be placed in a vertical position, primer-end down, in separate recessed holding blocks. The temperature controlled container(s) shall have been brought to the specified temperature and maintained at that temperature prior to conditioning the ammunition. The ammunition to be used for the EPVAT Test shall be conditioned at the specified temperature according to the period of time specified below:

Calibre	+21 °C	+ 52 °C	- 54 °C
4.6 mm	2 hours minimum (1 hour minimum under accelerated storage conditions[5])	4-24 hours (1 hour minimum under accelerated storage conditions[5])	6-24 hours (1 hour minimum under accelerated storage conditions[5])

Calibre	+21 °C	+ 52 °C	- 54 °C
5.56 mm	2 hours minimum (1 hour minimum under accelerated storage conditions[5])	4-24 hours (1 hour minimum under accelerated storage conditions[5])	6-24 hours (1 hour minimum under accelerated storage conditions[5])
5.7 mm	2 hours minimum (1 hour minimum under accelerated storage conditions[5])	4-24 hours (1 hour minimum under accelerated storage conditions[5])	6-24 hours (1 hour minimum under accelerated storage conditions[5])
7.62 mm	2 hours minimum (1 hour minimum under accelerated storage conditions[5])	4-24 hours (1 hour minimum under accelerated storage conditions[5])	6-24 hours (1 hour minimum under accelerated storage conditions[5])
9 mm	2 hours minimum (1 hour minimum under accelerated storage conditions[5])	4-24 hours (1 hour minimum under accelerated storage conditions[5])	6-24 hours (1 hour minimum under accelerated storage conditions[5])
12.7 mm	6 hours minimum (2 hours minimum under accelerated storage conditions[5])	6-24 hours (2 hours minimum under accelerated storage conditions[5])	6-24 hours (2 hours minimum under accelerated storage conditions[5])

Note 5: See paragraph 12.6.1.1 below for details.

12.6.1.1 Accelerated Storage Conditions

Conditioning times for the ammunition test samples may be shortened to periods of at least one (1) hour (2 hours for 12.7 mm) at + 21 °C ± 3 °C, at least one (1) hour (two (2) hours for 12.7 mm) at + 52 °C ± 3 °C and at least one (1) hour (2 hours for 12.7 mm) at - 54 °C ± 3 °C when the conditions below are met:

a. The temperature controlled container(s) shall be of the circulating air type to assure uniform conditioning of the ammunition.

b. The temperature controlled container(s) shall have been brought to the specified temperature and maintained at that temperature prior to conditioning the ammunition.

12.6.2 EPVAT Barrel Assembly

The EPVAT barrel assembly shall be in accordance with the applicable drawings and the measurements listed below shall be made before it is placed in service, after misfires, pierced primers, blowback or whenever a part replacement has been made in the breechblock/bolt assembly.

Calibre	Firing Pin Protrusion (mm)	Firing Pin Indent (mm)	Headspace (mm)
4.6 mm	0.76 to 0.99	0.45 to 0.65	32.35 to 32.5
5.56 mm	0.76 to 0.99	0.51 to 0.64	38.024 to 38.1 at 7.663 mm dia.
5.7 mm	0.76 to 0.99	0.51 to 0.64	23.75 to 23.826 at 7.00 mm dia.
7.62 mm	1.52 to 1.73	0.51 to 0.64	41.35 to 41.43 at 10.16 mm dia.
9 mm	0.89 to 0.94	0.28 to 0.38	19.15 to 19.23
12.7 mm	1.88 to 2.08	0.51 to 0.64	79.58 to 79.84 at 16.15 mm dia.

12.6.3 Firing Range Set Up

The firing range shall be set up as shown in the drawings listed below which can be found in this volume in Annex 12-C. The instrumental point shall be as specified in the table below. The test fixture shall be assembled on the mount as illustrated in Figure 12-C-3.

Calibre	Instrumental Point	Test Range Set-up
4.6 mm	24 metres	Figure 12-C-2
5.56 mm	24 metres	Figure 12-C-2
5.7 mm	24 metres	Figure 12-C-2
7.62 mm	24 metres	Figure 12-C-2
9 mm	16 metres	Figure 12-C-1
12.7 mm	24 metres	Figure 12-C-2

12.6.4 Barrel Preparation

a. Prior to conducting the EPVAT test, the bore of the barrel should be inspected for propellant residue and/or metal fouling. If it is determined that the bore needs to be cleaned, the following procedure is recommended:

(1) A soft bristle brush is saturated with a solvent type cleaner and worked through the bore with a vigorous scrubbing motion. **The solvent type cleaner should not contain any properties that will act as a lubricating agent in the bore.**

(2) A brass brush is then run completely through the bore in one long, continuous stroke. When the brush emerges from the opposite end of the barrel, the stroke is reversed and the brush is withdrawn through the bore.

(3) The bore is again swabbed with a soft bristle brush soaked in a solvent type cleaner. A cloth patch, soaked in a solvent type cleaner, is run through the bore several times. The chamber is carefully wiped with a similar patch.

(4) A succession of clean cloth patches are then run through the bore until it is completely dry and clean.

(5) EPVAT barrels should never be cleaned or preserved with products that leave lubrication after drying (e.g. Teflon based products).

b. The transducer mounting cavity shall contain no particles of foreign material. To ensure this condition, the following procedure shall be strictly adhered to prior to installing a transducer:

(1) Remove any burrs, combustion-particle residue, corrosion or other anomaly by touching up the sealing surface with the Kistler end finishing tool, Model 1300A25 or HPI finishing tool, Model Z3108

(2) Clean cavity and transducer thoroughly using clean, lint-free industrial wipes and degreaser spray.

c. The transducer(s) shall be installed in the EPVAT barrel as per the instructions detailed in Annex 12-A. The signal connector(s) on the transducer(s) and interconnecting line(s) shall be cleaned with degreaser spray and wiped clean with lint-free industrial wipes.

d. The chamber and bore of the barrel shall be wiped dry and the barrel boresighted into position.

12.6.5 Electronic Instrumentation Requirements

Electronic instrumentation requirements are outlined in Annex 12-A and recommended calibration procedures are listed in Annex 12-B.

12.6.6 Low Pass Filter

A low pass Butterworth type electronic filter shall be used as follows:

a. For 4.6 mm, 5.56 mm, 5.7 mm, 7.62 mm and 9 mm ammunition: 20 kHz or 22 kHz

b. For 12.7 mm ammunition: 10 kHz

12.7 Firing the Test

12.7.1 General Procedures

If at any time there is a significant delay in firing then the warming sequence shall be repeated. (The relevant time interval before it is necessary to fire warming shots will be at the discretion of the firing officer). The pressure, velocity and action time readings shall be recorded to assure that the measuring equipment is functioning properly. After the warming/fouling shots have been fired, the pressure transducer(s) shall be re-tightened to the appropriate torque level specified in Annex 12-A. The transducer signal line(s) shall be reconnected and securely tightened finger tight.

12.7.2 Firing Order

Firing shall adhere to the requirements in the table on the following page:

Serial	Firing Sequence [8]
1	Five (5) warmer/fouling cartridges (the last three (3) to be NATO Reference Ammunition) are to be fired.
2	Thirty (30) NATO Reference Cartridges are to be fired and the EPVAT data recorded. If the requirements of paragraph 12.5.1 are met the test is to continue. If not the test barrel; is to be changed and test procedure re-started.
3	Three (3) warmer cartridges from the test ammunition sample are to be fired.
4	Thirty (30) +21 ºC test cartridges are to be fired and the EPVAT data recorded.
5	Transducer shall be removed, cleaned, re-inserted and torqued.
6	Three (3) warmer cartridges from the test ammunition sample are to be fired.
7	Transducer shall be re-torqued.
8	Thirty (30) +52 ºC test cartridges are to be fired and the EPVAT data recorded.
9	Transducer shall be removed, cleaned, re-inserted and torqued.
10	Three (3) warmer cartridges from the test ammunition sample are to be fired.
11	Transducer shall be re-torqued.
12	Thirty (30) -54 ºC test cartridges are to be fired and the EPVAT data recorded.

Note 8: The +52 ºC and -54 ºC firing sequences may be fired in the reverse order, if required.

a. The conditioning cabinet shall be reasonably close to the firing point to avoid the ammunition being out of conditioning for more than sixty (60) seconds prior to firing. **For + 21 °C conditioned ammunition only**, the recessed holding block containing the ammunition may be moved from the conditioning chamber, placed close to the EPVAT assembly and the ammunition fired from that location only if the firing point temperature is at + 21 °C ± 5 °C. If the firing point temperature is not at + 21 °C ± 5 °C, no more than five cartridges may be placed in an insulated box which has been conditioned at + 21 °C ± 3 °C, and the box placed at a point convenient to the firing point. The cartridges shall then be removed singularly from the insulated box immediately before firing. If these conditions cannot be met for ammunition conditioned to + 21 °C, these cartridges must also be removed singularly from the conditioning cabinet no more than sixty (60) seconds before firing. For +52 °C and - 54 °C conditioned ammunition, the cartridges shall be removed singularly from the conditioning cabinet. If a delay occurs during the firing of the test and the delay exceeds sixty (60) seconds, the cartridge is to be either discarded or placed back into the conditioning chamber for a minimum of thirty (30) minutes.

b. In order that the propellant shall be uniformly positioned from shot to shot, attention to detail is necessary in handling and chambering the cartridge. The cartridge shall first be held vertically, bullet upward. It shall then be rotated slowly in a vertical plane, stopping the rotation momentarily after 180° of rotation when the bullet is downward, and then continuing through the remainder of 360°, stopping with the cartridge again bullet end upward. The bullet end of the cartridge shall now be lowered to a position slightly above the primer end of the case. The cartridge shall remain in this attitude, as far as is practical, as it is inserted into the chamber. The object is to have the propellant seated in the primer end of the case, and any airspace present at the bullet end of the case[9].

Note 9: Improper handling of ammunition immediately prior to and during the chambering operation (i.e. propellant is at the bullet end of the case when the cartridge is fired) will result in lower velocities and pressures being obtained than if the propellant is at the primer end of the case in a loose condition, provided air space is present. This condition is more likely to occur as the size of the caliber/case increases.

c. The breechblock/bolt shall be closed gently and the trip lever (where appropriate) shall be carefully engaged to the firing mechanism. If the technician encounters any difficulty closing the breechblock or engaging the trip lever, the test shall be discontinued until such difficulty is corrected[10]. The cartridge must be fired within twenty (20) seconds of being placed in the chamber. This is to minimise a change in the temperature of the cartridge being influenced by the temperature of the test barrel thereby having an effect on the pressure and velocity readings. If a delay in excess of twenty (20) seconds occurs the cartridge shall be extracted and another inserted in its place. The cartridge shall be discarded or returned for reconditioning for a minimum of thirty (30) minutes.

Note 10: If excessive force is used to close the breechblock/bolt, the positioning of the propellant may shift forward to the bullet end of the case resulting in lower velocities and pressures as described in

paragraph 12.7.2.b. As stated above, any difficulties encountered closing the breechblock/bolt should be identified and the cause thereof eliminated.

d. The technician shall then move to a safe position and activate the firing mechanism (normally using a lanyard) with a smooth, firm motion. To avoid an accelerated increase in barrel temperature that is likely to increase the standard deviation for the group, there is to be a minimum of 20 seconds between firing cartridges. The pressure(s), velocity and action time shall be recorded. The breechblock/bolt shall be opened, then the fired case extracted and visually examined for case casualties. If any case defects are observed they shall be sentenced in accordance with the requirements of paragraph 12.9.2.

e. Subject to the equipment performing correctly and the results being within the tolerances specified in paragraph 12.5.1, the procedure prescribed in paragraphs 12.7.2 b to d shall then be repeated at a rhythmic uniform rate until the required number of test cartridges have been fired.

f. If spurious results indicate excessive fouling, the following steps shall be taken:

(1) Remove the signal line(s) from the transducer(s).

(2) Remove the transducer(s) and inspect all components for excessive combustion particle residue, being careful to distinguish between normal combustion residue and metallic particles removed from the bullet jacket. Also inspect the transducer threads for combustion residue.

(3) Clean the transducer(s) and the cavities thoroughly using lint-free industrial wipes and degreaser spray. Once cleaned, inspect the sealing surface(s) of the transducer(s) and the cavities for signs of gas flow past the annular sealing rings.

g. Upon completion of the above steps, the following procedure shall be followed to restart the test:

(1) Excessive residue and/or bullet jacket particle should be investigated by firing the NATO Reference Ammunition and one other qualified ammunition type to eliminate barrel problems as the cause. If the barrel is thought to be causing the problem, a replacement barrel shall be assembled into the test fixture and a retest shall be conducted to replace the previous cartridges to assure that the residue fouling did not influence the test data. If the combustion particle residue on the sealing surfaces of the EPVAT barrel or transducer/diaphragm is not excessive, then further more detailed investigation will need to be undertaken for example checking of transducer and charge amplifier output.

(2) If the transducer threads show signs of combustion residue, both the EPVAT barrel and transducer with sealing component shall be machine refinished to a surface finish of 32 micro inches or better before attempting to re-use the barrel. The test re-start procedure prescribed in the paragraphs above shall be followed.

(3) If the transducer seating(s) in the EPVAT barrel show signs of gas flow past the sealing point, the barrel shall be removed for refinishing of the cavity seat. Similar signs of gas flow through the sealing surface of a transducer and/or component shall cause that unit to be removed for refinishing of the cavity seat. The test restart shall begin with the replacement of the defective unit(s) using the procedure prescribed in the above paragraphs.

12.8 Recording of Results

Results are to be recorded as follows:

a. Results of both NATO Reference and test cartridges shall be recorded directly on the Form 12 (Annex 12-D).

b. The corrected instrumental velocity shall be combined with the average bullet mass obtained during the Bullet Extraction Test to calculate the corrected instrumental energy according to the formula:

$$\overline{E}_x = \frac{\overline{m}\overline{V}_x^2}{2}$$

where *x* represents the position at which the velocity is measured (muzzle/24 m or 16 m) and the energy is calculated (muzzle/24 m or 16 m), $\bar{V}$ represents the mean velocity at the position and $\bar{m}$ represents the mean mass of the bullets.

c. When calculating standard deviation, the formula to be used shall be:

$$s = \sqrt{\frac{\Sigma\left(x - \bar{x}\right)^2}{n - 1}}$$

where *x* is the individual value, $\bar{x}$ is the mean of the individual values and n is the number of individual values.

12.9 Sentencing – Qualification Approval and Production Tests

The ammunition shall be considered to have met NATO requirements for the applicable calibres if the requirements contained in the table below are satisfied.

Calibre	4.6 mm	5.56 mm	5.7 mm	7.62 mm	9 mm	9 mm	12.7 mm
Transducer	**6215/GP6**	**6215/GP6**	**6215/GP6**	**6215/GP6**	**6203**	**6215/GP6**	**6215/GP6**
Maximum Corrected Mean Case Mouth Pressure for +21 °C sample	400 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Maximum Corrected Mean Case Mouth Pressure + 3 SD for +21 °C sample	460 MPa	445 MPa	370 MPa	445 MPa	265 MPa	285 MPa	450 MPa
Maximum Mean Case Mouth Pressure Difference between +52 °C sample and +21 °C sample	+ 60 MPa to - 60 MPa	+ 55 MPa to - 110 MPa	+ 40 MPa to - 40 MPa	+ 55 MPa to - 110 MPa	+ 65 MPa to - 65 MPa	+ 65 MPa to - 65 MPa	No Require-ment
Maximum Mean Case Mouth Pressure Difference between -54 °C sample and +21 °C sample	+ 60 MPa to - 60 MPa	+ 55 MPa to - 110 MPa	+ 40 MPa to - 40 MPa	+ 55 MPa to - 110 MPa	+ 65 MPa to - 65 MPa	+ 65 MPa to - 65 MPa	No Require-ment
Maximum Corrected Mean Case Mouth Pressure for +52 °C sample	No Require-ment	455 MPa	No Require-ment	460 MPa	No Require-ment	No Require-ment	No Require-ment
Maximum Corrected Mean Case Mouth Pressure for -54 °C sample	No Require-ment	455 MPa	No Require-ment	460 MPa	No Require-ment	No Require-ment	No Require-ment
Maximum Corrected Mean Case Mouth Pressure + 3 SD for +52 °C sample	500 MPa	No Require-ment	370 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Maximum Corrected Mean Case Mouth Pressure + 3 SD for -54 °C sample	500 MPa	No Require-ment	370 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Maximum Corrected Individual Case Mouth Pressure for +52 °C sample	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	450 MPa
Maximum Corrected Individual Case Mouth Pressure for -54 °C sample	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	450 MPa

Calibre	4.6 mm	5.56 mm	5.7 mm	7.62 mm	9 mm	9 mm	12.7 mm
Transducer	6215/GP6	6215/GP6	6215/GP6	6215/GP6	6203	6215/GP6	6215/GP6
Minimum Corrected Mean Port Pressure – 3 SD for +21 °C sample	No Require-ment	103 MPa	No Require-ment	56 MPa	No Require-ment	No Require-ment	No Require-ment
Maximum Mean Port Pressure Difference between +52 °C sample and +21 °C sample	No Require-ment	+ 15 MPa to - 15 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Maximum Mean Port Pressure Difference between -54 °C sample and +21 °C sample	No Require-ment	+ 15 MPa to - 15 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Minimum Corrected Mean Port Pressure – 3 SD for +52 °C sample	No Require-ment	103 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Minimum Corrected Mean Port Pressure for -54 °C sample	No Require-ment	103 MPa	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment
Maximum Mean Velocity Difference between +52 °C sample and +21 °C sample	+ 50 m/s To - 50 m/s	+ 50 m/s To - 80 m/s	+ 30 m/s To - 30 m/s	+ 45 m/s to - 75 m/s	+ 30 m/s To - 30 m/s	+ 30 m/s To - 30 m/s	No Require-ment
Maximum Mean Velocity Difference between -54 °C sample and +21 °C sample	+ 50 m/s To - 50 m/s	+ 50 m/s To - 80 m/s	+ 30 m/s To - 30 m/s	+ 45 m/s to - 75 m/s	+ 30 m/s To - 30 m/s	+ 30 m/s To - 30 m/s	No Require-ment
Maximum Individual Action Time for +21 °C sample	No Require-ment	No Require-ment	No Require-ment	4 ms	3 ms	3 ms	No Require-ment
Maximum Mean Action Time + 5 SD for -54 °C sample	2 ms	3 ms	2 ms	No Require-ment	No Require-ment	No Require-ment	4.5 ms

Calibre	4.6 mm	5.56 mm	5.7 mm	7.62 mm	9 mm	9 mm	12.7 mm
Transducer	**6215/GP6**	**6215/GP6**	**6215/GP6**	**6215/GP6**	**6203**	**6215/GP6**	**6215/GP6**
Muzzle Energy for +21 °C sample	Min: 450J **Note: For Info Only**	Min:1564 J (Min:1480 J at 24 metres from the muzzle) **Note: For Info Only**	Min:430 J (Min:381 J at 24 metres from the muzzle) **Note: For Info Only**	Min:2931 J (Min:2756 J at 24 metres from the muzzle) **Note: For Info Only**	Min:542 J Max:814 J (Min:482 J Max:704 J at 16 metres from the muzzle)	Min:551 J Max:823 J (Min:491 J Max:713 J at 16 metres from the muzzle)	No Require-ment

12.9.1 Sentencing - Surveillance Test

The acceptance parameters for the Surveillance Test are contained in Volume 4.

12.9.2 Other Defects and Incidents - Sentencing

If any defects occur that are not related to this particular test, either during firing, or visually after firing, during any test or re-test they shall be categorised in accordance with Volume 11 and sentenced in accordance with the cumulative sentencing requirements of Volume 7.

12.10 Re-Test Procedures

Re-Test after Suspected Equipment Failure

If a barrel or equipment problem is suspected, a thorough investigation is to take place and any defective equipment repaired or replaced. The complete EPVAT test is to be re-fired using the original sample size if a defect was found in the equipment that could have affected the results of the test.

12.10.1 Re-Test of Ammunition Failure

If a re-test is necessary because of an ammunition failure, all the original results shall be discarded and a complete re-test of all temperature conditions shall be conducted using double sample sizes of the test ammunition. The firing sequence at paragraph 12.7.2 shall be followed and all sixty (60) cartridges of any particular temperature condition shall be fired in one sequence. The firing rate shall be slowed sufficiently to ensure the barrel does not overheat.

12.10.2 Re-Test Sentencing

Final sentencing shall be dependent on the results of the re-test alone.

ANNEX 12-A

PIEZOELECTRIC PRESSURE TRANSDUCER, ELECTRONIC INSTRUMENTATION REQUIREMENTS

12.A.1 Purpose

To ensure the reliability of reported pressure measurements, the Peak Pressure Measurement System and the Transducer Sensitivity Measurement System shall conform to the standard performance specifications as detailed in this Annex. In addition, only those transducer types which have been officially evaluated and accepted for NATO testing, as listed in this Annex, shall be considered for use.

12.A.2 Pressure Transducer

12.A.2.1 Performance Specifications

The ballistic piezoelectric pressure transducer is a fast response high pressure sensor capable of enduring in excess of 2,000 ballistic cycles in a production testing environment. The nominal specifications are as follows:

	6203	**6215**	**GP6**
Maximum Measuring Range	0 to 500 MPa	0 to 600 MPa	0 to 600 MPa
Resolution (threshold)	0.002 MPa	0.002 MPa	0.002 MPa
Maximum Pressure	550 MPa	660 MPa	640 MPa
Sensitivity	25 ± 5 pC/MPa	14 pC/MPa	30 pC/MPa
Resonant Frequency	170 kHz	240 kHz	240 kHz
Rise Time	2 μs	1 μs	1 μs
Linearity (% full scale)	≤ ± 1%	≤ ± 1%	≤ ± 0.5%
Insulation Resistance	15 x 10^{13} ohm	15 x 10^{13} ohm	≥10^{13} ohm
Temperature Coefficient	≤ ± 0.02 % / °C	≤ ± 0.02 % / °C	≤0.01 % / °C
Working Temperature Range	-50 to +200 °C	-50 to +200 °C	-50 to +200 °C
Maximum Acceleration (Shock)	50,000 m/s²	250,000 m/s² (axial) 100,000 m/s² (trans)	250,000 m/s² (axial) 100,000 m/s² (trans)
Capacitance	6 pF	8 pF	8 pF
Acceleration Sensitivity	≤ 51 x 10^{-6} MPa/m.s^{-2}	≤ 20 x 10^{-6} MPa/m.s^{-2} (axial) ≤ 51 x 10^{-6} MPa/m.s^{-2} (transverse)	≤ 20 x 10^{-6} MPa/m.s^{-2} (axial) ≤ 50 x 10^{-6} MPa/m.s^{-2} (transverse)

In addition, the temperature-induced output error shall be less than ± 1% of peak output at pressure levels between 35 MPa and 350 MPa, a flash temperature of 1,650 °C, and ballistic time of one millisecond.

12.A.2.2 Transducers, Installation, Storage and Related Equipment

a. Transducer Types: The High Pressure Quartz Transducer Assemblies qualified for NATO Case Mouth and Port Pressure Testing are:

Kistler Model 6203
Kistler Model 6215
HPI GP6

The pressure transducers are found in this volume (Annex 12-A), see Figures 12-A-1, 12-A-2 and 12-A-3, respectively.

b. Equipment Required for Barrel Preparation and Transducer Installation

1	Kistler End Finishing Tool type 1300A25 HPI End Finishing Tool type Z3108
2	Lint-free industrial paper wipes
3	Degreaser spray
4	Kistler Grease type 1063 (**Note: The use of other grease has been shown to cause erratic results.**) HPI Silicon Grease type YJ-0123
5	Torque wrench: 18 N·m capacity, 12 mm six-point deep socket for the Kistler 6203 transducer
6	Torque wrench: 26 N·m capacity, 8 mm six-point deep socket for the Kistler 6215 transducer and HPI GP6 transducer

c. Preparation for Transducer Installation: The following procedure shall be followed for all transducer installations, i.e. case mouth and port positions of the EPVAT barrel, sensitivity test block.

1	**Sealing surface preparation:** Shallow annular grooves in sealing surface are normal; any burring, combustion particle residue, corrosion or other anomaly shall be removed by touching up the surface with the Kistler End Finishing Tool 1300A25. This tool shall be used in accordance with the Kistler Operating instructions. By using HPI GP6 transducer with Finishing Tool Z3108. This tool shall be used in accordance with the HPI Operating instructions.
2	Clean cavity and transducer thoroughly; use clean, lint-free industrial paper wipes and degreaser spray.
3	Transducer threads shall be coated with a thin film of Kistler 1063 grease prior to installation. By using HPI GP6 the transducer threads shall be coated with a thin film of HPI Silicon Grease type YJ-0123.
4	The signal connector on the transducer and interconnecting line shall be wiped clean with lint-free industrial wipes and degreaser spray.

d. Installation of the Kistler 6203 Transducer: Installation shall proceed as follows:

IMPORTANT NOTE: Only a very small amount of **Kistler 1063 grease** is to be used, as indicated below, before assembling the transducers with their sealing rings and protective diaphragms. This grease is used to aid sealing and additionally adhesion of the sealing ring(s) and protective diaphragm to assist with intact removal of the transducer assembly from the mounting cavity. The volume within the protective diaphragm **MUST NOT** be filled with grease as it causes erratic pressure readings.	
1	A very small amount of Kistler 1063 grease shall be placed in the vee impression of the Protection Diaphragm, Model 6555A, to make the sealing ring adhere.
2	The sealing ring, model 1101B, shall be placed on the face of the Protection Diaphragm.
3	A very small amount of Kistler 1063 grease shall be placed in the vee impression on the shoulder and on the lower sidewalls of the Kistler Model 6203 Transducer to make the Protective Diaphragm seal to the Transducer and to assist in the removal of the Transducer and Protective Diaphragm assembly from the mounting cavity without the Protective Diaphragm becoming detached from the Transducer. A very small amount of Kistler 1063 grease shall be applied to the Transducer thread.
4	The Protection Diaphragm shall then be placed on the Transducer and the complete assembly inserted into the mounting cavity.
5	The transducer shall be tightened with a torque wrench to **15 N·m.** This shall apply to all installations of the **Kistler Model 6203** transducer.
6	The signal line shall be connected to the transducer and securely tightened, finger tight.
7	For calibration of the Kistler Model 6203 transducer, drawing A-1 specifies the requirements for modification of the Protection Diaphragm.

e. Installation of the Kistler Model 6215 Transducer: Installation shall proceed as follows:

IMPORTANT NOTE: Only a very small amount of **Kistler 1063 grease** is to be used as indicated below before assembling the transducers with their sealing rings and protective diaphragms. This grease is used to aid sealing and additionally adhesion of the sealing ring(s) and protective diaphragm to assist with intact removal of the transducer assembly from the mounting cavity. The volume within the protective diaphragm **MUST NOT** be filled with grease as it causes erratic pressure readings.	
1	A very small amount of Kistler 1063 grease shall be placed in the vee impression on the face of the Kistler Model 6215 Transducer to make the sealing ring adhere.
2	The sealing ring, model 1100, shall be placed on the face of the Transducer.
3	The Protection Diaphragm, model 6567, shall then be placed over the face of the transducer and snapped evenly into position over the face.
4	A very small amount of Kistler 1063 grease shall be placed in the vee impression on the face of the Protection Diaphragm to make the second sealing ring adhere.
5	A second model 1100 sealing ring shall then be placed in the vee impression on the face of the Protection Diaphragm and the complete assembly inserted into the mounting cavity. A very small amount of Kistler 1063 grease shall be applied to the Transducer thread.
6	The Transducer shall be tightened with a torque wrench to **20 Nm.** This shall apply to all installations of the **Kistler Model 6215** transducer.
7	The signal line shall be connected to the transducer and securely tightened, finger tight.
8	For calibration of the Kistler Model 6215 transducer only the first sealing ring is used. The Protection Diaphragm, model 6567 and the second sealing ring Type 1100, **shall not be used.**

f. Installation of the HPI Model GP6 Transducer: Installation shall proceed as follows:

IMPORTANT NOTE: Only a very small amount of **HPI Silicon Grease type YJ-0123** is to be used as indicated below before assembling the transducers with their sealing rings and protective diaphragms. This grease is used to aid sealing and additionally adhesion of the sealing ring(s) and protective diaphragm to assist with intact removal of the transducer assembly from the mounting cavity. The volume within the protective diaphragm **MUST NOT** be filled with grease as it causes erratic pressure readings.	
1	A very small amount of HPI Silicon Grease type YJ-0123 shall be placed in the vee impression on the face of the HPI Model GP6 Transducer to make the sealing ring adhere.
2	The sealing ring, model Z3321, shall be placed on the face of the Transducer.
3	The Protection Diaphragm, model Z3323, shall then be placed over the face of the transducer and snapped evenly into position over the face.
4	A very small amount of HPI Silicon Grease type YJ-0123 shall be placed in the vee impression on the face of the Protection Diaphragm to make the second sealing ring adhere.
5	A second model Z3321 sealing ring shall then be placed in the vee impression on the face of the Protection Diaphragm and the complete assembly inserted into the mounting cavity. A very small amount of HPI Silicon Grease type YJ-0123 shall be applied to the Transducer thread.
6	The Transducer shall be tightened with a torque wrench to **20 Nm.** This shall apply to all installations of the **HPI Model GP6** transducer.
7	The signal line shall be connected to the transducer and securely tightened, finger tight.
8	For calibration of the HPI Model GP6 transducer only the first sealing ring is used. The Protection Diaphragm, model Z3323 and the second sealing ring Type Z3321, **shall not be used.**

g. Transducer Storage. Transducers should be stored in a clean moisture-free environment. Transducers, mechanical filters, diaphragm protections and cables shall be kept free from contamination and possible damage when not in use.

12.A.3 Transducer Sensitivity Measurement System (TSMS)

The TSMS consists of a hydraulic pressure source and a transducer charge output recording system.

a. Hydraulic pressure source. The hydraulic pressure source determines the sensitivity of a pressure transducer by subjecting it to a precisely known pressure level. The unit should contain an electrically and/or manually operated pressure generator, an oil reservoir, a port into which the transducer can be mounted and a precision pressure reference standard.

The unit should also contain a pressure safety monitor which gives a visual indication of system pressure at all times. The essential system specifications shall be the following:

(1) Pressure Range:

Maximum:	500 MPa
Increments:	35 MPa, or less
Accuracy:	± 0.25% of reading or better

(2) Pressure Safety Monitor: A non-precision pressure gauge which monitors system pressure at all times.

b. Transducer charge output recording system. The system shall provide charge signal conditioning and amplification, scaling and continuous amplitude measurement in units of charge. A basic system shall contain a charge amplifier, a digital voltmeter and a standard charge calibrator. The following essential specifications are required:

(1) Charge amplifier minimum specifications:

Input impedance:	10^{14} ohms
Linearity (full scale):	± 0.1%
Frequency response: (within ±5%)	DC to 100 kHz
DC drift:	0.05 pC/s

(2) Digital voltmeter specifications:

Range (full scale):	± 1 V, ± 10 V
Full range display ± 1 V:	± 10,000
Over range:	100%
Accuracy:	
(a) Short term: (24 hours 23 ± 1°C)	± 0.1% of reading ± 0.1% of full scale
(b) Long term stability: (6 months, 23 ± 5°C)	± 0.002% of reading

Response time: (Full scale step function)	1 second to 0.01% of reading
Reading rate:	4 readings per second or better
Input resistance:	10 M ohms

(3) Charge calibration

Full scale charge ranges: (Pico coulombs)	10^3, 10^4, 10^5
Accuracy	± 0.5% error of reading from 0.1 Full scale to full scale

12.A.4 Peak Pressure Measurement System

The piezoelectric transducer peak pressure measurement system shall measure, record and display the peak amplitude of two simultaneously occurring transient signals. For each of two input channels, the system shall provide: transducer charge signal conditioning and amplification, scaling and peak amplitude measurement in units of pressure. Whatever the complexity of the system, it must meet the following minimal but essential specifications:

a. Charge amplifier minimum specifications

Input impedance:	10^{14} ohms
Linearity (full scale):	± 0.1%
Frequency response:	DC to 100 kHz
DC drift:	0.05 pC/s

b. 20 kHz, 22 kHz or 10 kHz Low Pass Butterworth type filter as appropriate. When matched to output impedance of charge amplifier (Item a.) and input of peak meter (Item c.), the low pass filter performs as a second order low-pass filter which attenuates a 12 dB/octave above the specified cut-off of 20 kHz or 10 kHz, ± 2%: overshoot for a square-wave input must be less than 5.0%.

c. It should be noted that only the **Butterworth type filter** is used for the NATO EPVAT Test at the ERTC and the NARTC.

d. Peak amplitude detector system. This system may vary from a relatively low cost, analogue peak detecting system with discreet numeric display or printout, to a computer-controlled, ballistic measurement and data processing system. The essential characteristics of this system shall be the following:

(1)	Accuracy:	± 1% of peak amplitude (2 microseconds rise time to full scale)
(2)	Frequency Response: (without low-pass filter)	DC to 100 kHz
(3)	Sampling rate for digital systems	Minimum 250,000 samples per second, 1 Mb recommended. The sampling rate is for each pressure channel.

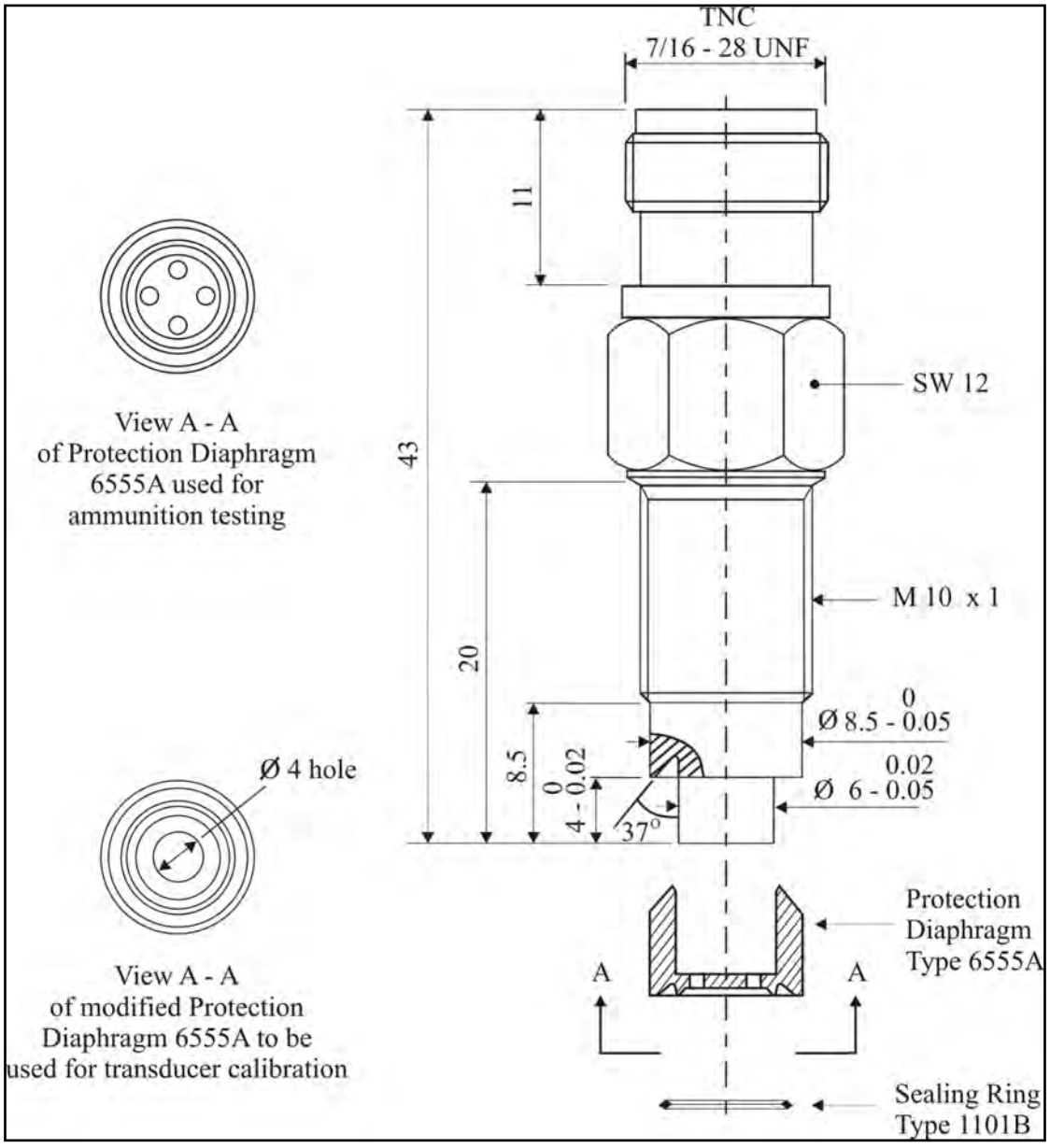


Figure. 12-A-1
Kistler Model 6203 High Pressure Quartz Transducer Assembly

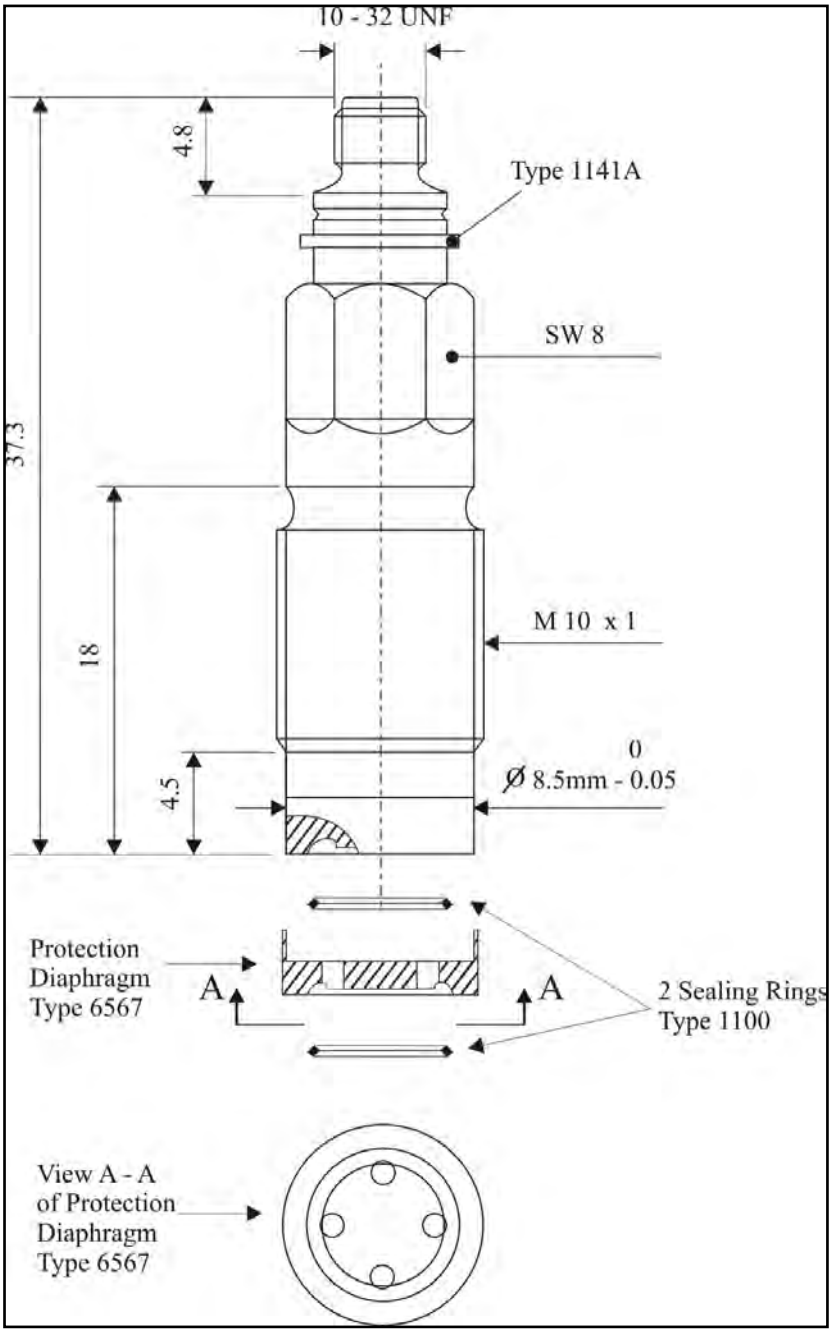


Figure. 12-A-2
Kistler Model 6215 High Pressure Quartz Transducer Assembly

Note: For calibrating in the hydraulic fluid the diaphragm protection, 6567, and the second sealing ring, 1100, shall not be used.

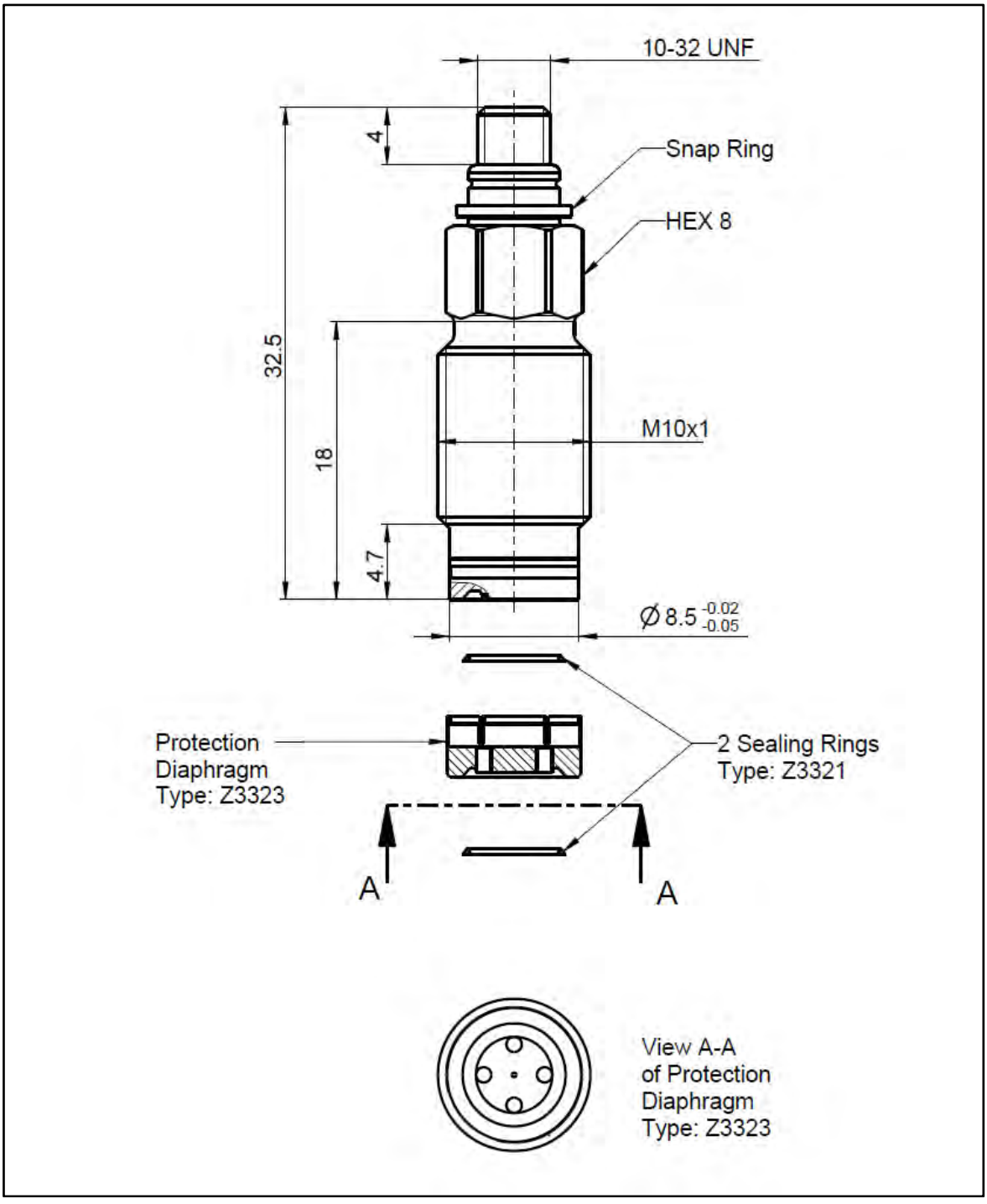


Figure. 12-A-3
HPI Model GP6 High Pressure Quartz Transducer Assembly

Note: For calibrating in the hydraulic fluid the diaphragm protection, Z3323, and the second sealing ring, Z3321, shall not be used.

ANNEX 12-B

PIEZOELECTRIC PRESSURE TRANSDUCER, ELECTRONIC INSTRUMENTATION CALIBRATION PROCEDURES

12.B.1 Purpose

The calibration of a transducer's sensitivity is required to establish the precise value of the pressure input to electrical output transformation. Once the sensitivity is determined, the electronic instrumentation can be calibrated and the output scaled to actual physical units of pressure.

12.B.2 Pressure Transducer

12.B.2.1 Calibration of Test Equipment

The hydraulic pressure source, charge calibrator and digital voltmeter shall have been calibrated with standards traceable to national standards. The recommended calibration interval is 6 months to 1 year.

12.B.2.2 Determination of Transducer Linearity

Transducer linearity shall be determined as follows:

a. The transducer shall be installed into the hydraulic pressure port according to the appropriate procedure specified in Annex 12-A.

b. The electronic instrumentation shall be adjusted so that when the system is in the "groundstate", zero charge is indicated by the recording device. Similarly, the electronic instrumentation shall be adjusted so that when a full-scale known charge is applied to the input, in place of the transducer, the digital voltmeter shall indicate the electrical equivalent of the known charge. The signal cable shall be connected from the transducer to the electronic instrumentation.

c. Zero MPa of hydraulic pressure shall be applied to the transducer and the transducer input momentarily electronically zeroed. The indicated reading from the digital voltmeter shall be zero units of charge. This reading shall remain stable to within ± 2 Pico coulombs for the duration of time it normally requires to reach the hydraulic pressure levels in paragraph 12.B.2.2.d.

d. The transducer shall be hydraulically pressurised up to 410 MPa and returned to zero MPa before applying the following pressure levels for record:

Low Range	**High Range**
(1) 35 MPa	(5) 210 MPa
(2) 75 MPa	(6) 250 MPa
(3) 105 MPa	(7) 280 MPa
(4) 140 MPa	(8) 350 MPa
	(9) 410 MPa

Each pressure level shall be applied three times either by applying increasing pressure levels in steps 1 to 9 above each time or by applying one pressure level at a time and returning to zero pressure before repeating. Electronic system drift and stability shall dictate which method should be used.

e. As each pressure level is reached, the charge reading observed on the digital voltmeter shall be noted* as the transducer charge output for that pressure level.

* Use a continuous readout mode during this phase since the peak reading mode is insensitive to decreasing the pressure (i.e., fluid leakage, correction for over pressurization, etc.). The long-time constant mode of the Charge Amplifier should also be used.

Note: A quick release pressure method may be used, in which case the transducer input should be momentarily grounded as each pressure level is reached. The indicated charge output shall then be recorded as the pressure drops from the calibration level to zero.

f. Record the charge readings obtained above. Using the mean of the three readings at each pressure level, the transducer linearity shall be determined by the full-scale error band method used in conjunction with the zero-based best straight line. The following is a description of this method:

(1) Plot the mean charge for each pressure level as shown in Figure 12-B-1.

(2) Consider the data points as two groups - High Pressure Group and Low Pressure Group.

(3) Fit a straight line, intercepting the origin (0.0), to the data points by equalising the error between the points below the line and the points above the line. Two separate lines shall be fitted, one each to the two data groups.

(4) A set of ± 1% Full Scale Error Bands, as shown in Figure 12-B-1, shall be constructed about the fitted line for each data group. The transducer shall have acceptable linearity if all data points in both groups fall within their respective error bands. If one or more points in either group falls outside its error band, the transducer shall have unacceptable linearity.

12.B.2.3 Determination of Transducer Sensitivity

The following steps shall be taken prior to the EPVAT test and on test completion. No more than 300 cartridges shall be fired before re-determining the sensitivity constant.

a. The procedure described in paragraphs 12.B.2.2 through 12.B.2.2.c shall be followed. The procedure of Volume 12.B.2.2.d shall also be followed with the exception that only the pressure level for which the transducer will be used need be applied.

b. Record the charge readings and their means for each new cartridge interval. Be sure to record the total number of cartridges fired on the transducer.

c. The sensitivity to be used for ballistic testing shall be computed by dividing the mean charge by the respective pressure level at which the charge was obtained.

12.B.2.4 Recommended Procedures for Ensuring Calibration Commonality for Transducers, Transducer Sensitivity Measurement System and Peak Pressure Measurement System

Refer to Figure 12-B-3. All instrumentation systems used for measuring the output of piezo-electric pressure transducers should be checked for electrical calibration each day, and each time the electrical range is changed. This is done by inserting a known voltage into a known capacitor, which produces a known electrical charge. This known charge corresponds to a known pressure level. For computer controlled, digital instrumentation, one checks to see that the correct pressure level is indicated when a known charge is inserted. For manually controlled, analogue instrumentation, the gain is adjusted until the desired signal level is indicated. For example, suppose a transducer with a sensitivity of 26 pC/MPa is to be used or calibrated at a pressure level of 350 MPa:

Q(ref) = Transducer sensitivity x Calibration Pressure

Q(ref) = 26 pC/MPa x 350 MPa

Q(ref) = 9,100 pC.

The precise value of Q(ref) is generated using a calibrated capacitor and by measuring V(ref) directly on the STANDARD DIGITAL VOLTMETER (5)**,

i.e. C(ref) = 1005 pF
Q(ref) = 9100 pC

And

$$V(ref) = \frac{Q(ref)}{C(ref)} \text{ Volt}$$

Hence

$$V(REF) = \frac{9100\ Pc}{1005pF} = 9.055\ Volts$$

For direct readings of pressure in a computer controlled, digital system, 9.055 volts is inserted into the calibration capacitor, which is connected to the CHARGE AMPLIFIER (4). The output of the system must indicate a pressure of 350 MPa to within ± 0.5%, meaning that the output must fall between 348.3 MPa and 351.8 MPa. For a manually adjustable, analogue system, the output signal must be adjusted to a convenient level, such as 100 MPa/volt, hence the output for this example would be adjusted to 3.5 volts ± 0.5%, which means that the output must fall between 3.483 volts and 3.518 volts.

For transducer calibration, direct readings of charge are desired. Using the values of the example above, 9.055 volts would be inserted into the calibration capacitor, which when connected to the CHARGE AMPLIFIER (4), must indicate 9100 pC to within ± 0.5%, hence the output must be between 9055 pC and 9146 pC. On a manually adjustable analogue system, the output would be adjusted to 1000 pC/Volt, meaning that the display must read between 9.055 volts and 9.146 volts.

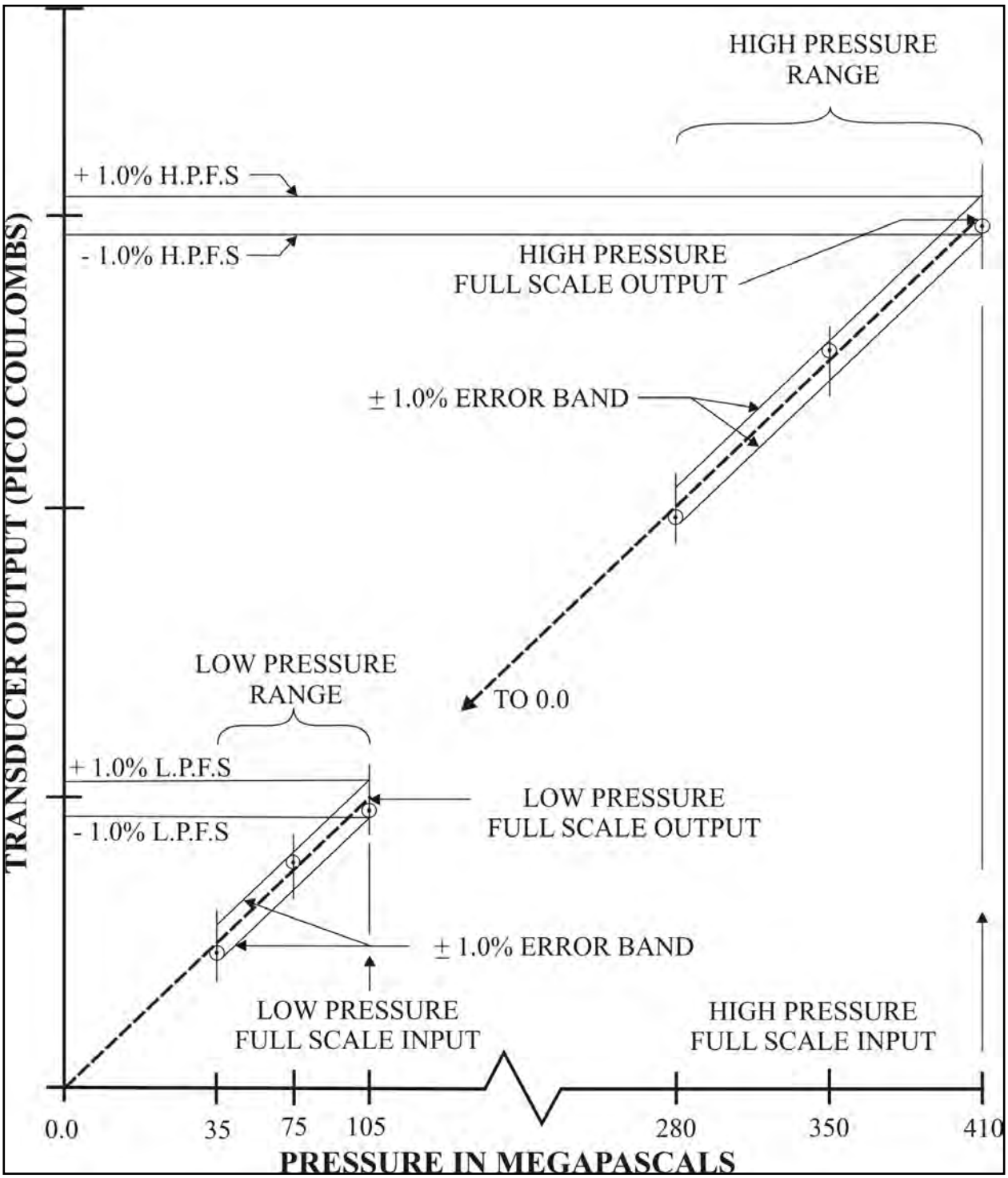


Figure. 12-B-1
Linearity Determination

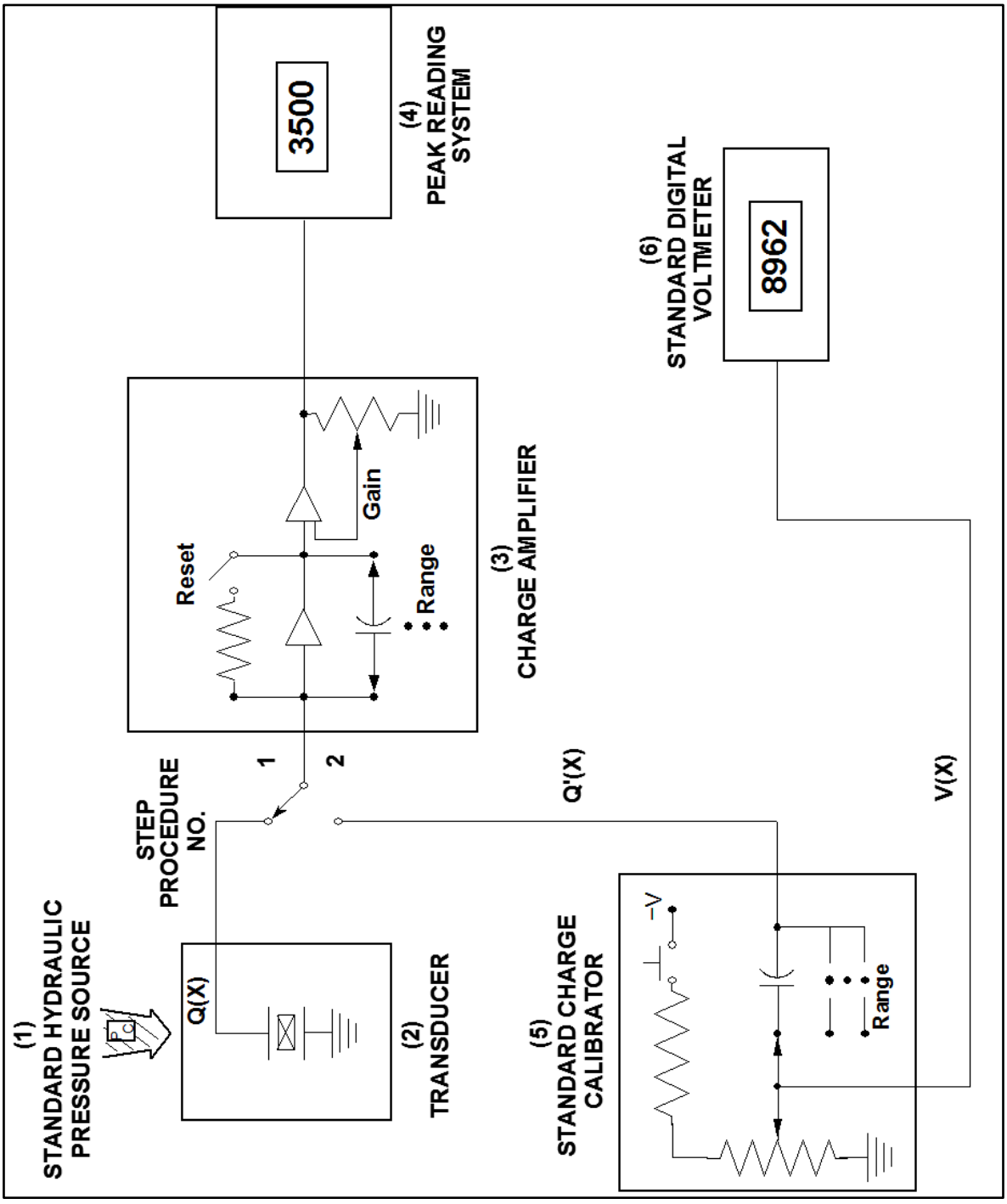


Figure. 12-B-2
Calibration Method A

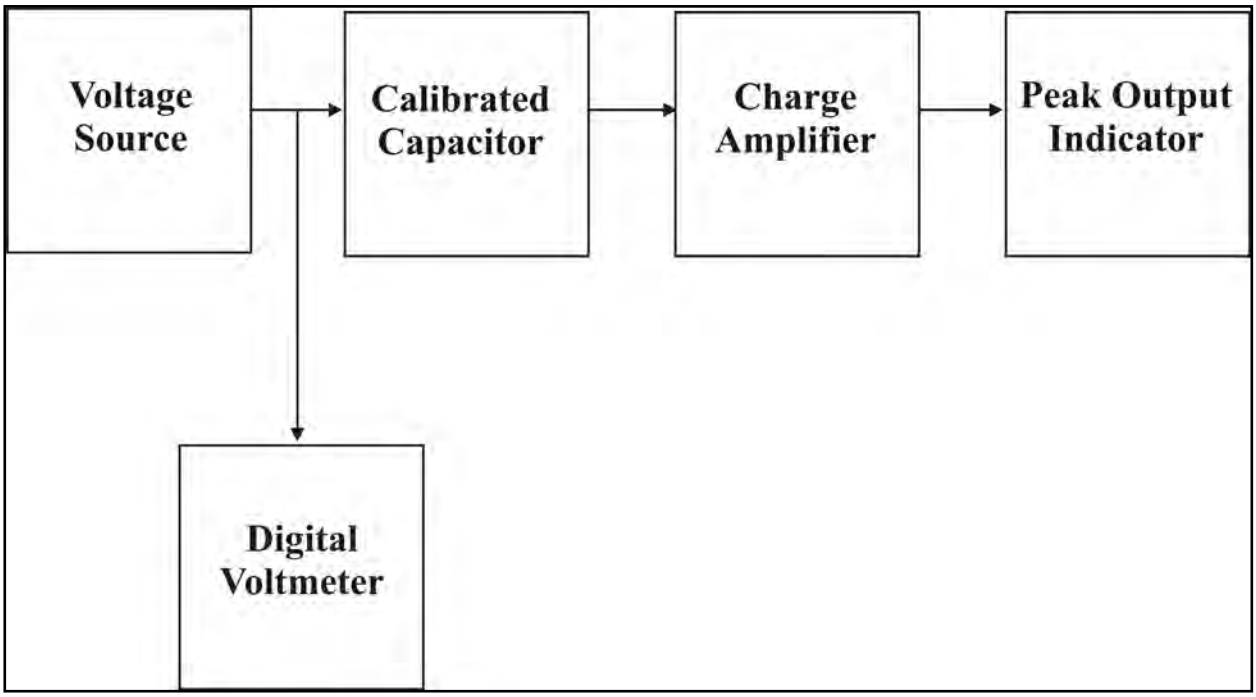


Figure. 12-B-3
Calibration of Electrical Equipment

ANNEX 12-C
COMBINATION ELECTRONIC PRESSURE, VELOCITY AND ACTION TIME (EPVAT) TEST RANGE SET-UPS

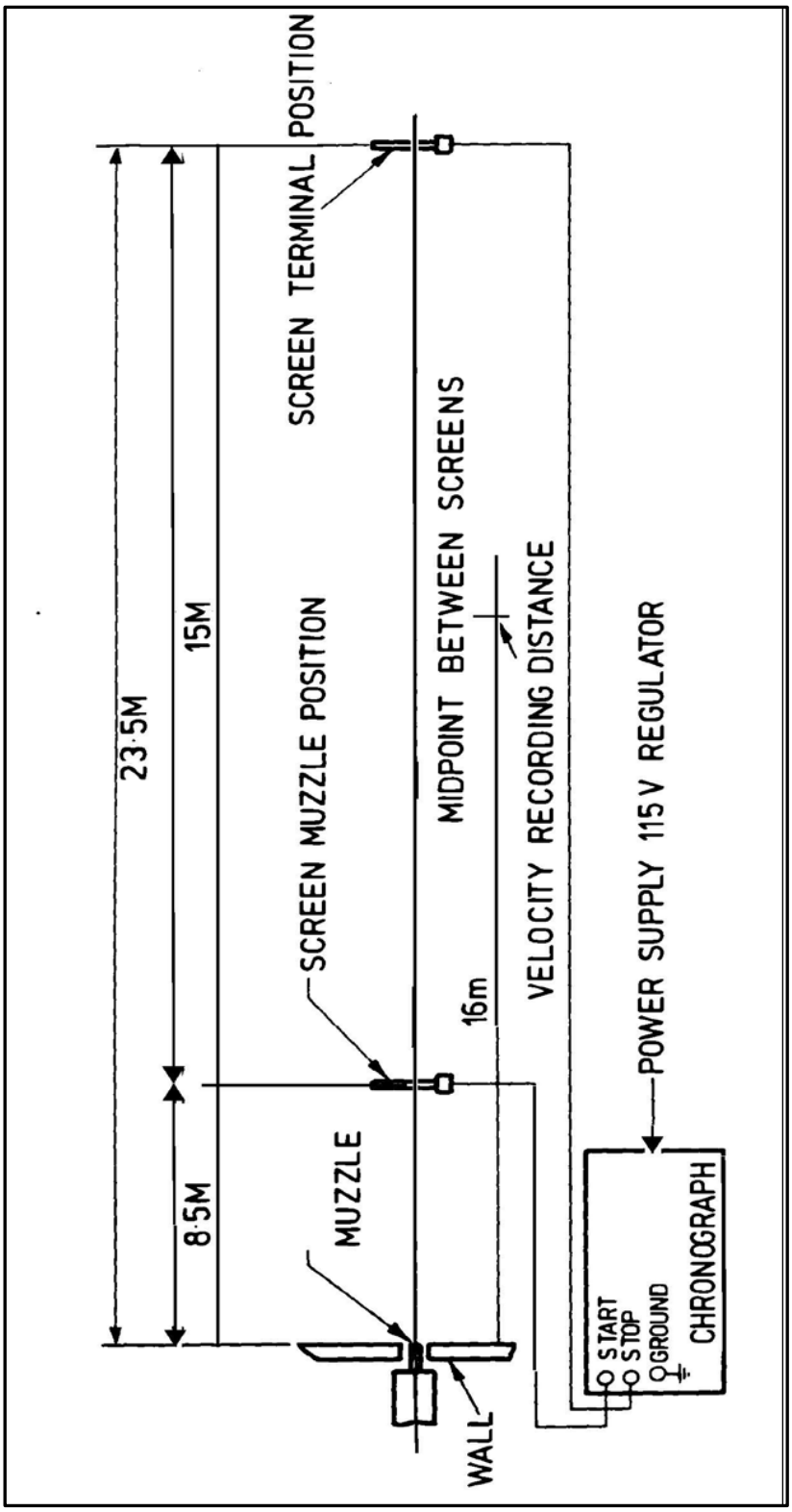


Figure. 12-C-1
16 METER INSTRUMENTAL VELOCITY TEST RANGE SET-UP

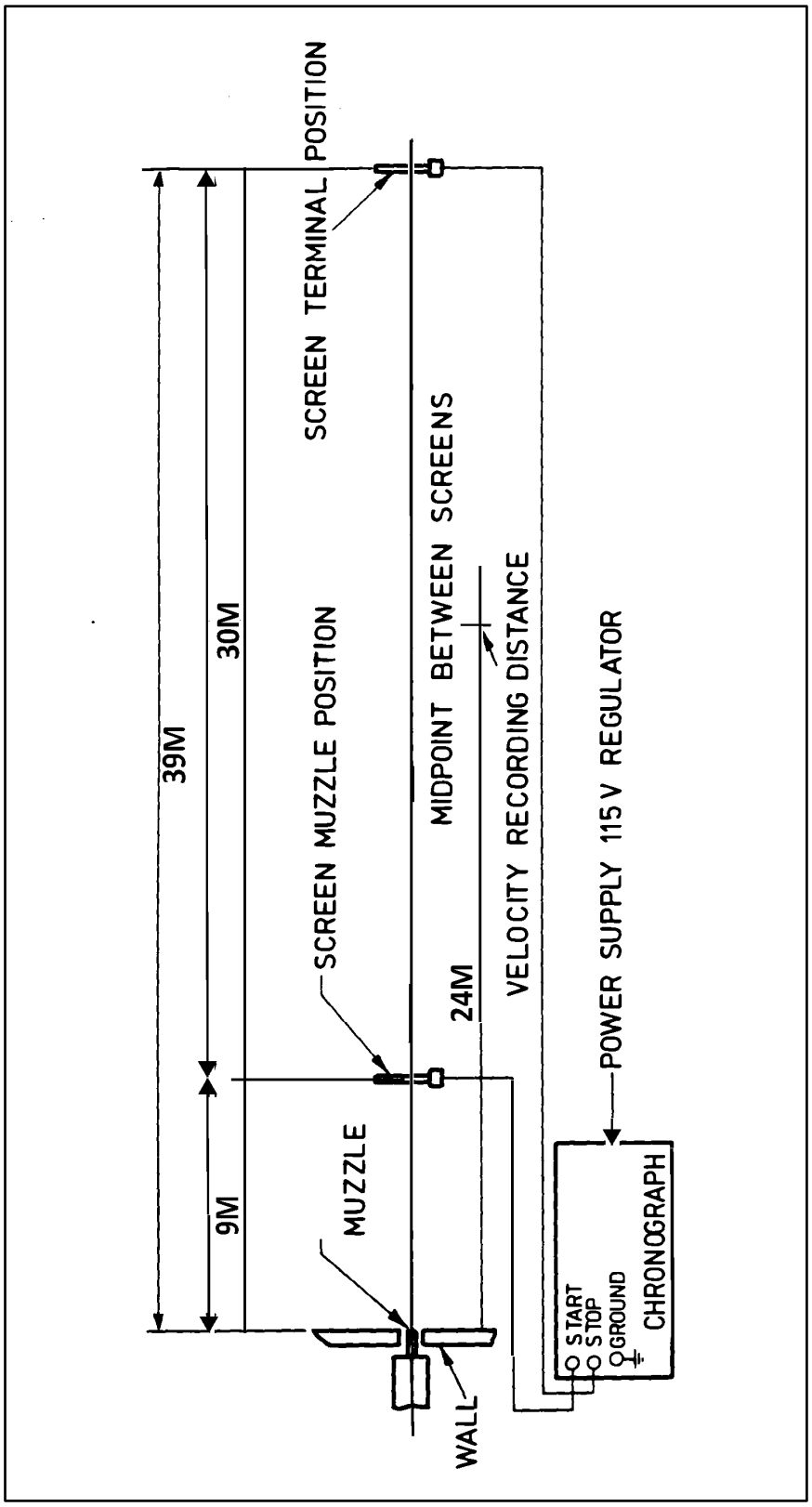
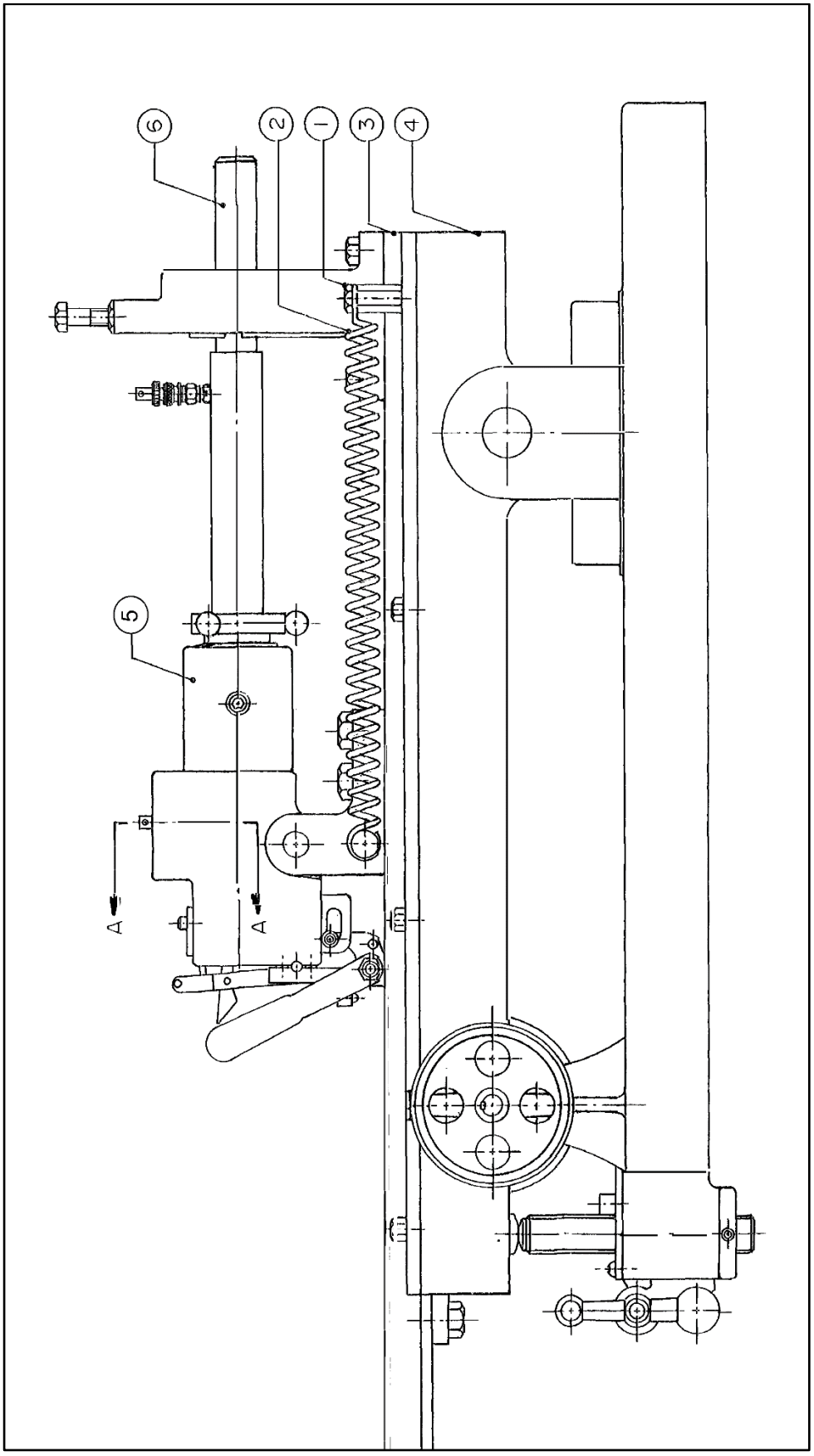


Figure. 12-C-2
24 METER INSTRUMENTAL VELOCITY TEST RANGE SET-UP



1 – SUPPORT, SPRING
2 – SPRING, RECOIL
3 – SLIDE, RECOIL
4 – BASE, ADJUSTABLE
5 – RECEIVER, UNIVERSAL
6 – BARREL, TEST

Figure. 12-C-3
EPVAT TEST FIXTURE

ANNEX 12-D

FORM NUMBER 12 - COMBINATION ELECTRONIC PRESSURE, VELOCITY AND ACTION TIME (EPVAT)

Per paragraph 12.8, Form Number 12 for recording of results for both NATO Reference and the test cartridges for the Combination Electronic Pressure, Velocity And Action Time (EPVAT) Testing is presented on the next four (4) pages found in Annex 12-D (pages 12-G-2, 12-D-3, 12-D-4 & 12-D-4).

12.D.1 FORM 12: COMBINATION ELECTRONIC PRESSURE, VELOCITY AND ACTION TIME (EPVAT) (PAGE 1 OF 4)

Form Number 12	Page 1 of 4	ELECTRONIC PRESSURE, VELOCITY AND ACTION TIME (EPVAT) +21°C

Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Individual Shot Data		30	Cartridges Fired @+21°C	
Cartridge No.	Chamber Pressure	Port Pressure	Velocity	Action Time
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

UNITS: (Pressure - MPa), (Velocity - m/s), (Time - ms)

Weapon Details			
Receiver Number		Life	
Barrel Number		Life	
Head Space		mm	
Pin Protrusion		mm	
Firing Pin Indent		mm	

Transducer Details		
	Chamber	Port
Type		
Serial Number		
Times Fired		
Sensitivity		
Low Pass Filter kHz		

Test Statistics		
Velocity (m/s)		
Mean		
Correction		
Corrected Mean		
SD		
Extreme Spread		
Highest Corr. Value		
Lowest Corr. Value		
Pressure (MPa)	**Chamber**	**Port**
Mean		
Correction		
Corrected Mean		
SD		
Extreme Spread		
Highest Corr. Value		
Lowest Corr. Value		

Current Assessed Values from NATO Reference Lot:			
Lot #:			
Velocity @	m		
Chamber Pressure			
Port Pressure			
Expected Action Time			

Action Time (ms)	
Mean	
SD	
Extreme Spread	
Highest Value	
Lowest Value	

Remarks

12.D.2 PAGE 2 - FORM 12 - COMBINATION ELECTRONIC PRESSURE, VELOCITY AND ACTION TIME (EPVAT)

Form Number 12	Page 2 of 4	ELECTRONIC PRESSURE, VELOCITY AND ACTION TIME (EPVAT) +21°C

Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Individual Shot Data		30	Cartridges Fired @+21°C	
Cartridge No.	Chamber Pressure	Port Pressure	Velocity	Action Time
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

UNITS: (Pressure - MPa), (Velocity - m/s), (Time - ms)

Current Assessed Values from NATO Reference Lot:

Lot #:		
Velocity @	m	
Chamber Pressure		
Port Pressure		
Expected Action Time		

Muzzle Energy (Joules) *

Bullet Mass (grams)		
Energy @	m	

**For information only except for 9mm*

Weapon Details			
Receiver Number		Life	
Barrel Number		Life	
Head Space		mm	
Pin Protrusion		mm	
Firing Pin Indent		mm	

Transducer Details	Chamber	Port
Type		
Serial Number		
Times Fired		
Sensitivity		
Low Pass Filter kHz		

Test Statistics		
Velocity (m/s)		
Mean		
Correction		
Corrected Mean		
SD		
Extreme Spread		
Highest Corr. Value		
Lowest Corr. Value		
Pressure (MPa)	**Chamber**	**Port**
Mean		
Correction		
Corrected Mean		
SD		
Extreme Spread		
Highest Corr. Value		
Lowest Corr. Value		
Corr. Mean +3SD's		
Corr. Mean -3SD's		
Action Time (ms)		
Mean		
SD		
Extreme Spread		
Highest Value		
Lowest Value		

Remarks

12.D.3 PAGE 3 - FORM 12 - COMBINATION ELECTRONIC PRESSURE, VELOCITY AND ACTION TIME (EPVAT)

Form Number 12	Page 3 of 4	ELECTRONIC PRESSURE, VELOCITY AND ACTION TIME (EPVAT) +52°C			
Test Centre			Test Reference		
Submitting Nation			Lot Number		
Manufacturer			Cartridge Type		
Date Fired			NATO Design No.		

Individual Shot Data		30	Cartridges Fired @+52°C	
Cartridge No.	Chamber Pressure	Port Pressure	Velocity	Action Time
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

UNITS: (Pressure - MPa), (Velocity - m/s), (Time - ms)

Current Assessed Values from NATO Reference Lot:

Lot #:		
Velocity @	m	
Chamber Pressure		
Port Pressure		
Expected Action Time		

Weapon Details			
Receiver Number		Life	
Barrel Number		Life	
Head Space		mm	
Pin Protrusion		mm	
Firing Pin Indent		mm	

Transducer Details	Chamber	Port
Type		
Serial Number		
Times Fired		
Sensitivity		
Low Pass Filter kHz		

Test Statistics		
Velocity (m/s)		
Mean		
Correction		
Corrected Mean		
SD		
Extreme Spread		
Highest Corr. Value		
Lowest Corr. Value		
Delta From +21°C		
Pressure (MPa)	**Chamber**	**Port**
Mean		
Correction		
Corrected Mean		
SD		
Extreme Spread		
Highest Corr. Value		
Lowest Corr. Value		
Corr. Mean -3SD's		
Delta From +21°C		
Action Time (ms)		
Mean		
SD		
Extreme Spread		
Highest Value		
Lowest Value		

Remarks

12.D.4 PAGE 4 - FORM 12 - COMBINATION ELECTRONIC PRESSURE, VELOCITY AND ACTION TIME (EPVAT)

Form Number 12	Page 4 of 4	ELECTRONIC PRESSURE, VELOCITY AND ACTION TIME (EPVAT) -54°C
Test Centre		
Submitting Nation		
Manufacturer		
Date Fired		

Test Reference	
Lot Number	
Cartridge Type	
NATO Design No.	

Individual Shot Data		30	Cartridges Fired @-54°C	
Cartridge No.	Chamber Pressure	Port Pressure	Velocity	Action Time
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

UNITS: (Pressure - MPa), (Velocity - m/s), (Time - ms)

Weapon Details			
Receiver Number		Life	
Barrel Number		Life	
Head Space		mm	
Pin Protrusion		mm	
Firing Pin Indent		mm	

Transducer Details	Chamber	Port
Type		
Serial Number		
Times Fired		
Sensitivity		
Low Pass Filter kHz		

Test Statistics		
Velocity (m/s)		
Mean		
Correction		
Corrected Mean		
SD		
Extreme Spread		
Highest Corr. Value		
Lowest Corr. Value		
Delta From +21°C		
Pressure (MPa)	**Chamber**	**Port**
Mean		
Correction		
Corrected Mean		
SD		
Extreme Spread		
Highest Corr. Value		
Lowest Corr. Value		
Delta From +21°C		

Action Time (ms)	
Mean	
SD	
Extreme Spread	
Highest Value	
Lowest Value	
Mean + 5SD's	

Current Assessed Values from NATO Reference Lot:

Lot #:		
Velocity @	m	
Chamber Pressure		
Port Pressure		
Expected Action Time		

Remarks

ANNEX 12-E

NATO M2 UNIVERSAL RECEIVER DRAWINGS

The following pages of Annex 12-E provide the drawings for the NATO M2 Universal Receiver for test barrels for 5.56mm, 7.62mm, 9mm and 12.7mm, approved for use by AC/225 (LCGDSS-SG/1) published previously as AC/225 (LG/3-SG/1)D/21 dated 9 March 1998. The drawings in Annex 12-E will be utilized for all calibres associated with AEP-97, including 4.6mm and 5.7mm.

Appendix 1 details the NATO M2 Universal Receiver assembly drawing (8649490) and its associated component drawings. These drawings are common to the calibres specified in AEP-97 as mentioned above.

Appendix 2 displays the Breechblock Assembly drawing (8596714) and its associated component drawings. Most of these components are common to the calibres specified in AEP-97. This appendix also provides the firing pin protrusion gage (10533828) and reiterates the headspace, firing pin protrusion, and firing pin indent measurements stated in paragraph 12.6.2 regarding EPVAT Barrel Assembly in tables form along with the associated drawings.

Appendix 3 provides the two velocity and pressure recoil slides for the M2 Universal Receiver (one for 4.6mm, 5.56mm, 5.7mm, 7.62mm and 9mm and the other for 12.7mm).

ANNEX 12-E - APPENDIX 1

NATO M2 UNIVERSAL RECEIVER DRAWINGS

NATO M2 Universal Receiver Assembly	8649490
Plate	10534341
Retainer	8649492
Housing	8649491
Receptacle	8596994
Breechblock Assembly	8596714
Shaft, Operating Lever	6173237
Lever, Trip	6173236
Bracket	6173235
Stud, Stop Screw	5185184
Bumper, Trip Lever	5185183
Arm, Breechblock	5185182
Lever, Operating	5185181
Pin, Operating Lever Shaft	5185179
Key, Bracket Alignment	5185178
Screw, Stop	5185177
Roller, Arm	5185176
Stud, Trip Lever	5185175
Pin, Breechblock Arm	5185169
Lever, Trip Arm	5185161
Spring, Trip Lever	5185032
Plunger, Trip Lever	5185031

DRAWING SIZE F (ARDEC TR-12)

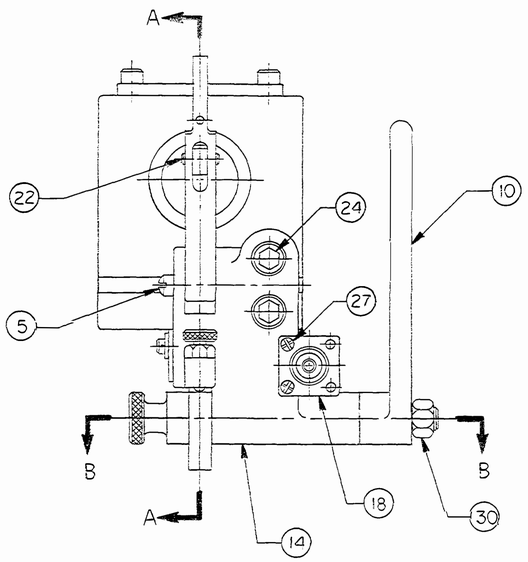
NOTES:-

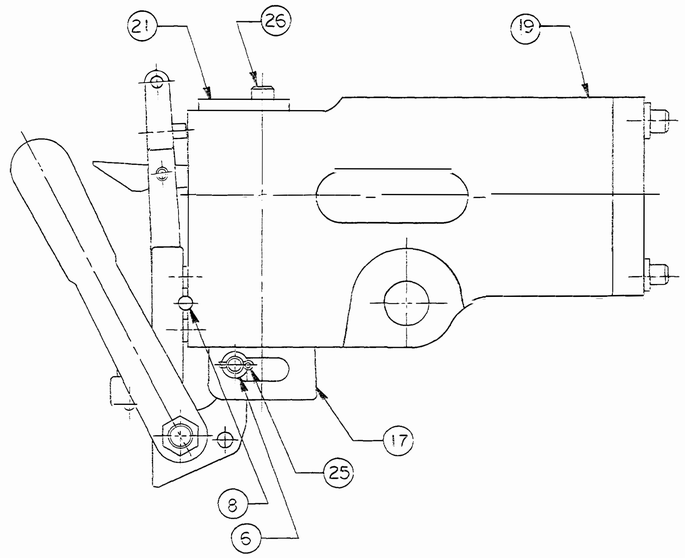
1-HEADSPACE:-
DIMENSION APPLIES TO FACE OF FIRING PIN PLATE.
USE SHIMS TO OBTAIN THIS DIMENSION.

2-FIRING PIN PROTRUSION:-
.030 +.009 -5.56 MM
.060 +.008 -7.62 MM, 9MM, CAL .30, CAL .38 & CAL .45
.074 +.008 -CAL .50

3-FIRING PIN COPPER CYLINDER INDENT:-
.011 +.004 -9MM, CAL .30 CBN, CAL .38 & CAL .45
.020 +.005 -5.56 MM, 7.62 MM, CAL .30 & CAL .50

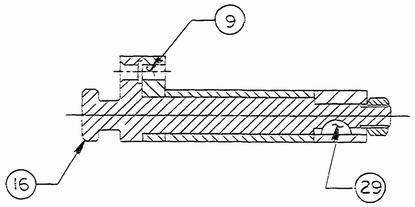
REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
-	PRODUCT BASELINE FRR M7Q2084	870720	
A	NOR R17Q2026/171212	171221	BAC



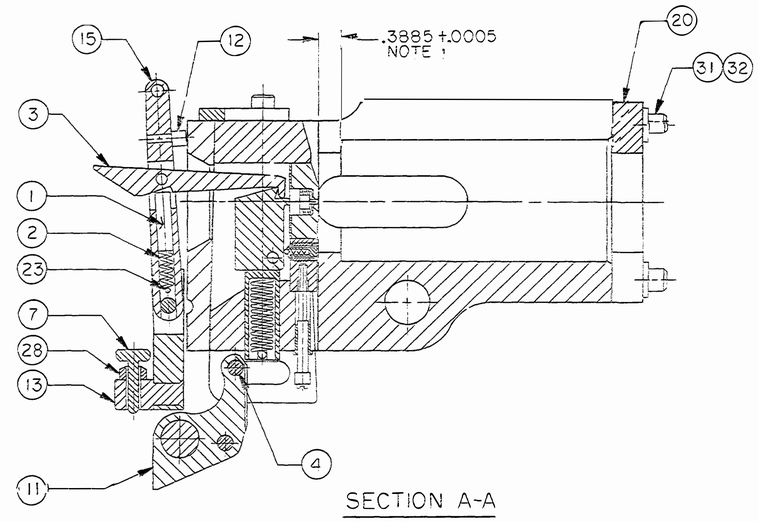


ITEM NO.	NOMENCLATURE OR DESCRIPTION	PART OR IDENT NO.	QTY REQD
32	SCREW, CAP, SOC HD 3/8-24UNF-2A X 1 1/4 LG		4
31	WASHER, LOCK, SPLIT, Ø3/8		4
30	NUT, SELF-LOCKING HEXAGON, 3/8-24UNF-2B		1
29	KEY, WOODRUFF, NO.3 .125 +.001 X Ø 1/2		1
28	NUT, PLAIN, HEXAGON JAM, 1/4-28UNF-2B		1
27	SCREW, MACH, PAN HEAD #6(.138)-32UNC-2AX1/4 LG		2
26	SCREW, CAP, SOC HD, 1/4-20 UNC-2A X 5/8 LG		2
25	PIN, COTTER, Ø.060-.004 X 1/2 LG		2
24	SCREW, CAP, SOC HD, 3/8-24UNF-2A X 5/8 LG		2
23	PIN, STRAIGHT, HEADLESS Ø.0636-.0002 X 1/2 LG		1
22	PIN, STRAIGHT, HEADLESS Ø.1878-.0002 X 5/8 LG		1
21	PLATE	B10534341	1
20	RETAINER	C8649492	1
19	HOUSING	F8649491	1
18	RECEPTACLE	A8596994	1
17	BREECHBLOCK ASSY	C8596714	1
16	SHAFT, OPERATING LEVER	B6173237	1
15	LEVER, TRIP	B6173236	1
14	BRACKET	C6173235	1
13	STUD, STOP SCREW	B5185184	1
12	BUMPER, TRIP LEVER	A5185183	1
11	ARM, BREECHBLOCK	B5185182	1
10	LEVER, OPERATING	B5185181	1
9	PIN, OPERATING LEVER SHAFT	A5185179	1
8	KEY, BRACKET ALIGNMENT	A5185178	1
7	SCREW, STOP	A5185177	1
6	ROLLER, ARM	A5185176	2
5	STUD, TRIP LEVER	A5185175	1
4	PIN, BREECHBLOCK ARM	A5185169	1
3	LEVER, TRIP ARM	B5185161	1
2	SPRING, TRIP LEVER	A5185032	1
1	PLUNGER, TRIP LEVER	A5185031	1

LIST OF PARTS



SECTION B-B



SECTION A-A

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

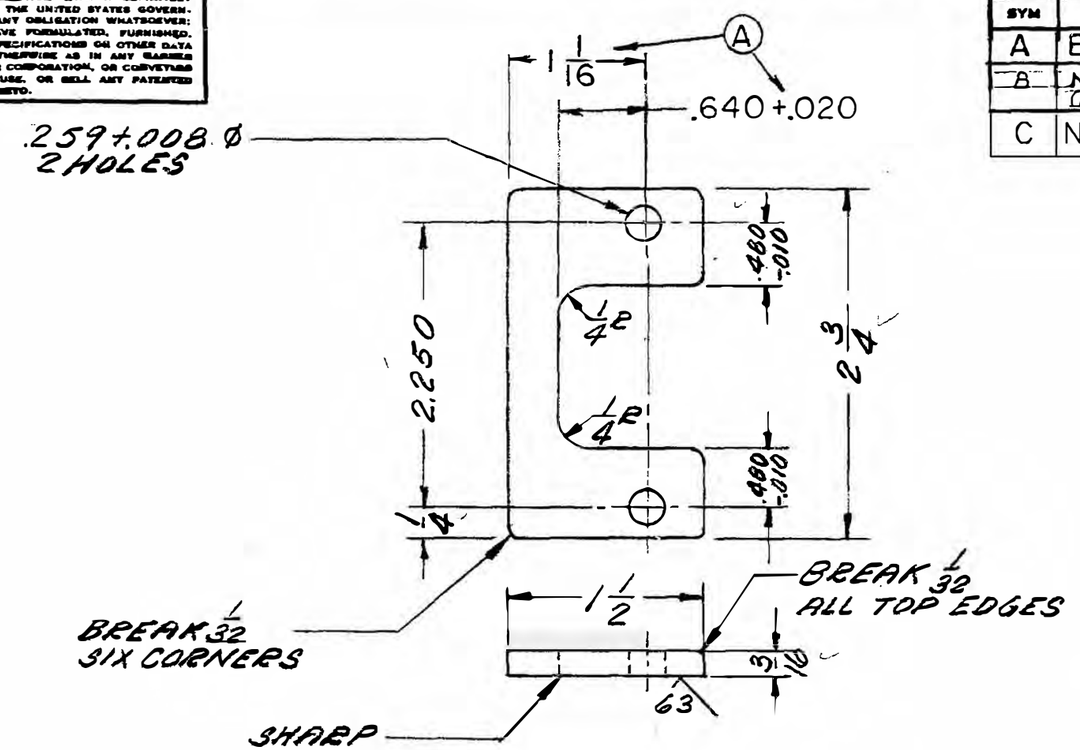
NEXT ASSY	USED ON	MECHANICAL PROPERTIES: YP, TS, EL2, RA, BH, RM	DO NOT SCALE DRAWING. UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS ± FRACTIONS ± ANGLES ± THIRD ANGLE PROJECTION	ORIGINAL DATE OF DRAWING 86-04-04	PART NO. 8649490
APPLICATION				DRAFTSMAN / CHECKER / ENGR / ENGR / ENGR / ENGR	U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT CENTER DOVER, NEW JERSEY 07801-5001
					RECEIVER, UNIVERSAL, M2E1, ASSEMBLY
					SIZE F; CAGE CODE 19200; 8649490
					SCALE 1/1; UNIT WT; SHEET

SMCAR FORM 69, 1 FEB 85, REPLACES ARRADCOM FORM 79, AUG 77

OO Form 1176-1
1 Oct 56

B10534341

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	E O NO ST 5015	6-18-65	
B	NOR A0S0009, 80-12-09 (ECP A0S0010 80-12-09)	820312	
C	NOR R17S2036/171126	171214	BAC



NOTES:-
1- SPEC ANSI Y14.5 & ASME B46.1 APPLY.
2- 250 ALL OVER EXCEPT AS NOTED

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

U S ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

CODE IDENT NO. 19200
PART NO. 10534341

		PHYSICAL PROPERTIES	
		YP	
		TS	
		EL 2	
SEE ENGINEERING RECORDS		RA	
NEXT ASSY	USED ON	BH	
APPLICATION		RH	C50 C55
DO NOT	APPLY PART NO		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ± 1/64 DECIMALS ±.01 ANGLES —
MATERIAL STEEL C1095
ANSI/ASTM A108
HEAT TREATMENT —
FINAL PROTECTIVE FINISH
COATING BLACK OXIDE
SPEC. MIL-C-13924

ORIGINAL DATE OF DRAWING 30 SEPT. 1964
DRAFTSMAN H.N.B. CHECKED BC
TRACED H.N.B. CHECKED
ENGR ENGR
SUBMITTED Heaney ENGR ORD CORPS
APPROVED BY ORDER OF THE CHIEF OF ORDNANCE L. N. Ormsby ORD CORPS

PLATE

SCALE 1-1 UNIT WT

~~PROCUREMENT AND PRODUCTION DIRECTORATE U S ARMY FRANKFORD ARSENAL~~

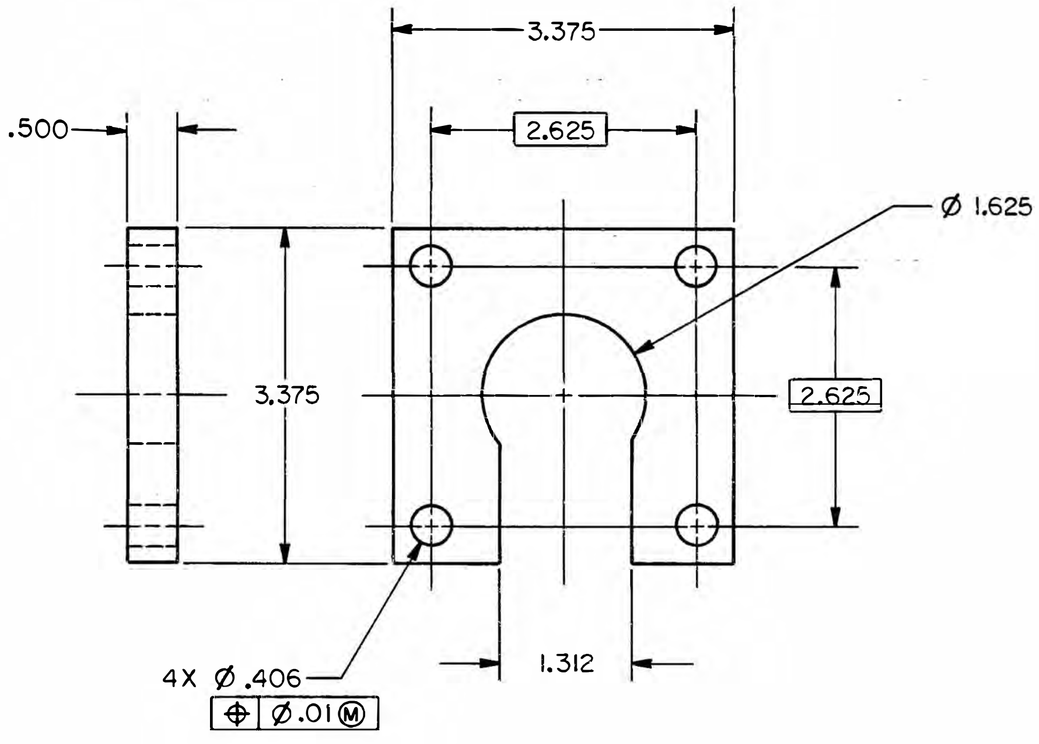
DWG SIZE B — 10534341 — SHEET OF

46-11786

DRAWING SIZE C
(ARDCR 70-12)

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
—	PRODUCT BASELINE ERR M7Q2084	870720	
A	NOR R17Q2026/171212	171221	BAC

NOTES:-
1-SPEC MIL-W-13855 & ANSI Y14.5M-1982 APPLY.
2-MATERIAL:-STEEL, 1020, ASTM-A568.
3-FINISH 63 ALL OVER.
4-FINAL PROTECTIVE FINISH:- BLACK OXIDE, MIL-C-13924.
5-ALL EDGES SHALL BE BROKEN R.005+.015 OR 45° CHAMFER.



DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

8649490	
NEXT ASSY	USED ON
APPLICATION	

MECHANICAL PROPERTIES	
YP	
TS	
EL2	
RA	
BH	
RH	

DO NOT SCALE DRAWING
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS ±.010
FRACTIONS ± —— ANGLES ± ——
THIRD ANGLE PROJECTION

ORIGINAL DATE OF DRAWING 86-04-04

DRAFTSMAN JS3	CHECKER Sam
ENGR	ENGR
ENGR	ENGR

PART NO. 8649492

U S ARMY ARMAMENT RESEARCH AND DEVELOPMENT CENTER
DOVER, NEW JERSEY 07801-5001

RETAINER

SIZE	CAGE CODE	
C	19200	8649492

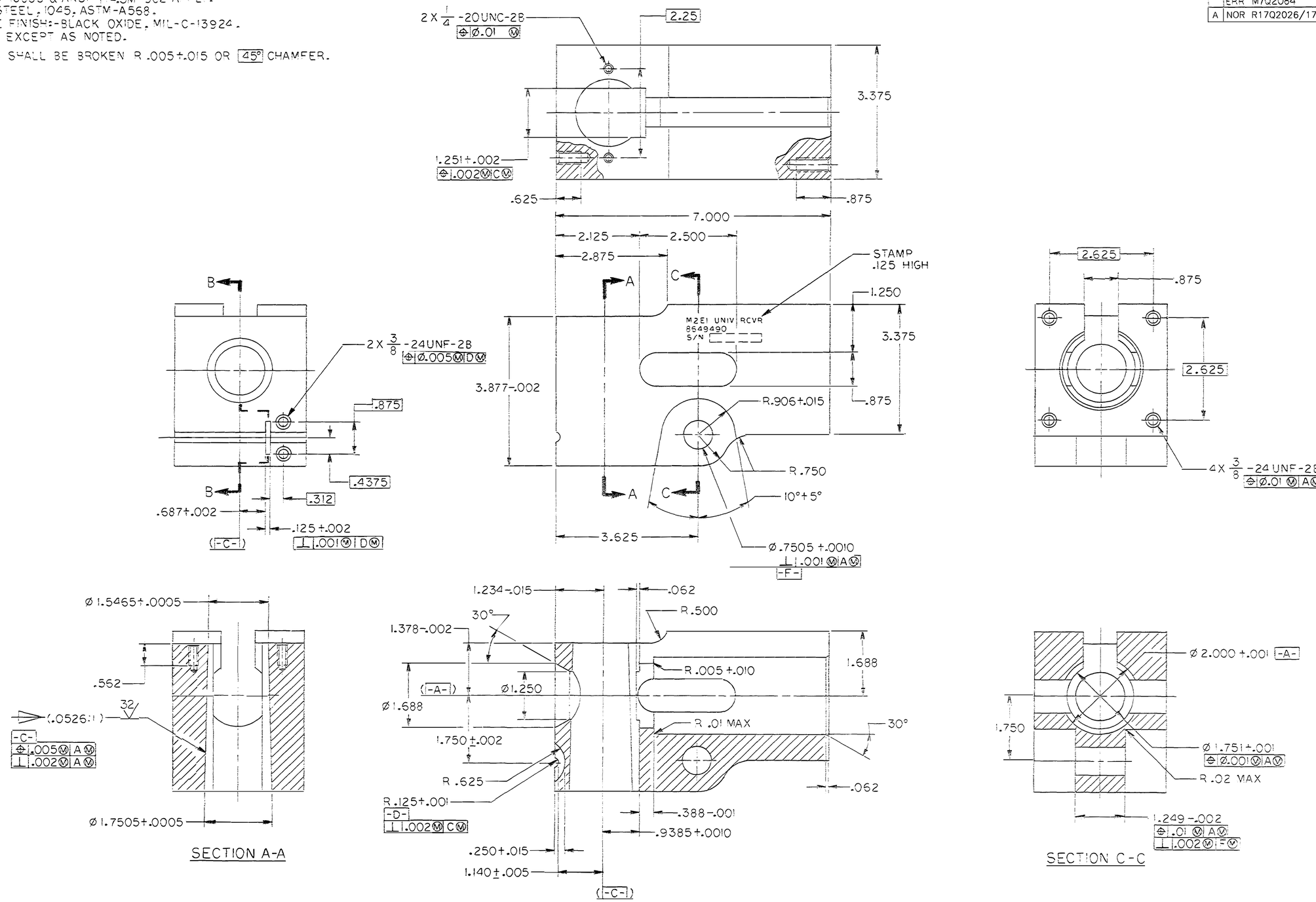
SCALE 1/1 | UNIT WT. —— | SHEET ——

SMCAR FORM 67, 1 FEB 85, REPLACES ARRADCOM FORM 67, AUG 77 (WHICH MAY BE USED UNTIL EXHAUSTED)

DRAWING SIZE F
(ARDCR 70-12)

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
–	PRODUCT BASELINE ERR M7Q2084	870720	
A	NOR R17Q2026/171212	171221	BAC

NOTES –
1–SPEC MIL-W-13855 & ANSI Y14.5M-1982 APPLY.
2–MATERIAL–STEEL, 1045, ASTM-A568.
3–PROTECTIVE FINISH:–BLACK OXIDE, MIL-C-13924.
4–FINISH 63/ EXCEPT AS NOTED.
5–ALL EDGES SHALL BE BROKEN R.005±.015 OR 45° CHAMFER.



DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

		MECHANICAL PROPERTIES	DO NOT SCALE DRAWING	ORIGINAL DATE OF DRAWING 86-04-04	PART NO. 8649491
		VP	UNLESS OTHERWISE SPECIFIED	DRAFTSMAN J.B. ICHBIAH	U S ARMY ARMAMENT RESEARCH AND DEVELOPMENT CENTER DOVER, NEW JERSEY 07801-5001
		TS	DIMENSIONS ARE IN INCHES	ENGR	ENGR
		EL2	TOLERANCES ON DECIMALS ± .010	ENGR	ENGR
		RA	FRACTIONS ± ANGLES ± 2°	ENGR	ENGR
		BH	THIRD ANGLE PROJECTION		HOUSING
8649490		RH	C30-35	SIZE F	CAGE CODE 19200
NEXT ASSY	USED ON			SCALE 1/1	UNIT WT.
APPLICATION					SHEET

SMCAR FORM 69, 1 FEB 85, REPLACES ARRADCOM FORM 79, AUG 77

O.O. FORM 9 AUG 48 1181-1

PHYSICAL PROPERTIES		APPLICATION		A 8596994			
YP		NEXT ASSY	USED ON				
TS		SEE ENGINEERING RECORDS		REVISIONS			
EL 2				SYM	DESCRIPTION	DATE	APPROVAL
RA		C8596714	PREFCHBLOCK 4.5CY	A	NOR R17Q2026/171212	171221	BAC
BH							
RH		DO NOT	APPLY PART NO.				
		SO	[illegible]				

[boilerplate redacted]

THE AMPHENOL ELECTRONICS CORPORATION, RECEPTACLE, SINGLE CONTACT CONNECTOR AMPHENOL CATALOG NO. 83-1R, MILITARY NO. SO-239 SUPPLIED BY THE AMPHENOL ELECTRONICS CORPORATION, 1830 SOUTH 54TH AVE., CHICAGO 50, ILL. HAS BEEN FOUND SATISFACTORY FOR USE IN THE PERFORMANCE OF THE FUNCTION REQUIRED.
ANY RECEPTACLE COMPLYING WITH THE FUNCTIONAL REQUIREMENTS OF THE ABOVE MENTIONED ITEM MAY BE ACCEPTABLE IF FOUND SATISFACTORY AFTER EVALUATION BY THE RESPONSIBLE ENGINEERING AGENCY.

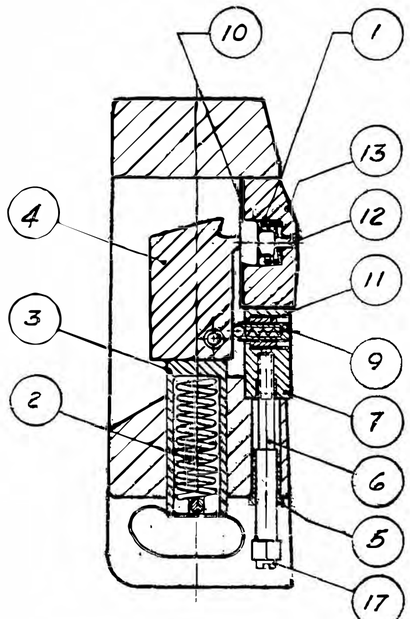
DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

ORDNANCE PART NO. 8596994

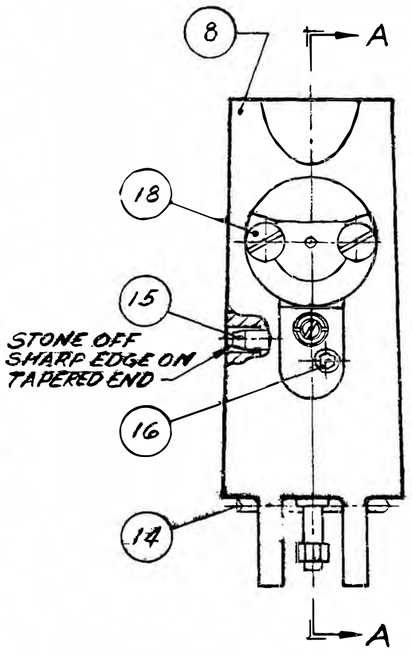
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON—	ORIGINAL DATE OF DRAWING MARCH 11, 1960		RECEPTACLE	INDUSTRIAL GROUP ORDNANCE CORPS DEPT OF THE ARMY U.S. ARMY ORDNANCE ARSENAL FRANKFORD
DECIMALS	DRAFTSMAN M.A.B.	CHECKER [illegible]		
FRACTIONS	TRACER M.A.B.	CHECKER [illegible]		
ANGLES	ENGINEER [illegible]	ENGINEER [illegible]		
MATERIAL	SUBMITTED [illegible] ENGR ORD CORPS			
HEAT TREATMENT				
FINAL PROTECTIVE FINISH	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E. A. Fletcher ORD CORPS		SCALE / UNIT WT	DWG SIZE A — 8596994 — SHEET OF

ARMY-RARITAN ARSENAL (NAVY) METUCHEN N.J. 57-1104

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
E	REPLACES REV D WITH CHANGES E.O. ST 9149	8-8-69	
F	NOR R71Q2026/171212	171221	BAC



SECTION A-A



ITEM NO.	NOMENCLATURE OR DESCRIPTION	PART OR IDENT NO.	QTY REQD
18	SCREW, MACHINE, FILH, SLOTTED, .190-32 UNF-2A × 1/2 LG	MS-35266-63	2
17	SCREW, MACH, PAN HD, BRASS, .112-40UNC-2A × 1/4 LG	MS-35214-12	1
16	SCREW, CAP, SOCKET HEAD, .112-40UNC-3A × 1/2 LG	MS-16997-11	1
15	PIN, STRAIGHT, HEADLESS, .1886 -.0002 DIA × 1 1/2 LG	MS-16556-45	1
14	PIN, COTTER, .120-.004 DIA, × 1 1/4 LG	MS-24665-372	1
13	PLATE, FIRING PIN 5.56 MM 7.62 MM, 9MM, CALIBERS .30. .38. .45 & .50	B10524157 B 8595542	1
12	PIN, FIRING 5.56 MM CAL. 50 7.62MM, 9MM, CALIBERS .30 .38 & .45	B10524158 A8596166 A5185165	1
11	BUSHING	A10523411	1
10	SHIM, FIRING PIN PLATE	B 8648330	1 FOR AS REQD
9	BALL PLUNGER	A 8596715	1
8	BREECHBLOCK	C8596713	1
7	INSERT	B8596712	1
6	SCREW, CONTACT	B8596711	1
5	BUSHING, INSULATION	A8596709	1
4	HAMMER	B6173233	1
3	RETAINER, HAMMER SPRING	A5185168	1
2	SPRING, HAMMER	A5185167	1
1	SPRING, FIRING PIN	A5185166	1

LIST OF PARTS

PART No. 8596714

NOTE:
SEE DWG F10520043 FOR FUNCTIONAL REQUIREMENTS.

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

MIN. MECHANICAL PROPERTIES	
YS	
TS	
EL 2	
RA	
BH	
RH	
F10520043	
SEE ENGINEERING RECORDS	
NEXT ASSY	USED ON
APPLICATION	
DO NOT ● APPLY PART NO.	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	
TOLERANCES ON FRACTIONS ±	
DECIMALS ± ANGLES ±	
MATERIAL	
HEAT TREAT	
PROTECTIVE FINISH	
ORIGINAL DATE MARCH 11, 1960	
DRAFT N.W.H	CHK Sam
TRACER	CHK
ENGR	ENGR
SUBMITTED	
APPROVED W.W. Inglis	

U. S. ARMY
FRANKFORD ARSENAL
PHILADELPHIA, PA. 19137

BREECHBLOCK ASSY
(ACTION TIME RECEIVER)

SIZE	CODE IDENT NO.	DRAWING NO.
C	19200	8596714

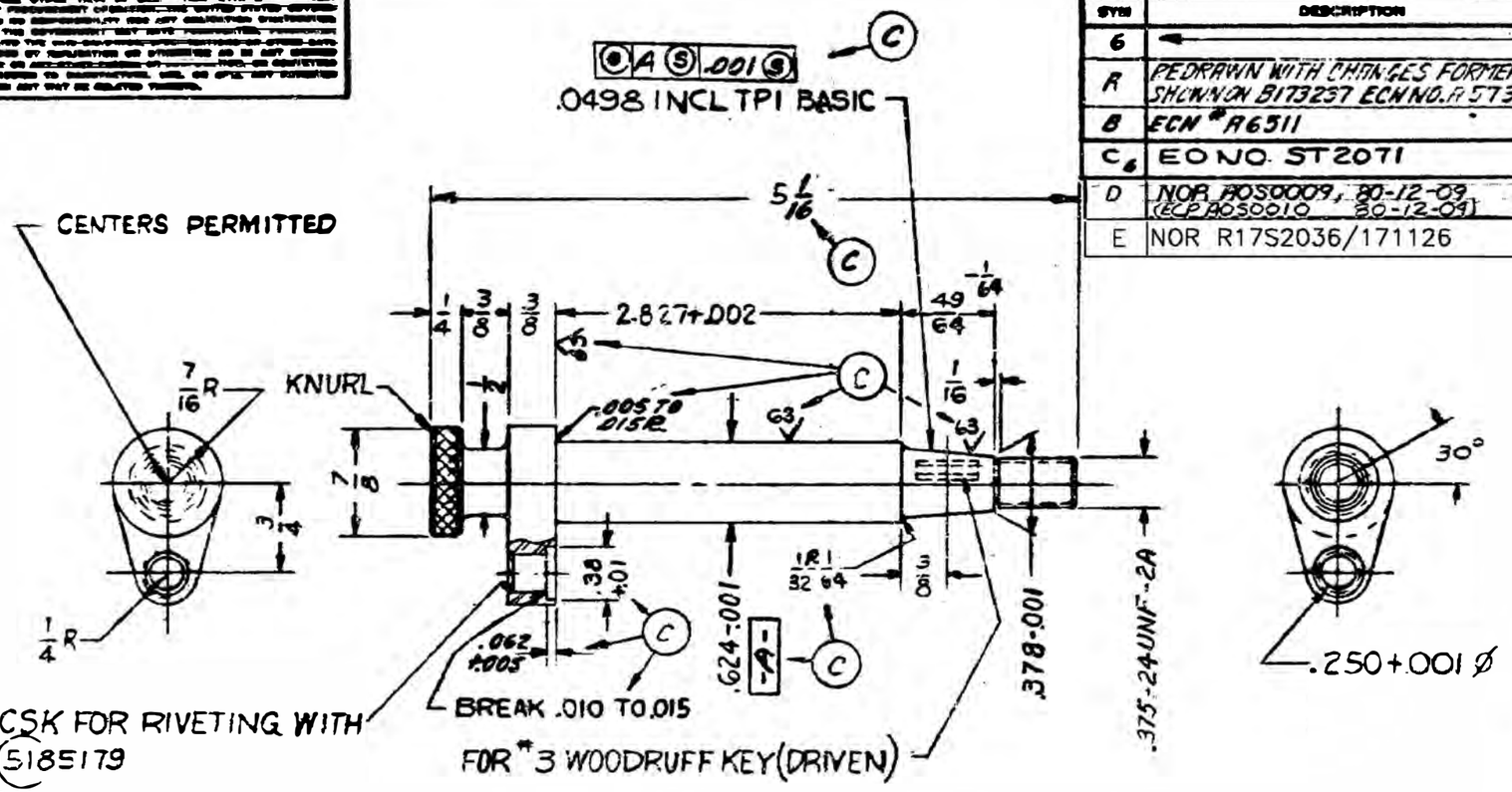
SCALE: 1/1 | UNIT WT. | SHEET 1 OF 1

3CA-1E

SBCTA Form 1677, 7 Jan 95
(Formerly SBCTA Form 0830)

56173237

SYM	DESCRIPTION	DATE	APPROVAL
6	←	2-23-54	
R	REDRAWN WITH CHANGES FORMERLY SHOWN ON B173237 ECN NO. R 5736	3-8-60	
B	ECN # R6511	9-27-60	
C6	EO NO. ST2071	8-7-63	
D	NOR A05 0009, 80-12-09 (ECP A05 0010 80-12-09)	820512	
E	NOR R17S2036/171126	171214	BAC



NOTES:-
1- SPEC ANSI Y14.5, MIL-STD-9 & ASME B46.1 APPLY.
2- FINISH ALL OVER 125 EXCEPT AS SHOWN

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

CODE IDENT NO. 19200

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

CODE IDENT NO. [redacted]

PART NO. 6173237

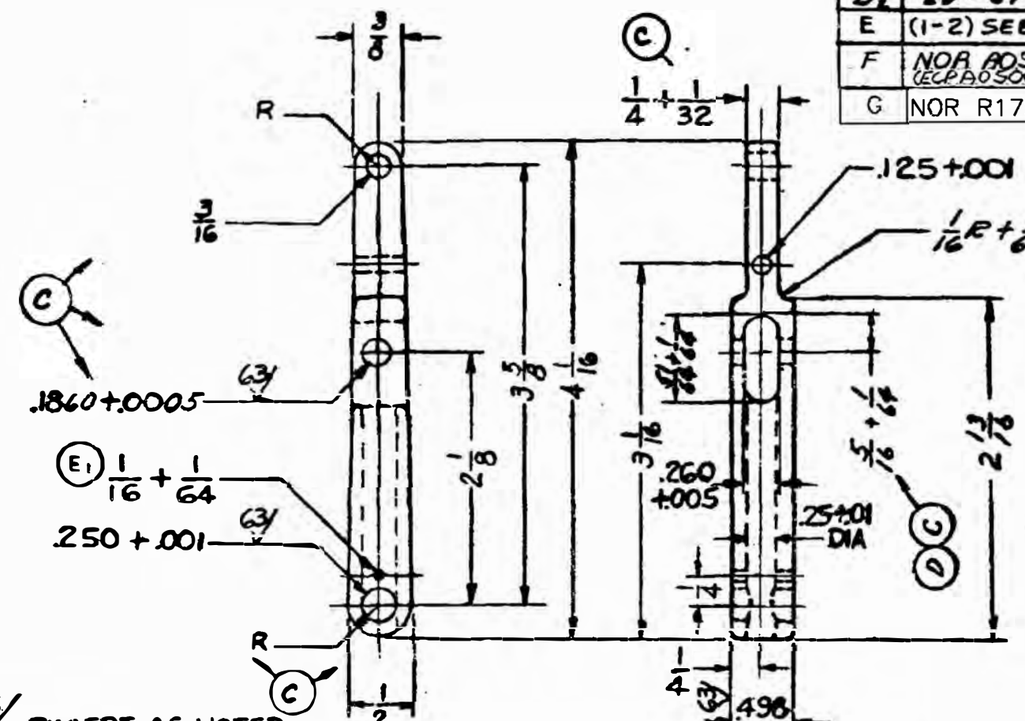
PHYSICAL PROPERTIES	TP, TS, EL 2, RA, BN, RN
SEE ENGINEERING RECORDS	NEXT ASSY / USED ON; APPLICATION; APPLT PART NO.
UNLESS OTHERWISE SPECIFIED	DIMENSIONS ARE IN INCHES; TOLERANCES ON FRACTIONS 1/64, DECIMALS .005, ANGLES 1°
MATERIAL	STEEL-C1020, ANSI/ASTM A575
HEAT TREATMENT	
FINAL PROTECTIVE FINISH	
ORIGINAL DATE OF DRAWING	SEPT 10, 1941
DRAFTSMAN	J.S.M.
TRACER	J.S.M.
SUBMITTED	O.N. Gotzel, ENGR ORD CORPS
APPROVED BY ORDER OF THE CHIEF OF ORDNANCE	E.O. Mattes, ORD CORPS
SHAFT, OPERATING LEVER	
SCALE	1/1
UNIT WT	
DWG SIZE	B
6173237	
SHEET	OF

DUPLICATE ORIGINAL DWG

BEST AVAILABLE

B6173236

SYM	DESCRIPTION	DATE	APPROVAL
4	◄ ►	9-18-52	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON B173236 ECN NOR5580	3-18-60	
B	ECN #A6510	9-27-63	
C,	EO # ST2071	8-7-63	
D,	EO # ST4067	9-30-64	
E	(1-2) SEE E.O. NO. ST0029	3-9-70	
F	NOR A050009, 80-12-09 (ECP A050010 80-12-09)	820312	
G	NOR R17S2036/171126	171214	BAC



DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

NOTES:-
1- FINISH ALL OVER 125 EXCEPT AS NOTED.
2- SPEC ANSI Y14.5 & ASME B46.1 APPLY.

CODE IDENT NO. 19200
PART NO. 6173236

B

SEE ENGINEERING RECORDS

NEXT ASSY | USED ON

APPLICATION

APPLT PART NO.

PHYSICAL PROPERTIES: TP, TS, EL 2, RA, BH, RH

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± ANGLES

MATERIAL STEEL-C1020, ANSI/ASTM A575

HEAT TREATMENT E2

FINAL PROTECTIVE FINISH BLACK OXIDE SPEC. MIL-C-13924

ORIGINAL DATE OF DRAWING SEPT 10 1941

DRAFTSMAN W.S.M. CHECKED

TRACER W.S.M. CHECKED

ENGR. CHIEF

SUBMITTED

APPROVED BY ORDER OF THE CHIEF OF ORDNANCE

LEVER, TRIP

SCALE 1/1 UNIT WT

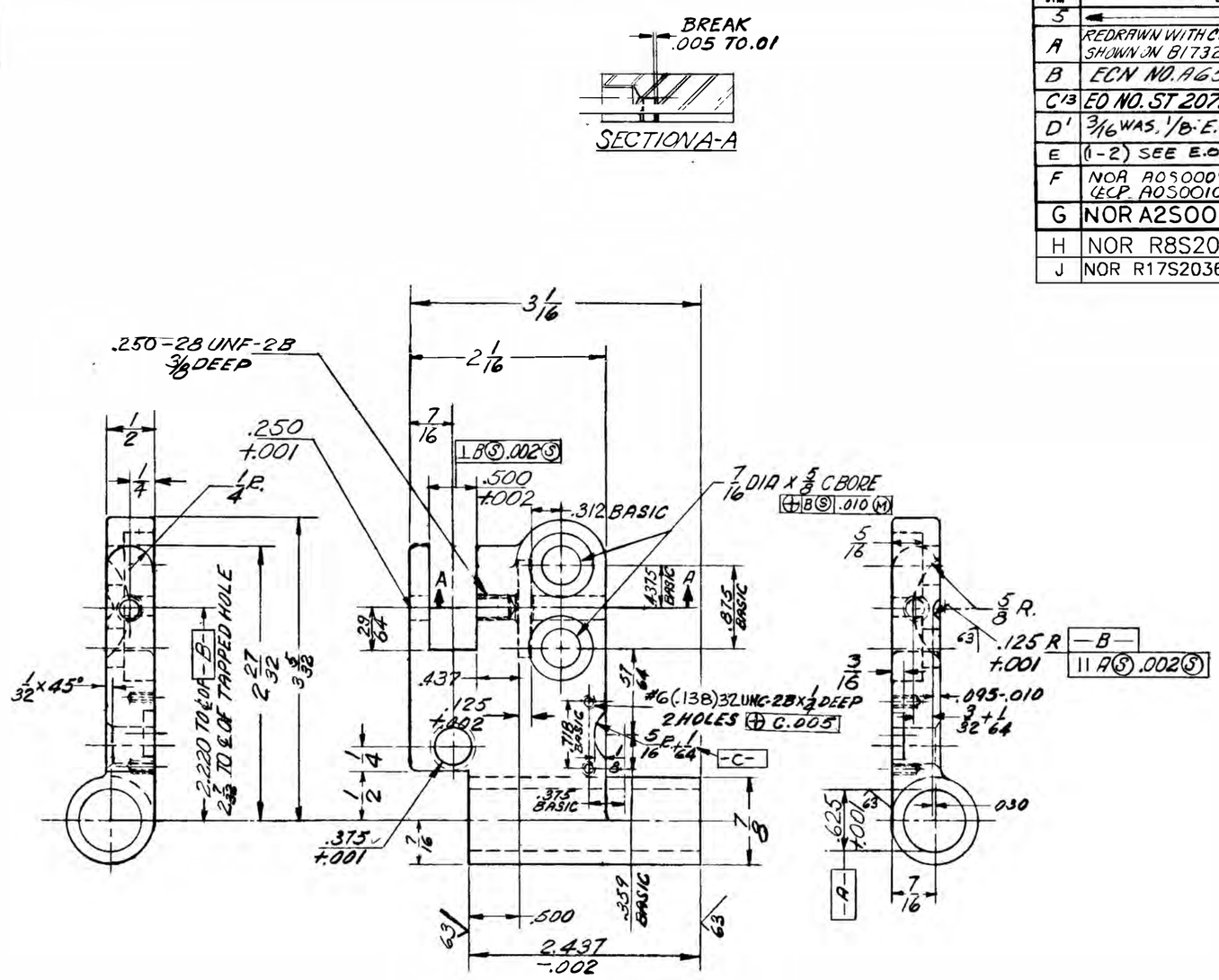
DWG SIZE B 6173236 SHEET OF

DUPLICATE ORIGINAL DWG

00 , FORM APR 54 1177-1

C6173235

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
3	◄	2-16-54	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON B173235 ECN NO. A5740	3-18-60	Eng
B	ECN NO. A6520	9-27-60	Eng
C13	EO NO. ST 2071	8-7-63	WEK M
D'	3/16 WAS, 1/8 E.O. NO. SQ6079	4-11-66	
E	(1-2) SEE E.O. NO. ST0029	3-9-70	VW
F	NOR A0S0009, 80-12-09 (ECP A0S0010 80-12-09)	820312	RH
G	NOR A2S0004 82-08-04	841018	
H	NOR R8S2035 981209	990121	JB
J	NOR R17S2036/171126	171214	BAC



NOTES:-

1-. FINISH ALL OVER 125 EXCEPT AS NOTED.
2-CASE HARDEN-RC 40-45-.025 DEEP
3-SPEC ANSI Y14.5, ASME B46.1 APPLY.
4-PROTECTIVE FINISH: BLACK OXIDE, SPEC. MIL-C-13924

CURRENT DESIGN ACTIVITY CAGE CODE 19200
US ARMY
ARMANENT RESEASRCH, DEVELOPMENT AND ENGINEERING CENTER
PICATINNY ARSENAL, NEW JERSEY 07806-5000

PART NO. 6173235

DISTRIBUTION STATEMENT A.
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

PHYSICAL PROPERTIES		UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING SEPT. 10, 194
YP		DIMENSIONS ARE N INCHES TOLERANCES ON FRACTIONS ±1/64 DECIMALS ±.005 ANGLES ±1°	DRAFTSMAN CHECKER
TS		MATERIAL STEEL C1020 ANSI/ASTM A576 (E2)	TRACER CHECKER
EL2		HEAT TREATMENT SEE NOTE 2	ENGR ENGR
RA		FINAL PROTECTIVE FINISH SEE NOTE 4	SUBMITTED G.H. Gehrt ENGR. ORD CORPS
BH			APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E.a Mattias ORD CORPS
RH			
SEE ENGINEERING RECORDS			
NEXT ASSY	USED ON		
APPLICATION			
APPLY PART NO.			
DO			

U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT CENTER
DOVER, NEW JERSEY 07801

BRACKET

FSCM NO.19200

SCALE:- 1/1 | UNIT WT

PROCUREMENT AND PRODUCTION DIRGR
U. S. ARMY MUNITIONS COMMAND
[illegible]

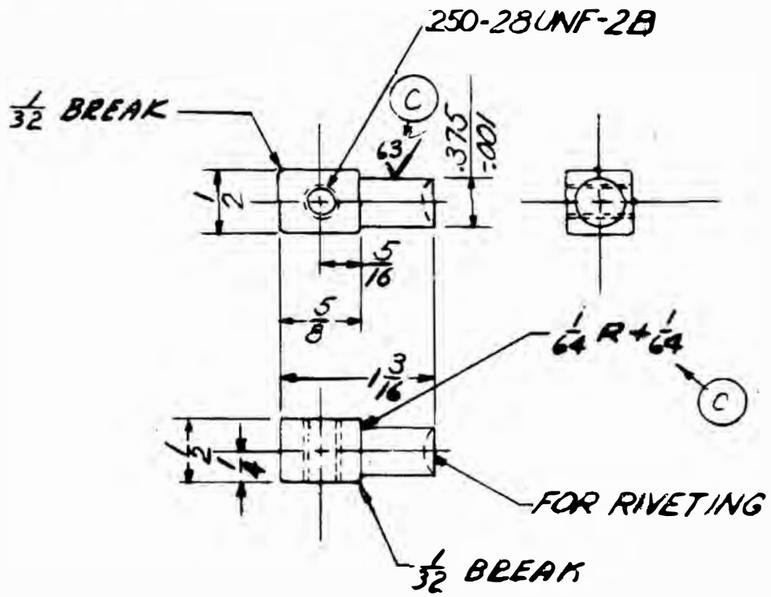
DWG SIZE C | 6173235 | SHEET OF

ARMY-RARITAN ARSENAL (MMPC), METUCHEN N.J. 60 1

DD, FORM 1176

B.5185184

SYM	DESCRIPTION	DATE	APPROVAL
2	← →	5-18-52	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON R.5184 ECN NO. R5738	5-18-60	Em
B	ECN R6509	9-27-62	Em
C	EO NO. ST2071	8-7-63	
D	NOR AOS0009, 80-12-09 (ECP AOS0010 80-12-09)	820312	
E	NOR R17S2036/171126	171214	BAC



NOTES:-
1-SPEC ANSI Y14.5 ANS ASME B46.1 APPLY.
2- FINISH ALL OVER 125 EXCEPT AS NOTED

CODE IDENT NO.
19200

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
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C ~~CODE IDENT NO. 00000~~
PART NO. 5185184

SEE ENGINEERING RECORDS		PHYSICAL PROPERTIES: YP, TS, EL 2, RA, BH, RH	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON FRACTIONS ± 1/64, DECIMALS, ANGLES. MATERIAL STEEL-C1020, ANSI/ASTM A575. HEAT TREATMENT. FINAL PROTECTIVE FINISH.	ORIGINAL DATE OF DRAWING SEPT 10, 141. SUBMITTED ENGR. APPROVED BY ORDER OF THE CHIEF OF ORDNANCE.	STUD, STOP SCREW	~~ORDNANCE CORPS~~	
NEXT ASSY	USED ON					DWG SIZE B	5185184
APPLICATION					SCALE 1-1/1	UNIT WT	SHEET OF
DO	APPLY PART NO.						

DUPLICATE ORIGINAL DWG

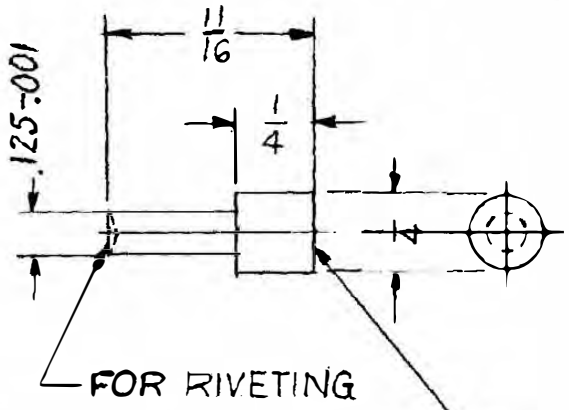
A5185183

NOTICE.— When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

PHYSICAL PROPERTIES		DO NOT APPLY PART NO. [redacted]	
YP		APPLICATION	
TS		NEXT ASSY	USED ON
EL2		SEE ENGINEERING RECORDS	
RA			
BM			
RM			

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
3	← →	3-18-52	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185183 ECN NO. A5592	3-18-60	
B	ECN A6490 MICRUFILM	9-27-60	
C_2	EO NO. ST2071	8-7-63	
D	NOR A05O009, 80-12-09 TFCP A05O010 80-12-09	820312	
E	NOR R17S2036/171126	171214	BAC

C



NOTE:-

1- FINISH ALL OVER 63

2—SPEC ANSI Y14.5 & ASME B46.1 APPLY.

CODE IDENT NO. **19200**

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

C

PART NO. 5185183

~~CODE IDENT NO 00000~~

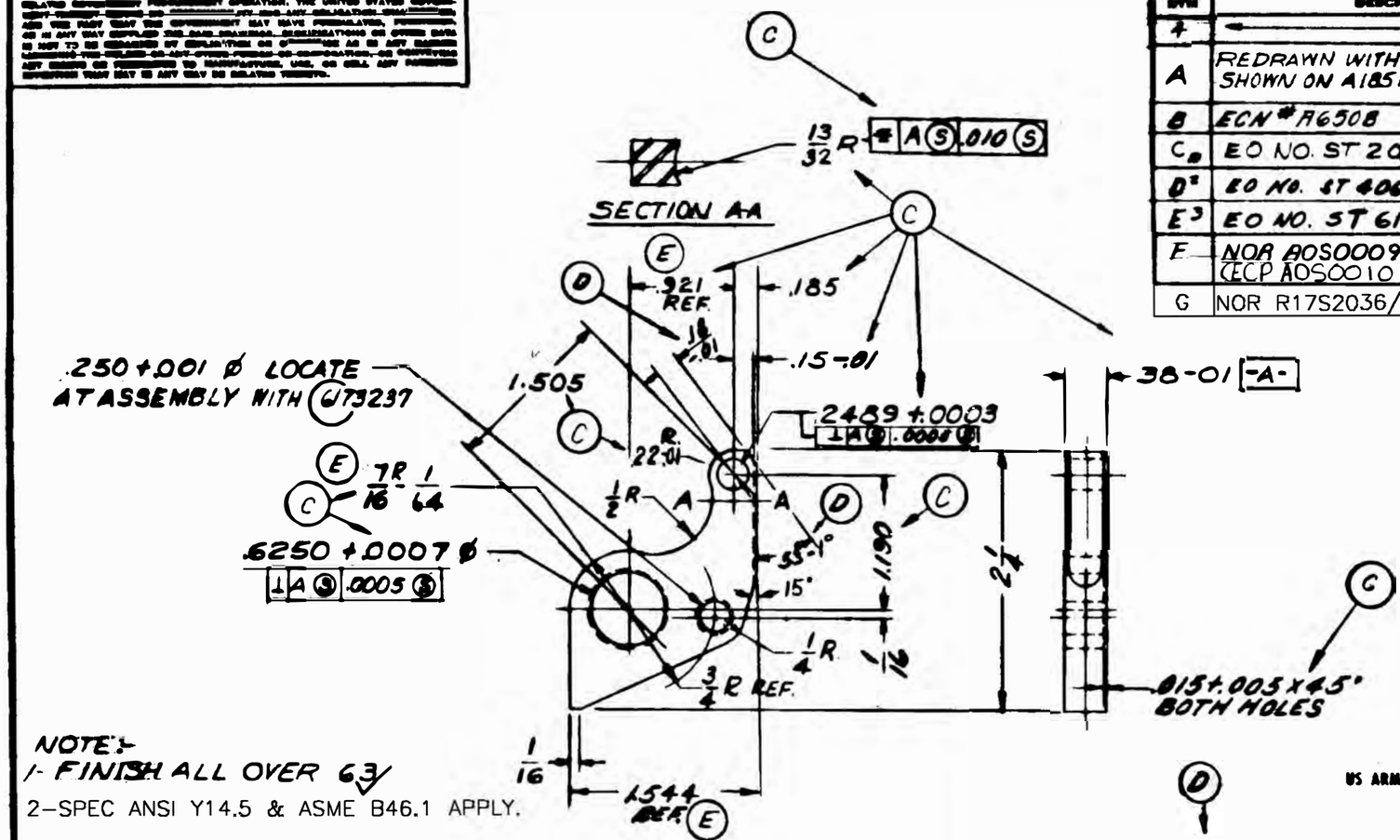
DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING SEPT 10, 1941		
DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ±1/64	DRAFTSMAN W.S.M.	CHECKER C.S.B.	
MATERIAL STEEL-C1095, ANSI/ASTM A108	TRACER W.S.M.	CHECKER	BUMPER, TRIP LEVER
HEAT TREATMENT	ENGR	ENGR	~~PROCUREMENT AND PRODUCTION GROUP~~
FINAL PROTECTIVE FINISH	SUBMITTED [signature] ENGR ORD CORPS		~~U.S. ARMY AMMUNITION COMMAND~~ ~~FRANKFORD ARSENAL~~
	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE [signature] ORD CORPS	SCALE :- 2/1	DWG SIZE A — 5185183
		UNIT WT	SHEET OF

SAA 15

B5185182

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
4	← →	3-18-52	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185182 ECN NOA5608	3-18-60	
B	ECN # A6508	9-27-	
C	EO NO. ST 2071	8-7-	
D	EO NO. ST 4067	9-30-	
E	EO NO. ST 6190	9-26-66	
F	NOR A0S0009, 80-12-09 (ECP A0S0010 80-12-09)	B20312	
G	NOR R17S2036/171126	171214	BAC



NOTES:
1- FINISH ALL OVER 63
2—SPEC ANSI Y14.5 & ASME B46.1 APPLY.

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

DISTRIBUTION STATEMENT A
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CODE IDENT NO. 19200
PART NO. 5185182

SEE ENGINEERING RECORDS	PHYSICAL PROPERTIES: YP, TS, EL 2, RA, BH, RH	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ±1/64 DECIMALS .005 ANGLES 1°
NEXT ASSY / USED ON	MATERIAL STEEL-C1095, ANSI/ASTM A108	
APPLICATION	HEAT TREATMENT	
APPLY PART NO.	FINAL PROTECTIVE FINISH	

ORIGINAL DATE OF DRAWING SEPT 10, 1941
SUBMITTED ENGR ORD CORPS
APPROVED BY ORDER OF THE CHIEF OF ORDNANCE ORD CORPS

ARM, BREECH BLOCK

SCALE :- 1 | UNIT WT

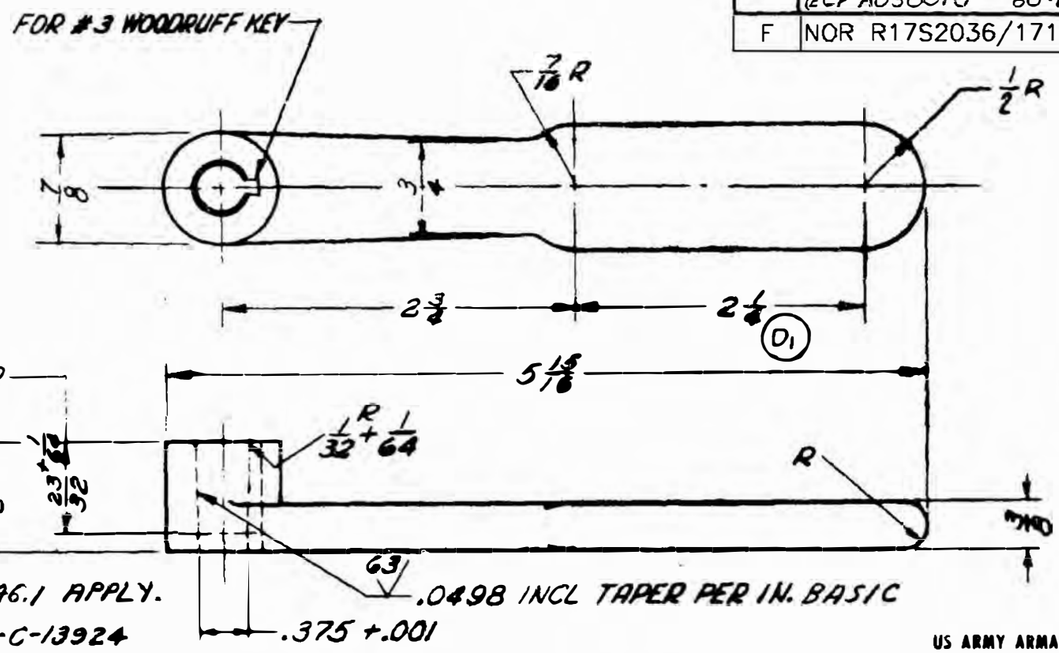
DWG SIZE B | 5185182 | SHEET OF

DUPLICATE ORIGINAL DWG

B5185181

00 FORM 1 APR 64 1176

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
3	←	2-23-59	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185181 ECN NO. A5610	3-18-60	
B	ECN #A6507	9-27-60	
C	EO NO. ST 2071	8-7-63	
D	(1-2) SEE E.O. No. ST0029	3-9-70	
E	NOR A0S0009, 80-12-09 (ECP A0S0010 80-12-09)	B20312	
F	NOR R17S2036/171126	171214	BAC



NOTES:-

1- SPECS ANSI Y14.5 & ASME B46.1 APPLY.
2- COATING, BLACK OXIDE, SPEC MIL-C-13924
3- FINISH ALL OVER 125 EXCEPT AS NOTED

DISTRIBUTION STATEMENT A
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US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

PART NO. 5185181
CODE IDENT NO. 19200

(B)
(C)

SEE ENGINEERING RECORDS		PHYSICAL PROPERTIES: YP, TS, EL 2, RA, BH, RH	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ANGLES	ORIGINAL DATE OF DRAWING SEPT 10, 1941	LEVER, OPERATING
NEXT ASSY	USED ON		MATERIAL STEEL-C1020, ANSI/ASTM A575	DRAFTSMAN WSM CHECKER	
APPLICATION			HEAT TREATMENT (D3)	TRACER WSM CHECKER	
[redacted] DO	APPLY PART NO. [redacted]		FINAL PROTECTIVE FINISH SEE NOTE 2	SUBMITTED ENGR ORD CORPS	SCALE :- 1/1 UNIT WT
				APPROVED BY ORDER OF THE CHIEF OF ORDNANCE ORD CORPS	DWG SIZE B 5185181 SHEET OF

DUPLICATE ORIGINAL DWG

NOTICE. — When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

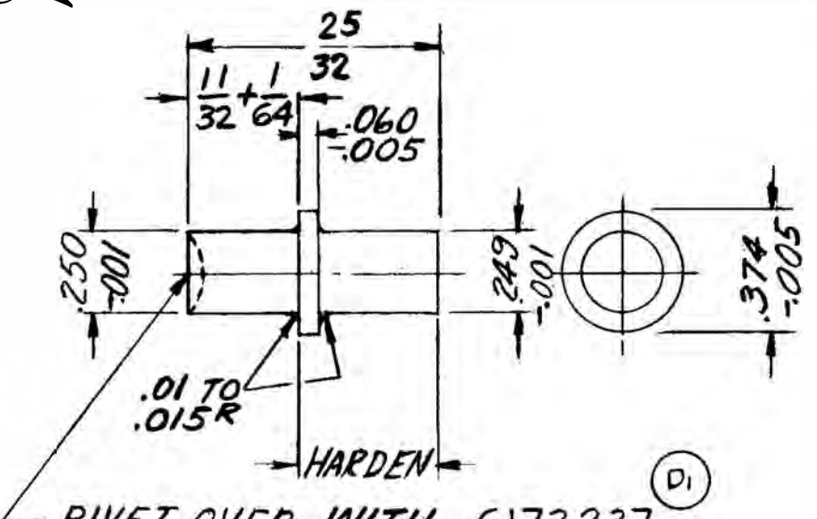
PHYSICAL PROPERTIES	
YP	
TS	
EL2	
RA	
BM	
RM	C40-44

DO NOT APPL'Y PART NO. DO [redacted]

APPLICATION	
NEXT ASSY	USED ON
SEE ENGINEERING RECORDS	

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
2	← →	3-18-52	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185179 ECN NO. A 5602	3-18-60	Em
B	ECN A6492 MICROFILM	9-27-60	Em
C_2	EO NO. ST2071	8-7-63	MM
D	(1-2) SEE E.O. NO. ST0029	3-9-70	VW
E	NDA A05 0009, 80-12-09 (5% A05 5010 80-12-09)	820312	
F	NOR R17S2036/171126	171214	BAC

C



NOTES:-

1-FINISH ALL OVER 63

2-SPEC ANSI Y14.5 & ASME B46.1 APPLY.

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

DISTRIBUTION STATEMENT A
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PART NO. 5185179
CODE IDENT NO 19200

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64	ORIGINAL DATE OF DRAWING SEPT 10, 1941	PIN, OPERATING LEVER SHAFT	~~PROCUREMENT AND PRODUCTION GROUP~~ ~~U.S. ARMY MUNITIONS COMMAND PICATINNY ARSENAL~~
MATERIAL STEEL C1095, ANSI/ASTM A108	DRAFTSMAN W.S.M. CHECKER A.J.K.		
HEAT TREATMENT D2	TRACER W.S.M. CHECKER [illegible]		
FINAL PROTECTIVE FINISH	ENGR [illegible] ENGR [illegible]		
	SUBMITTED A.J.K. ENG ORD CORPS		
	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E.A. Mathews ORD CORPS	SCALE 2/1	DWG SIZE A — 5185179
		UNIT WT	SHEET OF

SAA IE

00 1181-1

ARMY-RARITAN ARSENAL (NMPC), METUCHEN, NJ-56-178

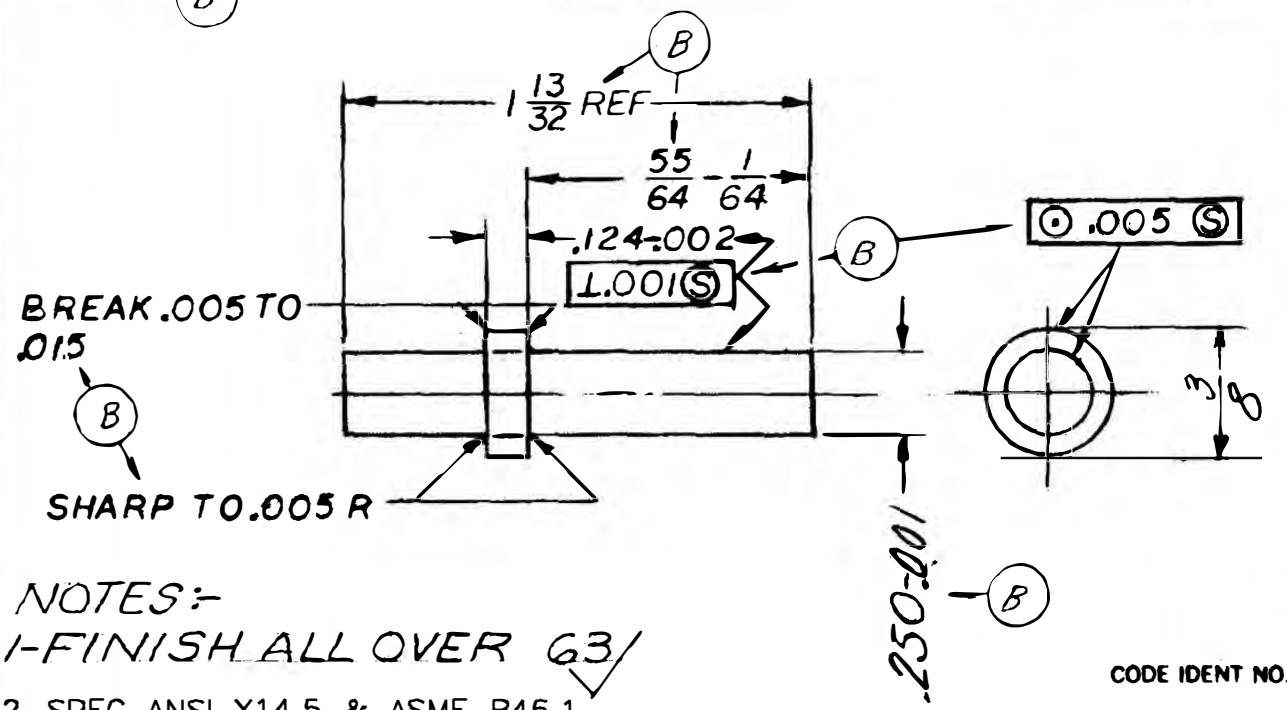
PHYSICAL PROPERTIES	
YP	
TS	
EL2	
RA	
BM	
RM	

APPLY PART NO. [redacted]
DO [redacted]

APPLICATION	
NEXT ASSY	USED ON
SEE ENGINEERING RECORDS	

REVISIONS

SYM	DESCRIPTION	DATE	APPROVAL
2	← →	3-18-52	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185178 ECN NO. A5604	3-18-60	
B6	E.O. NO ST 2071	8-7-63	M
C	NOR AOS0009, 80-12-09 (ECP AOS0010 80-12-09)	820312	
D	NOR R17S2036/171126	171214	BAC



NOTES:-
1-FINISH ALL OVER 63
2-SPEC ANSI Y14.5 & ASME B46.1 APPLY.

CODE IDENT NO.
19200
US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

PART NO. 5185178
~~CODE IDENT NO. 00000~~

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING SEPT 10, 1941	KEY, BRACKET ALIGNMENT	~~PROCUREMENT AND PRODUCTION GROUP~~ ~~U.S. ARMY MUNITIONS COMMAND~~ ~~FRANKFORD ARSENAL~~
DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64	DRAFTSMAN W S M CHECKER		
MATERIAL STEEL-C1020, ANSI/ASTM A575	TRACER W S M. CHECKER		
HEAT TREATMENT	ENGR ENGR		
FINAL PROTECTIVE FINISH	SUBMITTED A.N. ENGR ORD CORPS	SCALE = 2/1	DWG SIZE A
	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE Ed Mathews ORD CORPS	UNIT WT	5185178 SHEET OF

OO 1181-1

ARMY-RARITAN ARSENAL (NMPC), METUCHEN, NJ-88-178

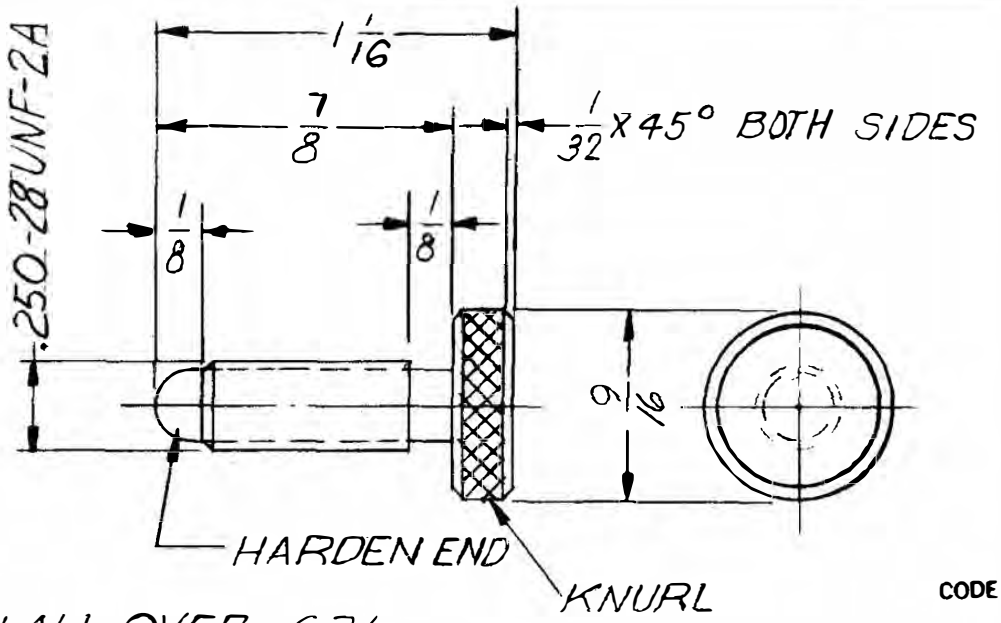
PHYSICAL PROPERTIES	
YP	
TS	
EL2	
RA	
BM	
RM	C50-55

APPLY PART NO. DO [redacted]

APPLICATION	
NEXT ASSY	USED ON
SEE ENGINEERING RECORDS	

REVISIONS

SYM	DESCRIPTION	DATE	APPROVAL
1	← →	3-18-52	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185177 ECN NO. A5606	3-18-60	EMM
B	ECN #A6494 MICROFILM	9-27-60	EMM
C2	EO NO. ST2071	8-7-63	ABK M
D	NOR A05O009, 80-12-09 (ECP A05001Q 80-12-09)	BZ0312	PJS
E	NOR R17S2036/171126	171214	BAC



NOTE:-
1- FINISH ALL OVER 63

2-SPEC ANSI Y14.5 & ASME B46.1 APPLY.

DISTRIBUTION STATEMENT A
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CODE IDENT NO 19200

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

PART NO. 5185177

~~CODE IDENT NO 00000~~

UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING SEPT 10, 1941	SCREW, STOP	~~PROCUREMENT AND PRODUCTION GROUP~~ ~~U.S. ARMY AMMUNITION COMMAND~~ ~~FRANKFORD ARSENAL~~
DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64	DRAFTSMAN W.S.M. CHECKER		
MATERIAL STEEL-C1095, ANSI/ASTM A108	TRACER W.S.M. CHECKER		
HEAT TREATMENT	ENGR J.W.N. ENGR		
FINAL PROTECTIVE FINISH	SUBMITTED A.V. Smith ENGRG CORPS; APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E.A. Mattias ORD CORPS	SCALE ÷ 2/1; UNIT WT	SIZE A; 5185177; SHEET OF

SAS 15

00 1181-1

ARMY-RARITAN ARSENAL (NMPC), METUCHEN, NJ-58-178

A5185176

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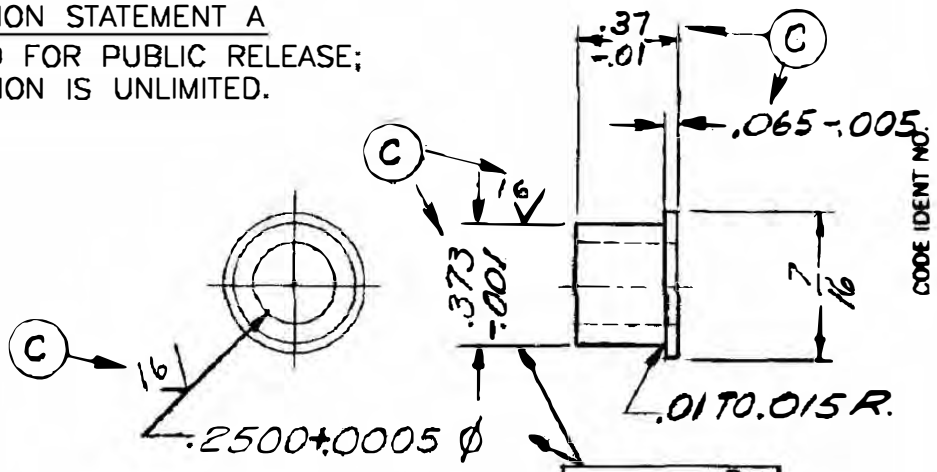
PHYSICAL PROPERTIES	
YP	
TS	
EL2	
RA	
BM	
RM	C61-62

[redacted] APPLY PART NO.
DO [redacted]

APPLICATION	
NEXT ASSY	USED ON
SEE ENGINEERING RECORDS	

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
2	← →	3-18-52	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185176 ECN NO. A 5584	3-18-60	
B	ECN #A6495 MICROFILM	9-27-60	
C6	EO NO ST 2071	8-7-63	
D	NOR AOS0009, 80-12-09	820912	
E	NOR R17S2036/171126	171214	BAC

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.



NOTES:—
1- SPEC ANSI Y14.5 & ASME B46.1 APPLY.
2- MATERIAL: STEEL-FS-02 SPEC QQ-T-570
3- FINISH ALL OVER 63 EXCEPT AS NOTED

PART NO. 5185176
~~CODE IDENT NO. 80330~~

CODE IDENT NO. 19200
US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING SEPT 10, 1941	ROLLER, ARM	~~PROCUREMENT AND PRODUCTION GROUP~~
DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64	DRAFTSMAN W S M CHECKER		~~U.S. ARMY MUNITIONS COMMAND~~
MATERIAL SEE NOTE 2	TRACER W S M CHECKER		
HEAT TREATMENT HARDEN	ENGR CHECKER		
FINAL PROTECTIVE FINISH COATING-BLACK OXIDE -SPEC MIL-C-13924	SUBMITTED ENGR ORD CORPS	SCALE 1-2/1	DWG SIZE A — 5185176
	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE ENGR ORD CORPS	UNIT WT	SHEET OF

SAA 12

DD 1181-1
1 APR 54

ARMY-RARITAN ARSENAL (NMPC), METUCHEN, NJ-58-178

A5185175

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PHYSICAL PROPERTIES	
YP	
TS	
EL2	
RA	
BM	
RM	

[redacted] APPLY PART NO. DO [redacted]

APPLICATION	
NEXT ASSY.	USED ON
SEE ENGINEERING RECORDS	

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
2	← →	3-18-52	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185175 ECN NO. A5596	3-18-60	Em
B	ECN# A6496 MICROFILM	9-27-60	
C_2	EO NO. ST2071	8-7-63	
D	NOR A0S0009, 80-12-09 (ERRATA 80-12-09)	820312	
E	NOR R17S2036/171126	171214	BAC

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
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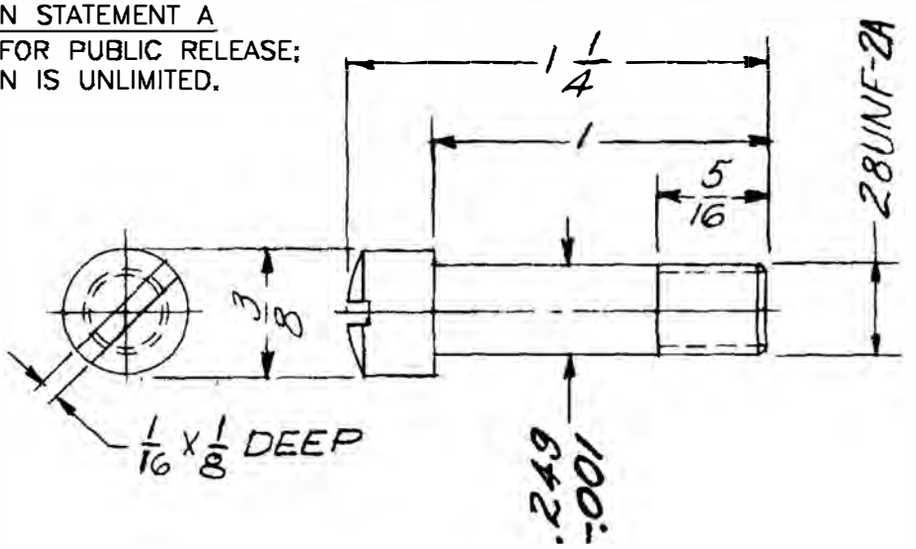

CODE IDENT NO.
19200

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

NOTE:
1- FINISH ALL OVER 63 ✓
2- SPEC ANSI Y14.5, MIL-STD-9[illegible] ASME B46.1 APPLY.

(C)

PART NO. 5185175

~~CODE IDENT NO 00000~~

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64	ORIGINAL DATE OF DRAWING SEPT. 10, 1941. DRAFTSMAN W.S.M. CHECKER [illegible] TRACER W.S.M. CHECKER [illegible] ENGR [illegible] ENGR [illegible]	STUD, TRIP LEVER	~~PROCUREMENT AND PRODUCTION GROUP~~ ~~U.S. ARMY AMMUNITION COMMAND~~ ~~FRANKFORD ARSENAL~~
MATERIAL STEEL-C1020 ANSI/ASTM A575	SUBMITTED A.M. [illegible] ENGR ORD CORPS		
HEAT TREATMENT			
FINAL PROTECTIVE FINISH	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E A Mueller ORD CORPS	SCALE ÷ 2/1 UNIT WT	DWG SIZE A 5185175 SHEET OF

SAA IE

OO 1181-1
1 APR 54

ARMY-RARITAN ARSENAL (NBPC), METUCHEN, NJ.

A5185169

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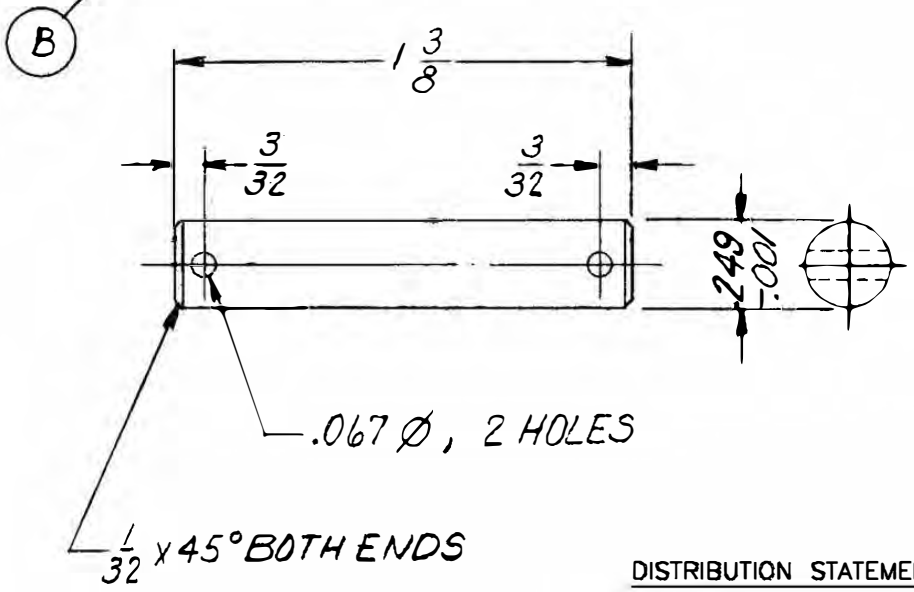
PHYSICAL PROPERTIES		APPLY PART NO. DO [redacted]	
YP		APPLICATION	
TS		NEXT ASSY	USED ON
EL2		SEE ENGINEERING RECORDS	
RA			
BM		D6543621	RECEIVER, UNIVERSAL M2
RM	C36-38		
		D10520043	RECEIVER, UNIVERSAL, ACTION TIME

REVISIONS

SYM	DESCRIPTION	DATE	APPROVAL
4	← →	6-22-54	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185169. ECN NO. A5600	3-18-60	
B	ECN #A6497 MICROFILM	9-27-60	
C	NOR A05O009, BO-12-09 (ECP AD5007O BO-12-07)	820312	
D	NOR R17Q2026/171212	171221	BAC



DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

NOTE:-
FINISH ALL OVER 63

CODE IDENT NO.
19200
US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

ORDNANCE PART NO. 5185169

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64 ± 5°	ORIGINAL DATE OF DRAWING SEPT 10, 1941 DRAFTSMAN W.S.M. CHECKER TRACER W.S.M. CHECKER ENGR ENGR SUBMITTED ENGR ORD CORPS APPROVED BY ORDER OF THE CHIEF OF ORDNANCE ORD CORPS	PIN, BREECH-BLOCK ARM	~~INDUSTRIAL GROUP~~ ~~ORDNANCE CORPS~~ ~~DEPT OF THE ARMY~~ ~~U.S. ARMY RADFORD ARSENAL~~ ~~RADFORD, VA.~~
MATERIAL STEEL-C.1095, ANS/ASTM A108 HEAT TREATMENT HARDEN FINAL PROTECTIVE FINISH		SCALE 2/1 UNIT WT	DWG SIZE A 5185169 SHEET OF

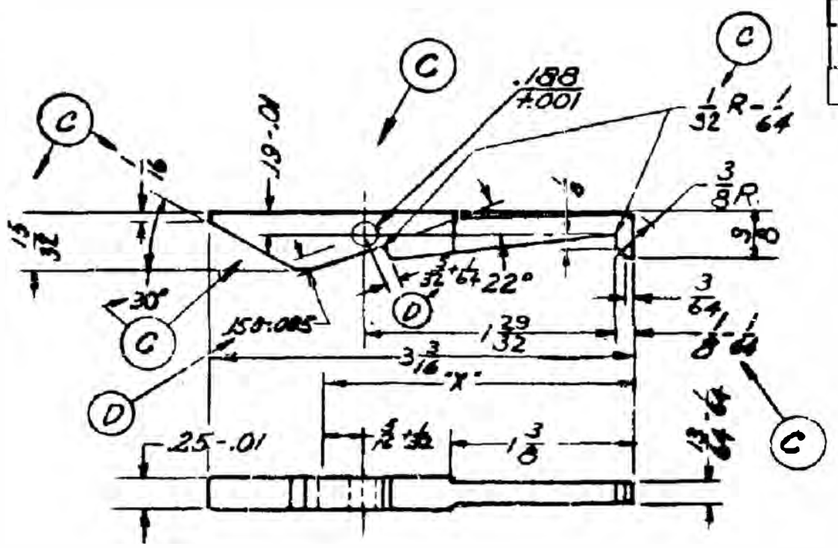
OO 1181-1
1 APR 54

ARMY-RARITAN ARSENAL (NMPC), METUCHEN, NJ-58-178

00 FORM 1176

B 5185161

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
S	←	3-18-58	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185161 ECN NO. 95519	3-18-60	
B	ECN # A 506	9-27-60	
CR	EO NO. ST 3071	8-7-63	
D1	EO. NO. ST #067	9-30-64	
E	NOR A05-0009, 80-12-09 (ECP A05-0010 80-12-09	820312	
F	NOR R17S2036/171126	171214	BAC



3/32 R IN "X" AREA

NOTES :-
1- FINISH ALL OVER 63
2- COATING - BLACK OXIDE - SPEC MIL-C-13924
3- SPEC ANSI Y14.5 & ASME B 46.1 APPLY
4- BREAK ALL EDGES .005 TO .01 EXCEPT AS NOTED

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

CODE IDENT NO. 19200
PART NO. 5185161

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

PHYSICAL PROPERTIES		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ±1/64 DECIMALS ANGLES ±1°	ORIGINAL DATE OF DRAWING SEPT. 10, 1941
YP		MATERIAL STEEL-C1045, ANSI/ASTM A108	LEVER, TRIP ARM
TS		HEAT TREATMENT	
EL 2		FINAL PROTECTIVE FINISH SEE NOTE 2	SCALE 1/1
RA			UNIT WT
BH			DWG SIZE B — 5185161
RH	C30-45		SHEET COP
SEE ENGINEERING RECORDS			
NEXT ASSY	USED ON		
APPLICATION			
APPLY PART NO.			

DUPLICATE ORIGINAL DWG

A5185032

NOTICE — When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

PHYSICAL PROPERTIES	DO NOT APPLY PART NO. [redacted]	
YP	APPLICATION	
TS	NEXT ASSY	USED ON
EL2	[redacted] ENGINEERING	
RA	RECORDS	
BM		
RM		

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
B	←	9-27-60	
C	EO NO. ST2071	8-7-63	
D	NOR R17Q2026/171212	171221	BAC

THE ASSOCIATED SPRING CORPORATION, #C240-032-1000 SUPPLIED BY THE WALLACE BARNES DIVISION BRISTOL, CONN. HAS BEEN FOUND SATISFACTORY FOR USE IN THE PERFORMANCE OF THE FUNCTION REQUIRED. ANY SPRING COMPLYING WITH THE FUNCTIONAL REQUIREMENTS OF THE ABOVE MENTIONED ITEM MAY BE ACCEPTABLE IF FOUND SATISFACTORY AFTER EVALUATION BY THE RESPONSIBLE ENGINEERING AGENCY.

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

PART NO. 5185032
CODE IDENT NO. 00000

UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING AUG. 7, 1963	SPRING, TRIP LEVER	PROCUREMENT AND PRODUCTION GROUP
DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES	DRAFTSMAN WM CHECKED 8-8-63		U. S. ARMY MUNITIONS COMMAND FRANKFORD ARSENAL
MATERIAL	TRACED WM CHECKED		
HEAT TREATMENT	ENGR WLK ENGR		
FINAL PROTECTIVE FINISH	SUBMITTED J. L. Barr ENGR ORD CORPS	SCALE	DWG SIZE A — 5185032
	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E. A. Mathias ORD CORPS	UNIT WT	SHEET OF

OD 1181-1
1 APR 54

SAA IE

A5185031

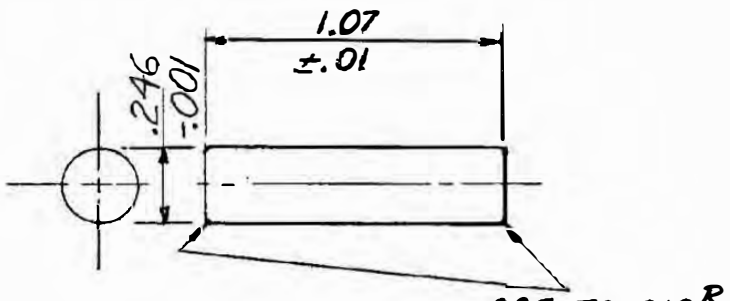
PHYSICAL PROPERTIES	
YP	
TS	
EL2	
RA	
BM	
RN	C50-55

DO APPLY PART NO.

APPLICATION	
NEXT ASSY	USED ON
SEE ENGINEERING RECORDS	

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
1	←	3-18-52	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185031 ECN NO. A 5502	3-18-60	
B	ECN # A6504 MICROFILM	9-27-60	
C2	E.O. NO. ST 2071	8-7-63	
D	NOR AOS0009.80-12-09 (ELPAOS0010 80-12-09)	820312	
F	NOR R17S2036/171126	171214	BAC

B



NOTE:-
1- FINISH ALL OVER 63

2—SPEC ANSI Y14.5 & ASME B46.1 APPLY.

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

CODE IDENT NO.
19200

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

PART NO. 5185031
~~TITLE IDENT NO. 00000~~

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ±1/64	ORIGINAL DATE OF DRAWING DEC 29, 1941	PLUNGER, TRIP LEVER	~~PROCUREMENT AND PRODUCTION CIRCUIT U.S. ARMY ARMAMENT COMMAND FRANKFORD ARSENAL~~
MATERIAL: STEEL-C.1095, ANSI/ASTM A108	DRAFTSMAN C.W.D. CHECKER		
HEAT TREATMENT HARDEN	TRACER C.W.D. CHECKER		
FINAL PROTECTIVE FINISH	ENGR ENGR		
	SUBMITTED C. N. Robert ENGR ORD CORPS		
	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E. A. Moore ORD CORPS	SCALE:- 2/1	DWG SIZE A — 5185031
		UNIT WT	SHEET OF

DO 1181-1
1 APR 54

SAA IE

ANNEX 12-E - APPENDIX 2

NATO M2 UNIVERSAL RECEIVER BREECHBLOCK ASSEMBLY DRAWINGS

Breechblock Assembly	8596714
Plate, Firing Pin, Universal Receiver, 7.62mm, 9mm, 12.7mm	12-(MC)-1*
Plate, Firing Pin, Universal Receiver, 4.6mm, 5.56mm, 5.7mm	12-(MC)-3*
Firing Pin, Universal Receiver, 4.6mm, 5.56mm, 5.7mm	12-(MC)-2*
Firing Pin, Universal Receiver, 7.62mm	12-(7.62mm)-4*
Firing Pin, Universal Receiver, 9mm	12-(9mm)-5*
Firing Pin, Universal Receiver, 12.7mm	12-(12.7mm)-3*
Bushing	10523411
Shim, Firing Pin Plate	8648330
Ball Plunger	8596715
Breechblock	8596713
Insert	8596712
Screw, Contact	8596711
Bushing, Insulation	8596709
Hammer	6173233
Retainer, Hammer Spring	5185168
Spring, Hammer	5185167
Spring, Firing Pin	5185166
Gage, Indicating, Firing Pin Protrusion For Small Arms Ammunition	10533828

***Drawings are provided in AEP-97, Volume 6.**

Table of Headspace Requirements

Calibre	Headspace Min (mm)	Headspace Max (mm)	Diameter Datum (mm)	Drawing* No. #
4.6 mm	32.35	32.5	N/A	12-(4.6mm)-7
5.56 mm	38.024	38.1	@ 7.663	12-(5.56mm)-7
5.7 mm	23.75	23.826	@ 7.00	12-(5.7mm)-7
7.62 mm	41.35	41.43	@ 10.16	12-(7.62mm)-6
9 mm	19.15	19.23	N/A	12-(9mm)-7
12.7 mm	79.58	79.84	@ 16.15	12-(12.7mm)-5

Table of Firing Pin Indent Requirements

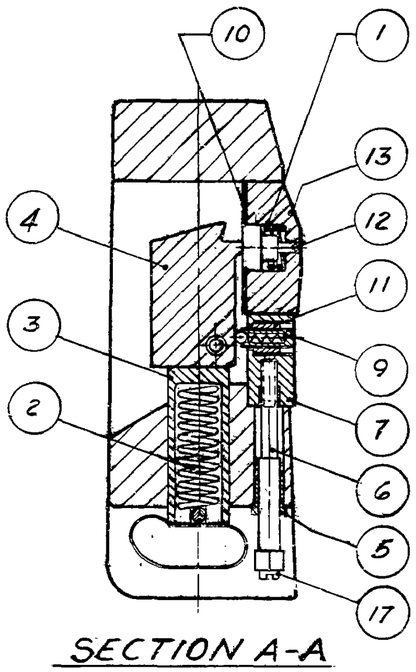
Calibre	Firing Pin Indent Min (mm)	Firing Pin Indent Max (mm)	Drawing* No. #
4.6 mm	0.45	0.65	12-(4.6mm)-6
5.56 mm	0.51	0.64	12-(5.56mm)-6
5.7 mm	0.51	0.64	12-(5.7mm)-6
7.62 mm	0.51	0.64	12-(7.62mm)-5
9 mm	0.28	0.38	12-(9mm)-6
12.7 mm	0.51	0.64	12-(12.7mm)-4

Table of Firing Pin Protrusion Requirements

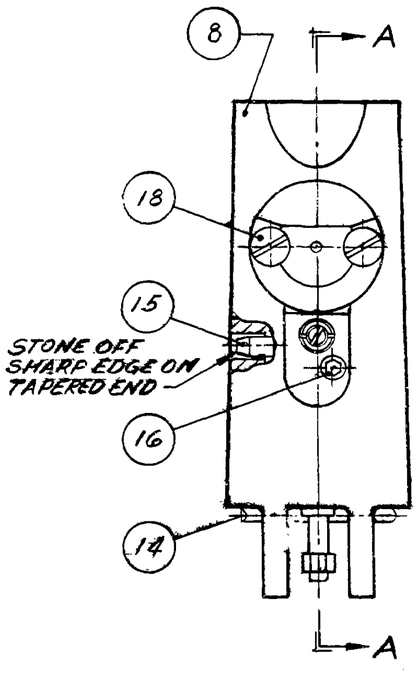
Calibre	Firing Pin Protrusion Min (mm)	Firing Pin Protrusion Max (mm)	Drawing* No. #
4.6 mm	0.76	0.99	10533828
5.56 mm	0.76	0.99	10533828
5.7 mm	0.76	0.99	10533828
7.62 mm	1.52	1.73	10533828
9 mm	0.89	0.94	10533828
12.7 mm	1.88	2.08	10533828

***Drawings are provided in AEP-97, Volume 6.**

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
E	REPLACES REV D WITH CHANGES E.O. ST 9149	8-8-69	
F	NOR R71Q2026/171212	171221	BAC



SECTION A-A



ITEM NO.	NOMENCLATURE OR DESCRIPTION	PART OR IDENT NO.	QTY REQD
18	SCREW, MACHINE, FILH, SLOTTED, .190-32 UNF-2A × 1/2 LG	MS-35266-63	2
17	SCREW, MACH, PAN HD, BRASS, .112-40UNC-2A × 1/4 LG	MS-35214-12	1
16	SCREW, CAP, SOCKET HEAD, .112-40UNC-3A × 1/2 LG	MS-16997-11	1
15	PIN, STRAIGHT, HEADLESS, .1886-.0002 DIA × 1 1/2 LG	MS-16556-45	1
14	PIN, COTTER, .120-.004 DIA, × 1 1/4 LG	MS-24665-372	1
13	PLATE, FIRING PIN 5.56 MM 7.62 MM, 9MM, CALIBERS .30. 38. 45 & .50	B 10524157 B 8595542	1
12	PIN, FIRING 5.56 MM CAL. 50 7.62 MM, 9MM, CALIBERS .30 .38 & .45	B 10524158 A 8596166 A 5185165	1
11	BUSHING	A 10523411	1
10	SHIM, FIRING PIN PLATE	B 8648330	AS REQD
9	BALL PLUNGER	A 8596715	1
8	BREECHBLOCK	C 8596713	1
7	INSERT	B 8596712	1
6	SCREW, CONTACT	B 8596711	1
5	BUSHING, INSULATION	A 8596709	1
4	HAMMER	B 6173233	1
3	RETAINER, HAMMER SPRING	A 5185168	1
2	SPRING, HAMMER	A 5185167	1
1	SPRING, FIRING PIN	A 5185166	1

LIST OF PARTS

PART No. 8596714

NOTE:
SEE DWG F10520043 FOR FUNCTIONAL REQUIREMENTS.

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

MIN. MECHANICAL PROPERTIES			
YS			
TS			
EL 2			
RA		F10520043	
BH		SEE ENGINEERING RECORDS	
RH		NEXT ASSY	USED ON
		APPLICATION	
		DO NOT APPLY PART NO.	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS ±
DECIMALS ± ANGLES ±
MATERIAL
HEAT TREAT
PROTECTIVE FINISH

ORIGINAL DATE MARCH 11, 1960
DRAFT N.W.H CHK Sam
TRACER CHK
ENGR ENGR
SUBMITTED
APPROVED W. W. Inglis

U. S. ARMY
FRANKFORD ARSENAL
PHILADELPHIA, PA. 19137

BREECHBLOCK ASSY
(ACTION TIME RECEIVER)

SIZE	CODE IDENT NO.	DRAWING NO.
C	19200	8596714

SCALE: 1/1 UNIT WT. SHEET 1 OF 1

SCA-IE

SHCTA Form 1073, 7 Jun 66
(Formerly SHCTA Form C3630)

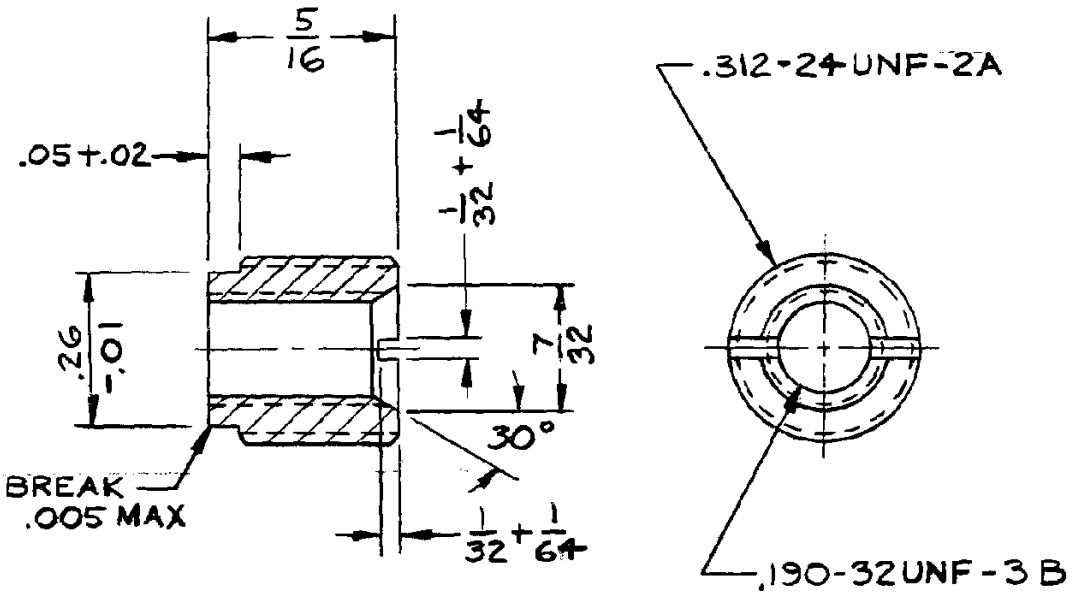
DO NOT ~~DO~~ APPLY PART NO.

APPLICATION

NEXT ASSY | USED ON

SEE ENGINEERING RECORDS

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	REPLACES ORIG WITH CHANGE SEE EO ST 8127	8-8-68	
B	NOR A05 0009, 80 1209 (ECP A05 0010 80 1209)	820312	
C	NOR R17Q2026/171212	171221	BAC



FINISH ALL OVER 63

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

PART No. 10523411

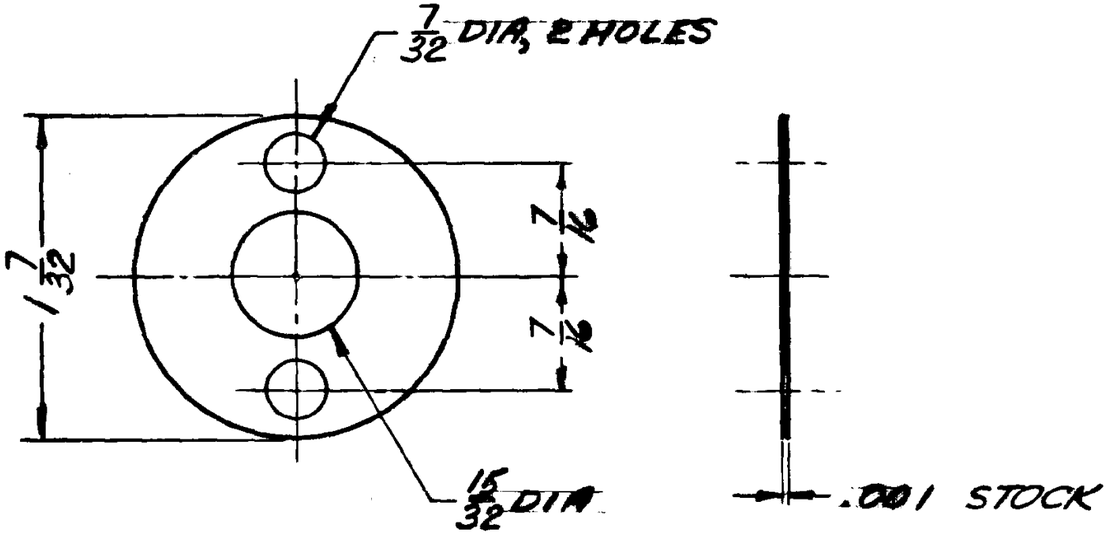
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	ORIGINAL DATE 7 AUG, 1963	~~U.S. ARMY~~ ~~FRANKFORD ARSENAL~~ ~~PHILADELPHIA, PA 19137~~	
TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64 .x ±2°	DRAFT / CHK		
MATERIAL:- STEEL C1020 ANSI/ASTM A575	TRACER / CHK	BUSHING	
HEAT TREAT	ENGR / ENGR		
PROTECTIVE FINISH	SUBMITTED / APPROVED W. W. Inglis	SIZE A / CODE IDENT NO. 19200 / DRAWING NO. 10523411	
		SCALE: 4/1 / UNIT WT. / SHEET 1 OF 1	

SCA-1E

SMUPA Form 1071, 7 Jan 66
(Formerly SMUPA Form C3818)

00 FORM 1 APR 54 1176-R

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	NOR R17Q2026/171212	171221	BAC



NOTES:-
1 - MATERIAL:- STEEL, SPEC. QQ-S-698.
2 - REMOVE ALL BURRS.

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

CODE IDENT. NO. 19200

		PHYSICAL PROPERTIES	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ±1/64	ORIGINAL DATE OF DRAWING 29 Sept 54	SHIM, FIRING PIN PLATE	QUALITY ASSURANCE DIRECTORATE U. S. ARMY PICATINNY ARSENAL	SCA-1
UNIV. REC.		YP	MATERIAL SEE NOTE 1	DRAWN R CHECKED [illegible]			
SEE ENGINEERING RECORDS		TS	HEAT TREATMENT	TRACED [illegible] CHECKED [illegible]			
NEXT ASSY	USED ON	EL 2	FINAL PROTECTIVE FINISH	ENGR [illegible] ENGR [illegible]			
APPLICATION		RA		SUBMITTED [signature] ORD CORPS			
DO NOT	APPLY PART NO.	BH		APPROVED BY ORDER OF THE CHIEF OF ORDNANCE W. W. Inglis	SCALE 2:1 UNIT WT	SIZE B	8648330
		RH				SHEET 1 OF 1	

A8596715

NOTICE.—When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

PHYSICAL PROPERTIES	
YP	
TS	
EL2	
RA	
BM	
RM	

DO NOT APPLY PART NO. [redacted]

APPLICATION	
NEXT ASSY	USED ON
SEE ENGINEERING RECORDS	

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	REDRAWN WITH CHANGES ECN NO. A8123	10-13-61	
B[2]	E.O. NO FA85861	8-7-63	M
C[2]	EO NO. ST5011	4-13-65	
D	NOR R17Q2026/171212	171221	BAC

B

C THE VLIER ENGINEERING CORPORATION, BALL PLUNGER BL-52N SUPPLIED BY THE VLIER ENGINEERING CORPORATION, SUB. OF BARRY CONTROLS INC. 8900 SANTA MONICA BLVD., LOS ANGELES 46, CALIFORNIA HAS BEEN FOUND SATISFACTORY FOR USE IN THE PERFORMANCE OF THE FUNCTION REQUIRED.
ANY BALL PLUNGER COMPLYING WITH THE FUNCTIONAL REQUIREMENTS OF THE ABOVE MENTIONED ITEM MAY BE ACCEPTABLE IF FOUND SATISFACTORY AFTER EVALUATION BY THE RESPONSIBLE ENGINEERING AGENCY.

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

C

B CODE IDENT NO. 19200
PART NO. 8596715

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES	ORIGINAL DATE OF DRAWING MARCH 11, 1960	BALL PLUNGER	PROCUREMENT AND PRODUCTION GROUP U. S. ARMY WEAPONS COMMAND FRANKFORD ARSENAL
MATERIAL	DRAFTSMAN JOE CHECKER [illegible]		
HEAT TREATMENT	TRACER JOE CHECKER		
FINAL PROTECTIVE FINISH	ENGR C.W.H. ENGR C.F. SUBMITTED John B. Barr ENGR. ORD CORPS APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E.Q. Mathews ORD CORPS	SCALE UNIT WT	DWG SIZE A 8596715 SHEET OF

OO 1181-1
1 APR 54

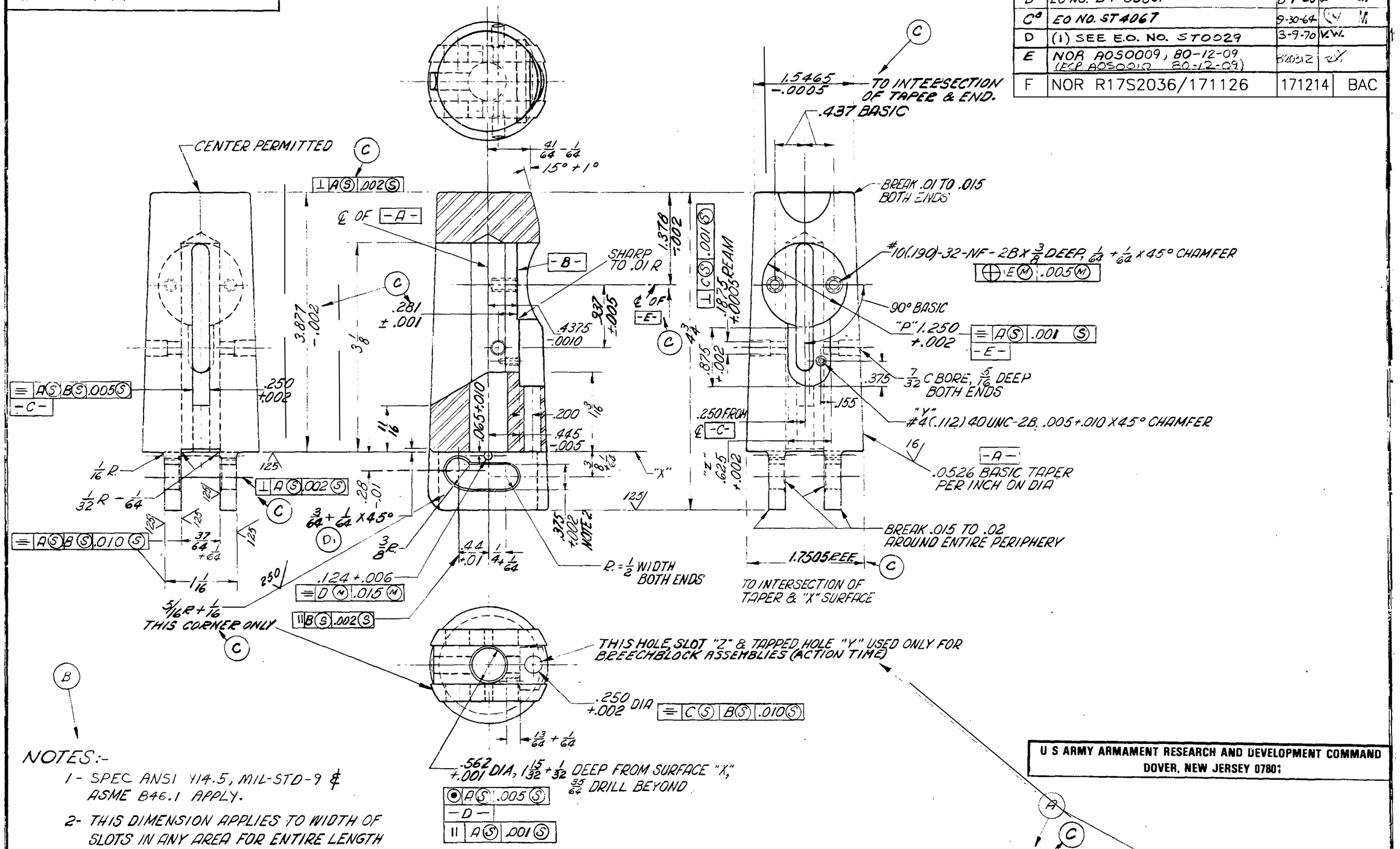
ARMY-RARITAN ARSENAL (NMPC), METUCHEN, N.J.-30-179

00 FORM APR 54 1177-1

|C| 8596713

NOTICE.--When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A[2]	ECN NO. A 81120	10-13-61	..
B[3]	EO NO. ST 85861	8-7-63	WSK M
C[0]	EO NO. ST 4067	9-30-64	[illegible]
D	(1) SEE E.O. NO. ST0029	3-9-70	V.W.
E	NOR A0S0009, 80-12-09 (ECP A0S0010 80-12-09)	820312	RV
F	NOR R17S2036/171126	171214	BAC



NOTES:-

1- SPEC ANSI Y14.5, MIL-STD-9 & ASME B46.1 APPLY.

2- THIS DIMENSION APPLIES TO WIDTH OF SLOTS IN ANY AREA FOR ENTIRE LENGTH

3- FINISH ALL OVER 63 EXCEPT AS NOTED

U S ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

CODE IDENT NO. 19200
PART NO. 8596713

PHYSICAL PROPERTIES: YP, TS, EL2, RA, BH, RH	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES; TOLERANCES ON FRACTIONS ±1/64, DECIMALS ±.005, ANGLES —; MATERIAL STEEL-FS-4150, ANSI/ASTM A322; HEAT TREATMENT —; FINAL PROTECTIVE FINISH BLACK OXIDE, SPEC MIL-C-13924	ORIGINAL DATE OF DRAWING MARCH 11, 1960; DRAFTSMAN W.A.B. CHECKER; TRACER W.A.B. CHECKER; ENGR W.D.H. ENGR; SUBMITTED ENGR ORD CORPS; APPROVED BY ORDER OF THE CHIEF OF ORDNANCE ORD CORPS	BREECHBLOCK
SEE ENGINEERING RECORDS; NEXT ASSY; USED ON; APPLICATION; APPLY PART NO.; DO		SCALE 1/1	UNIT WT
PROCUREMENT FROM PRODUCTION SOURCE IS NOW MADE FROM CONTRACTOR FURNISHED DRAWING		DWG SIZE C	8596713 SHEET OF

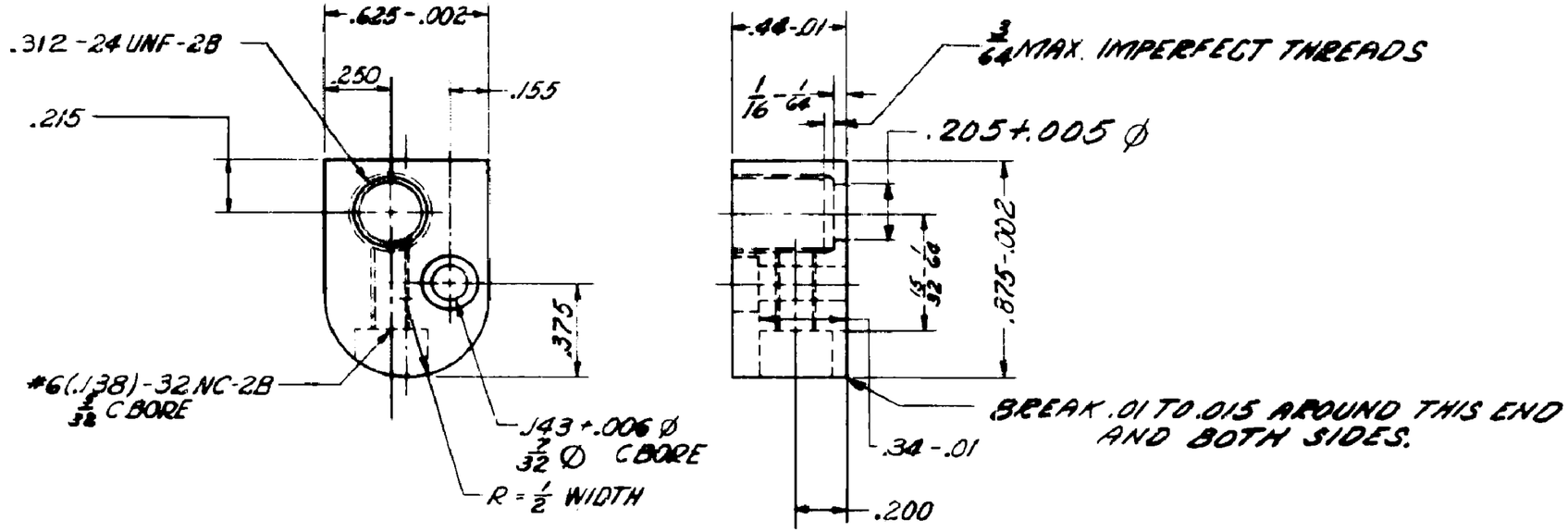
ARMY-RARITAN ARSENAL (NNPC) METUCHEN, NJ-08-187

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

OO Form 1176-1
1 Oct 54

B 8596712

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	← →	10-13-61	
B	REDRAWN WITH CHANGES. ED NO. FA 85961	8-7-63	OEK
C	NOR A0S0009, 80-12-09	820312	DR
D	NOR M5Q2004 950308	960420	JB
E	NOR R17Q2026/171212	171221	BAC



NOTES:-

1 - SPEC ANSI Y14.5, MIL-STD-9 & ANSI B46.1 APPLY.

2- FINISH ALL OVER 63

CURRENT DESIGN ACTIVITY CADE CODE 19200
U.S. ARMY
ARMAMENT RESEASE, DEVELOPMENT AND ENGINEERING CENTER
PICATINNY ARSENAL, NEW JERSEY 07806-5000

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

PART NO. 8596712
~~CODE IDENT NO. 00000~~

SEE ENGINEERING RECORDS		PHYSICAL PROPERTIES	UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING MARCH 11, 1960	INSERT
NEXT ASSY	USED ON	YP	DIMENSIONS ARE IN INCHES	DRAFTSMAN	CHECKER
APPLICATION		TS	TOLERANCES ON FRACTIONS ±1/64 DECIMALS ±.005 ANGLES	TRACER	CHECKER
DO NOT SCALE	APPLY PART NO	EL 2	MATERIAL PLASTIC SPEC MIL-I-24768/14	ENGR	ENGR
		RA	HEAT TREATMENT	SUBMITTED John B. Starr ENGR ORD CORPS	
		BH	FINAL PROTECTIVE FINISH	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E. A. Mattus ORD CORPS	SCALE 2 UNIT WT
		RH			

~~PROCUREMENT AND PRODUCTION GROUP~~

DWG SIZE B | 8596712 | SHEET OF

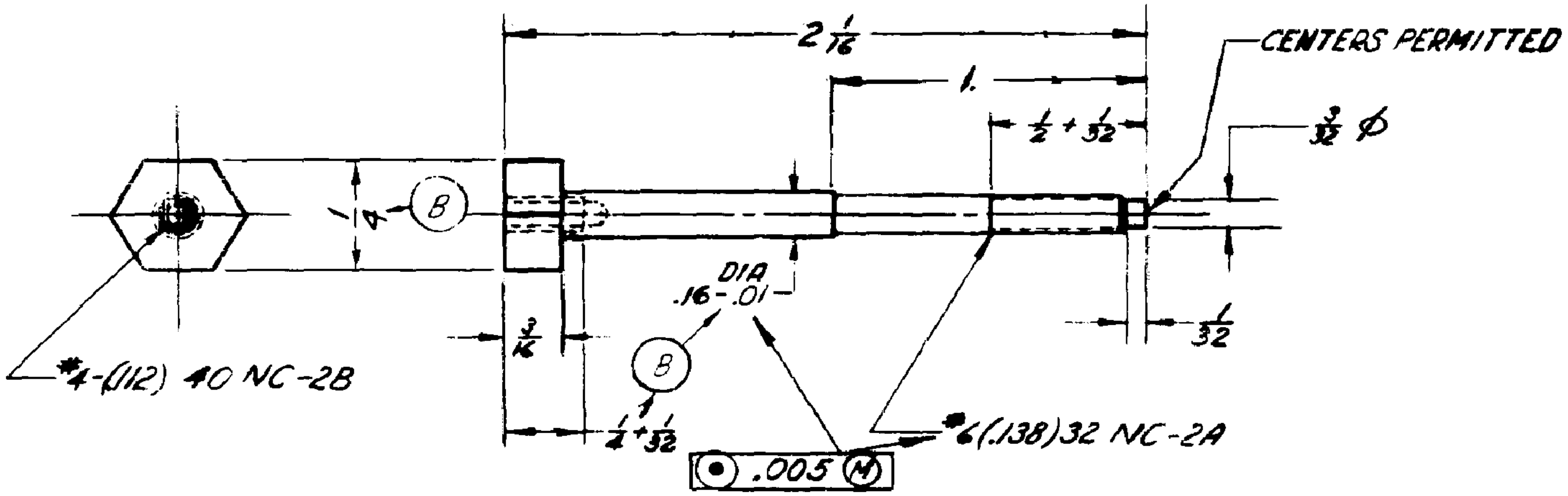
SEE IE

OO FORM 1 APR 54 1176

B 8596711

NOTICE — WHEN GOVERNMENT DRAWINGS, SPECIFICATIONS, OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE UNITED STATES GOVERNMENT THEREBY INCURS NO RESPONSIBILITY NOR ANY OBLIGATION WHATSOEVER AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED, OR IN ANY WAY SUPPLIED THE SAID DRAWINGS, SPECIFICATIONS OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS IN ANY MANNER LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE, OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO.

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A²	ECN NO. A8065	10-3-61	M
B₅	EO NO. FA85861	8-7-63	[illegible]
C	NOR A050009, 80-12-09	820312	[illegible]
D	NOR M5Q2004 950308	960420	JB
E	NOR R17Q2026/171212	171221	BAC



NOTES:-
1-SPEC ANSI Y14.5, MIL-STD-9 & ANSI B46.1 APPLY.
2-FINISH ALL OVER 63

CURRENT DESIGN ACTIVITY CADE CODE 19200
U.S. ARMY
ARMAMENT RESEASE, DEVELOPMENT AND ENGINEERING CENTER
PICATINNY ARSENAL, NEW JERSEY 07806-5000

DISTRIBUTION STATEMENT A
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DISTRIBUTION IS UNLIMITED.

~~CODE IDENT NO. 00000~~
PART NO. 8596711

SEE ENGINEERING RECORDS

NEXT ASSY	USED ON
APPLICATION	
[redacted] APPLY PART NO.	
DO	[redacted]

PHYSICAL PROPERTIES: YP, TS, EL %, RA, BH, RH

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ± 1/64 DECIMALS ANGLES

MATERIAL COMM BRASS ROD, COMPOSTION 22, HALF HARD SPEC ASTM-B36

HEAT TREATMENT

FINAL PROTECTIVE FINISH

ORIGINAL DATE OF DRAWING MARCH 11 1947
DRAFTSMAN [illegible] CHECKER [illegible]
TRACER [illegible] CHECKER [illegible]
ENGR [illegible] ENGR [illegible]
SUBMITTED [signature] FA&P ORD CORPS
APPROVED BY ORDER OF THE CHIEF OF ORDNANCE [signature] ORD CORPS

SCREW, CONTACT

~~PROCUREMENT AND PRODUCTION GROUP U.S. ARMY MUNITIONS COMMAND FRANKFORD ARSENAL~~

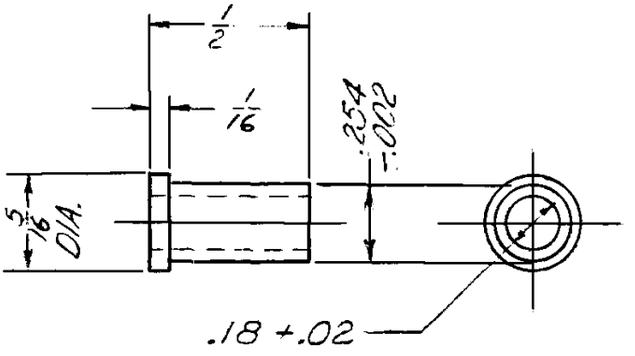
DWG SIZE B 8596711

SCALE:- 4 | UNIT WT | SHEET OF

A8596709

PHYSICAL PROPERTIES	DO NOT APPLY PART NO.
YP	APPLICATION
YS	NEXT ASSY USED ON
EL2	SEE ENGINEERING RECORDS
RA	
RM	
RV	

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A[1]	ECN NO. A8062	10-13-61	[illegible] M
B[2]	EO NO. FA85861	8-7-63	RK M
C	NOR M5Q2004 950308	960420	JB
D	NOR R17Q2026/171212	171221	BAC



DISTRIBUTION STATEMENT A
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U.S. ARMY
ARMAMENT RESEASE, DEVELOPMENT AND ENGINEERING CENTER
PICATINNY ARSENAL, NEW JERSEY 07806-5000

CODE IDENT NO. 00000
PART NO. 8596709

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ±1/64	ORIGINAL DATE OF DRAWING MARCH 11 1960	BUSHING, INSULATION	PROCUREMENT AND PRODUCTION GROUP U.S. ARMY MUNITIONS COMMAND FRANKFORD ARSENAL
MATERIAL PLASTIC MIL-I-24768/14	DRAFTSMAN A.O.B. CHECKER [illegible] TRACER A.O.B. CHECKER [illegible] ENGR [illegible] ENGR [illegible]		
HEAT TREATMENT	SUBMITTED [illegible] ENGR ORD CORPS		
FINAL PROTECTIVE FINISH	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E.A. Whitman ORD CORPS	SCALE 2/1 UNIT WT	DWG SIZE A — 8596709 SHEET OF

STAN 18

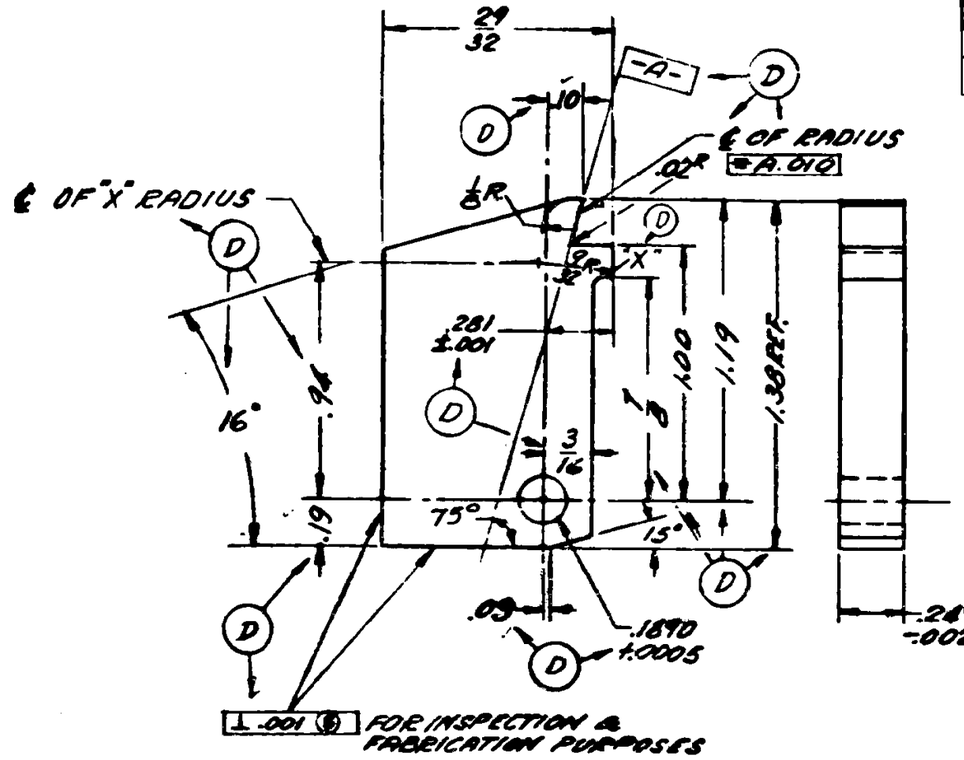
DD 1181-1
1 APR 54

ARMY-RARITAN ARSENAL (NRPCI, METUCHEN, N.J.)

DD Form 1378-2
1 Oct 96

B6173233

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
C	———	10-13-61	
D,	REDRAWN & REVISED EO NO. ST 2071	8-7-63	DBK
E	NOR A05O009, 80-12-09 (ECP A05O010 80-12-09)	820312	RH
F	NOR R17S2036/171126	171214	BAC



NOTES:-
1—SPECIFICATION ANSI Y14.5 & ASME B46.1 APPLY.
2-FINISH ALL OVER 63

CODE IDENT NO.
19200

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

DISTRIBUTION STATEMENT A
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(D) ~~CODE IDENT NO 19200~~ PART NO. 6173233

		PHYSICAL PROPERTIES		UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING SEPT. 10 1941			
		YP		DIMENSIONS ARE IN INCHES	DRAFTSMAN G.L.A.	CHECKER [illegible]	HAMMER	~~[illegible]~~
		TS		TOLERANCES ON FRACTIONS ±1/64 DECIMALS ±.01 ANGLES ±1°	TRACER J.V.B	CHECKER [illegible]		
SEE ENGINEERING RECORDS		EL 2		MATERIAL STEEL-C1095 ANSI/ASTM A108	ENGR [illegible]	ENGR		
		RA			SUBMITTED [illegible] ENGR OCD CDRR			
NEXT ASSY	USED ON	BH		HEAT TREATMENT HARDEN-QUENCH IN OIL	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E.A. Mattson CDRR			
APPLICATION		RH	C50-32	FINAL PROTECTIVE FINISH COATING-BLACK OXIDE SPEC. MIL-C-13924			SCALE: 2/1	UNIT WT.
[redacted]	APPLS PART NO							
[redacted]								

~~[illegible]~~

DWG SIZE	
B	6173233
SHEET	OF

DUPLICATE ORIGINAL DWG

A 5185168

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PHYSICAL PROPERTIES	
YP	
TS	
EL2	
RA	
BM	
RM	RC 12-46

APPLY PART NO. [redacted] DO [redacted]

APPLICATION	
NEXT ASSY	USED ON
SEE ENGINEERING RECORDS	

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
3	←	3-10-52	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185168 ECN NO A5297	1-20-60	
B[2]	ECN* A8058	10-13-61	M
C[2]	E.O. NO. ST 2071	8-7-63	M
D	NOR A0S0009, 80-12-09 (EXCEPT A0S0010 — 80-12-09)	820312	M
E	NOR R17S2036/171126	171214	BAC

DISTRIBUTION STATEMENT A
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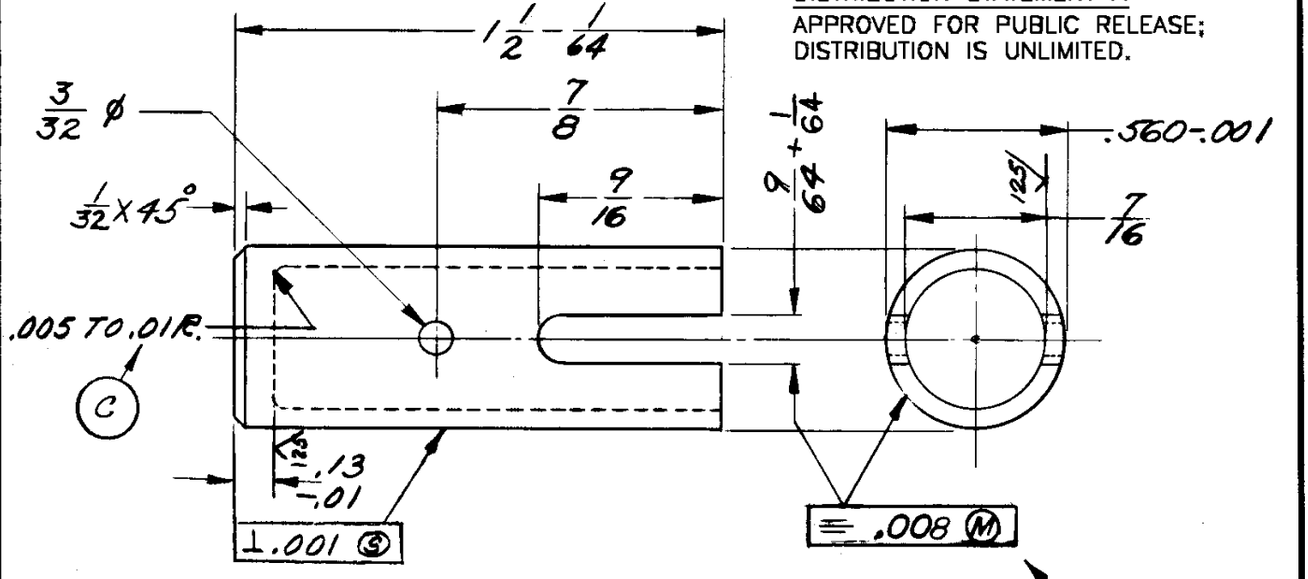
DISTRIBUTION IS UNLIMITED.



NOTES:-
1- FINISH ALL OVER 63 EXCEPT AS NOTED
2—SPEC ANSI Y14.5 & ASME B46.1 APPLY.

CODE IDENT NO. 19200
US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

PART NO. 5185168

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64	ORIGINAL DATE OF DRAWING SEPT. 10, 1941	RETAINER, HAMMER SPRING
MATERIAL STEEL - FS 1095, ANSI/ASTM A108	DRAFTSMAN [illegible] CHECKER [illegible]	PROCUREMENT AND PRODUCTION GROUP U.S. ARMY MUNITIONS COMMAND FRANKFORD ARSENAL
HEAT TREATMENT HARDEN	TRACER [illegible] CHECKER [illegible]	
FINAL PROTECTIVE FINISH BLACK OXIDE	ENGR [illegible] ENGR [illegible]	
	SUBMITTED A. M. Gehrt ENG ORD CORPS	
	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E. B. Wolbrun ORD CORPS	
SCALE 2/1	DWG SIZE A	5185168
UNIT WT		SHEET OF

SAAIE

OO 1181-1
1 APR 54

ARMY-RARITAN ARSENAL (NMPC), METUCHEN, NJ-88-178

A5185167

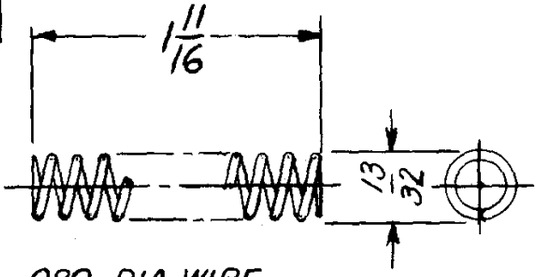
PHYSICAL PROPERTIES	
YP	
TS	
EL2	
RA	
BM	
RM	

DO NOT APPLY PART NO. [redacted]

APPLICATION	
NEXT ASSY	USED ON
SEE ENGINEERING RECORDS	

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
3	← →	3-10-52	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185167-ECN NO. A5295	1-20-60	Eng M
B[2]	ECN NO A 8059	10-13-61	JMB
C[2]	E.O. NO. ST 2071	8-7-63	M M
D[2]	E.O. NO. SQ 6135	6-17-66	M M
E	NOR R17Q2026/171212	171221	BAC

FREE LENGTH



.080 DIA WIRE
12 ACTIVE COILS
12 TOTAL COILS
DIRECTION OF HELIX OPTIONAL
LOAD AT COMPRESSED LENGTH
OF 1.25 = 62 # ± 6 #
SOLID LENGTH .972 MAX
OPEN ENDS GROUND SQUARE WITHIN
3° IN FREE POSITION

DISTRIBUTION STATEMENT A
APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION IS UNLIMITED.

PART NO 5185167
CODE IDENT NO. 19200

UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING SEPT 10, 1941	SPRING, HAMMER	PROCUREMENT AND PRODUCTION GROUP
DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64	DRAFTSMAN W S.M. CHECKER		U. S. ARMY MUNITIONS COMMAND FRANKFORD ARSENAL
MATERIAL MUSIC WIRE SPEC QQ-W-470	TRACER W S.M. CHECKER		
HEAT TREATMENT	ENGR ENGR		
FINAL PROTECTIVE FINISH	SUBMITTED ENG ORD CORPS		
	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E. A. Mathias ORD CORPS	SCALE 1/1	DWG SIZE A — 5185167
		UNIT WT	SHEET OF

SCA-IF

IO 1181-4
APR 54

ARMY-RARITAN ARSENAL (NMPC), METUCHEN, NJ-58-178

A 5185166

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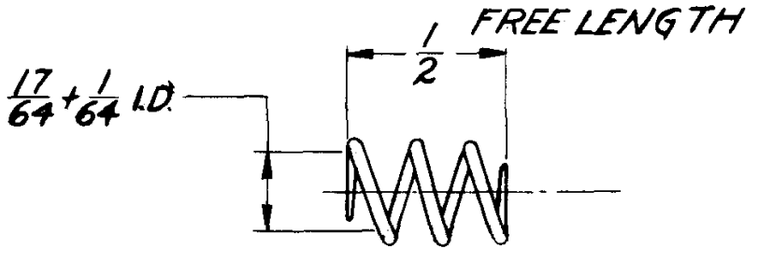
PHYSICAL PROPERTIES	
YP	
TS	
EL2	
RA	
BM	
RM	

DO NOT APPLY PART NO. [redacted]

APPLICATION	
NEXT ASSY	USED ON
SEE ENGINEERING RECORDS	

REVISIONS

SYM	DESCRIPTION	DATE	APPROVAL
3	← →	3-10-52	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON A185166 ECN NO. A 5291	1-20-60	
B[2]	ECN NO. A8056	10-13-61	
C	E.O. NO. ST 2071	8-7-63	
D	NOR R17Q2026/171212	171221	BAC



.028 DIA. WIRE
3 ACTIVE COILS
4 TOTAL COILS
DIRECTION OF HELIX OPTIONAL
LOAD AT COMPRESSED LENGTH
OF .31 = 1.7 # ± 3 OZS
SOLID LENGTH .11 MAX
ENDS GROUND SQUARE
WITHIN 3° IN FREE POSITION

DISTRIBUTION STATEMENT A
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DISTRIBUTION IS UNLIMITED.

PART NO. 5185166
CODE IDENT NO. 00000

UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING SEPT. 10 1941	SPRING, FIRING PIN	PROCUREMENT AND PRODUCTION GROUP
DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64	DRAFTSMAN [illegible] CHECKER [illegible]		U. S. ARMY MUNITIONS COMMAND FRANKFORD ARSENAL
MATERIAL MUSIC WIRE COMP-B SPEC QQ-W-470	TRACER 106 CHECKER [illegible]		
HEAT TREATMENT	ENGR [illegible] ENGR [illegible]		
FINAL PROTECTIVE FINISH	SUBMITTED A. N. Getzil ORD CORPS	SCALE = 2/1	DWG SIZE A — 5185166
	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E. A. Mathias ORD CORPS	UNIT WT	SHEET OF

SAA IE

00 1161-1
1 APR 54

ARMY-RARITAN ARSENAL (NMPC), METUCHEN, NJ-58-178

A 8596166

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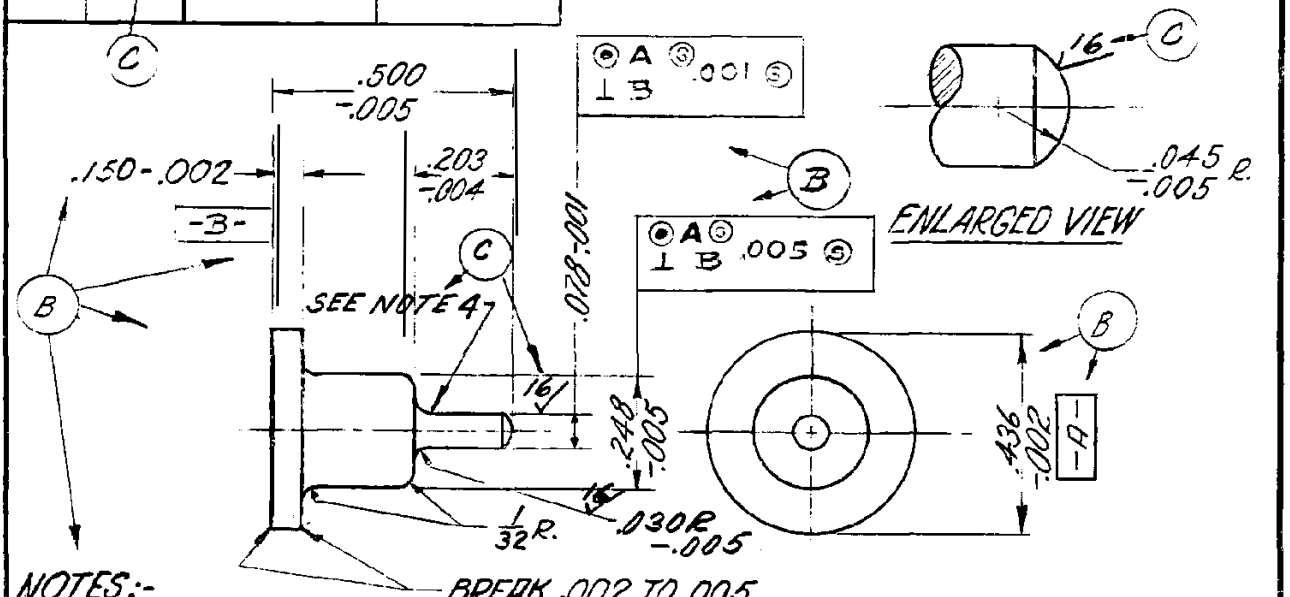
PHYSICAL PROPERTIES		APPLY PART NO.
YP		DO
TS		APPLICATION
EL2		NEXT ASSY / USED ON
RA		SEE ENGINEERING RECORDS
BM		
RH	C41-45	

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A3	ECN NO. A 8064	10-13-61	
B5	EO NO. ST 2071	8-7-63	
C6	EO NO. ST 5004	2-12-65	
D	NOR A05000-9 801209 (REF A05000-10 801209)	820312	
E	NOR R17S2036/171126	171214	BAC



NOTES:-

1- SPECS ANSI Y14.5 & ASME B46.1 APPLY

2- COATING, BLACK OXIDE, SPEC MIL-C-13924

3- FINISH 63 EXCEPT AS NOTED.

A-RADIUS MUST BLEND SMOOTHLY WITH DIAMETER

BREAK .002 TO .005

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
DOVER, NEW JERSEY 07801

DISTRIBUTION STATEMENT A
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CODE IDENT NO. 19200
PART NO. 8596166

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64	ORIGINAL DATE OF DRAWING OCT. 20, 1959	PIN, FIRING, CAL .50 & CAL.50 SPOTTER-TRACER
MATERIAL STEEL AISI 4140 ANSI/ASTM A322	DRAFTSMAN H.O.B. CHECKER	~~PROCUREMENT AND PRODUCTION GROUP U.S. ARMY MUNITIONS COMMAND PICATINNY ARSENAL~~
HEAT TREATMENT HARDEN	TRACER H.O.B. CHECKER	
FINAL PROTECTIVE FINISH SEE NOTE 2	ENGR ENGR SUBMITTED O.N. Gulick ENGR. ORD CORPS	
	APPROVED BY ORDER OF THE CHIEF OF ORDNANCE ORD CORPS	SCALE :- 3/1, 10/1
		UNIT WT
		DWG SIZE A
		8596166
		SHEET OF

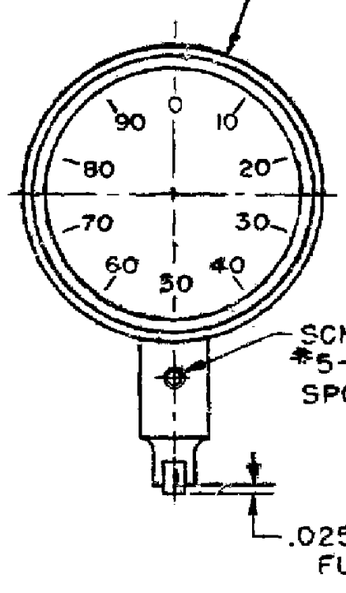
SAA 1

OO 1181-1
1 APR 54

ARMY-RARITAN ARSENAL (NMPC), METUCHEN, NJ-58-178

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	REDRAWN WITH CHANGE EO ST 7140	9-19-67	
B	NOR R10S2052/101207	110127	JTD

DIAL INDICATOR, AGD GROUP 2, RANGE .250, CONTINUOUS DIAL GRAD IN .001, FLAT BACK, HARDENED STAINLESS STEEL STEM, LUFKIN INSTRUMENTS MODEL P28D OR EQUAL



ASSEMBLY

NOTE:
1. SPEC MIL-G-10944 & MIL-I-18422 APPLY.
2. APPLY PART NO. ON INDICATOR BACK.
3. FINISH 63 EXCEPT AS NOTED.

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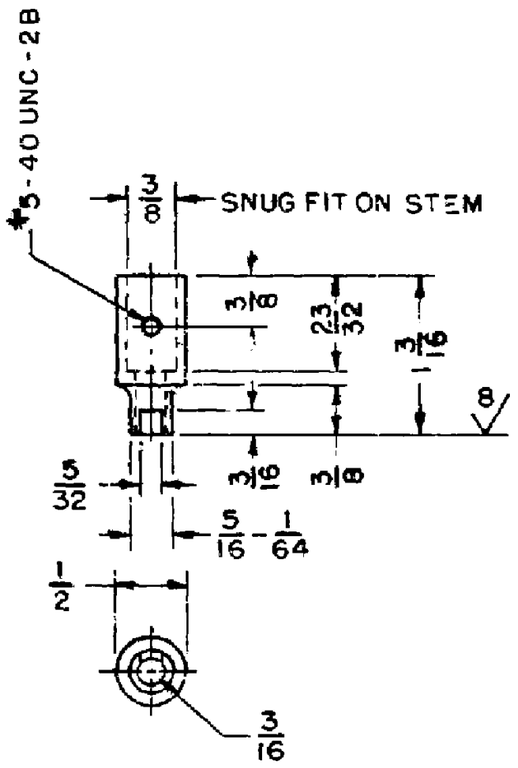
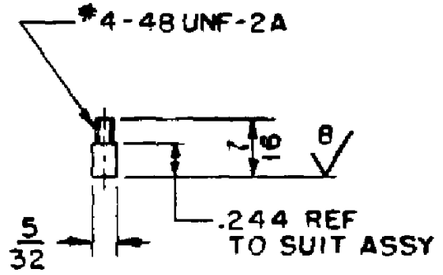


BODY

TOOL STEEL
HDN TO ROCK. C60-63



CONTACT POINT

TOOL STEEL
HDN TO ROCK. C60-63

PART NO. 10533828

MIN. MECHANICAL PROPERTIES			UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	ORIGINAL DATE MAR 11, 1964	U.S. ARMY FRANKFORD ARSENAL PHILADELPHIA, PA. 19137
YS			TOLERANCES ON FRACTIONS ±1/64 DECIMALS ± ANGLES ±	DRAFT CHK	GAGE, INDICATING, FIRING PIN PROTRUSION FOR SMALL ARMS WEAPONS
TS			MATERIAL	TRACER CHK	
EL 2		SEE ENGINEERING RECORDS		ENGR ENGR	
RA		NEXT ASSY USED ON	HEAT TREAT	SUBMITTED	SIZE B / CODE IDENT NO. 19200 / DRAWING NO. 10533828
BH		APPLICATION		APPROVED W.W. Jones	SCALE: 1/1 / UNIT WT. / SHEET 1 OF 1
RH		DO APPLY PART NO.	PROTECTIVE FINISH		

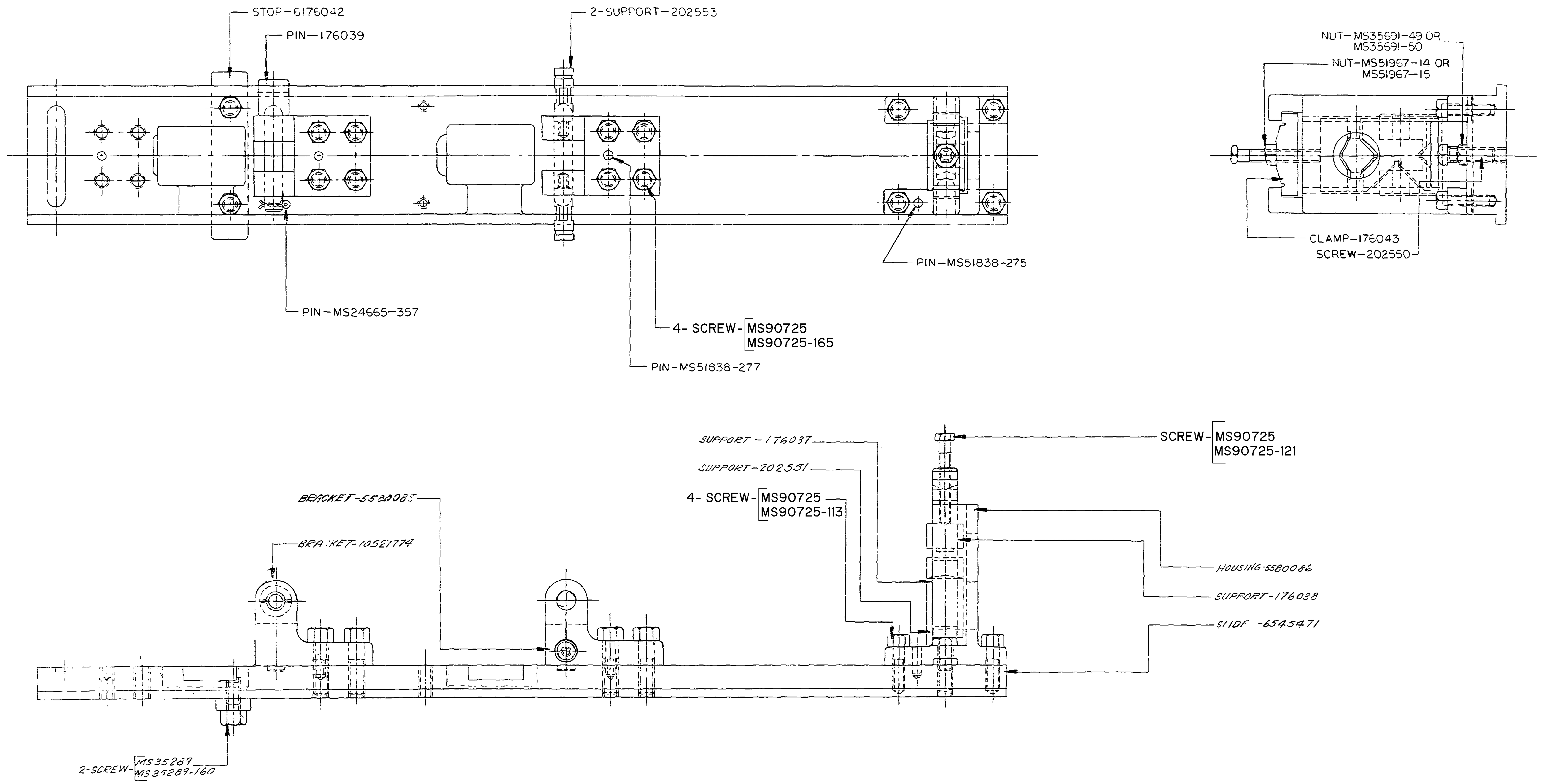
SBCA - III

SBUFFR Form 1072, 2 Jan 68
(Formerly SBUFFA Form C3819)

ANNEX 12-E - APPENDIX 3

NATO M2 UNIVERSAL RECEIVER DRAWINGS

Slide, Recoil, Receiver, Universal, M2, Assembly (4.6mm, 5.56mm, 5.7mm, 7.62mm, 9mm)	6545470
Slide, Recoil, Receiver, Universal, M2, Assembly (12.7mm)	10521773



CURRENT DESIGN ACTIVITY CAGE CODE 19200
U. S. ARMY
ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
PICATINNY ARSENAL, NEW JERSEY 07806-5000

SYM	DESCRIPTION	DATE	APPROVAL
G	NOR R17Q2026/171212	171221	BAC
F	NOR R11S2070/111123	111215	BMG
E	NOR M6Q2019 960719	961010	HJS
D	ERR Z9Z1169J (ECP A6S0014/860627)	891016	
C	E.O. No. ST 3149	1-24-64	
B	E.O. NO. FA85855	4-4-62	
A	REDRAWN WITH CHANGES FORMERLY SHOWN ON D 45470 ECN NO-A 8171	10-13-61	
7		11-16-60	

REVISIONS

NEXT ASSY	USED ON
F10521994	FIXTURE, TEST, PRESSURE NATO, CAL 7.62MM ASSEMBLY
49-6-42A	TEST, RECOIL, ELECTRIC UNIV. NATO, CAL 7.62 MM 30 & 50 ASSY
D7692115	SLIDE, RECOIL MULTIPLE PURPOSE ASSEMBLY
F7553908	FIXTURE TEST PRESSURE CAL .38 ASSEMBLY
F10520303	FIXTURE, TEST, VELOCITY CAL .38 ASSEMBLY
SEE ENGINEERING RECORDS	

APPLICATION

DO NOT APPLY PART NO. AS SPECIFIED

PHYSICAL PROPERTIES: YP, TS, EL 2, RA, RH

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS, ANGLES, FRACTIONS
MATERIAL
HEAT TREATMENT
FINAL PROTECTIVE FINISH

ORDNANCE PART NO. 6545470

ORIGINAL DATE OF DRAWING JUNE 16, 1942
DRAFTSMAN H.J.B.
TRACER
ENGINEER J.W.H. ENGINEER C.F.
SUBMITTED JOHN G. BARR ORD CORPS
APPROVED BY ORDER OF THE CHIEF OF ORDNANCE E.A. MATHIAS ENGR ORD CORPS

SLIDE, RECOIL RECEIVER, UNIVERSAL, M2, ASSEMBLY

INDUSTRIAL GROUP
ORDNANCE CORPS
DEPT OF THE ARMY
U. S. ARMY ORD ARSENAL FRANKFORD

CODE IDENT No 19200
DWG SIZE F
6545470
SCALE 1-2
UNIT WT
SHEET OF

DISTRIBUTION STATEMENT A
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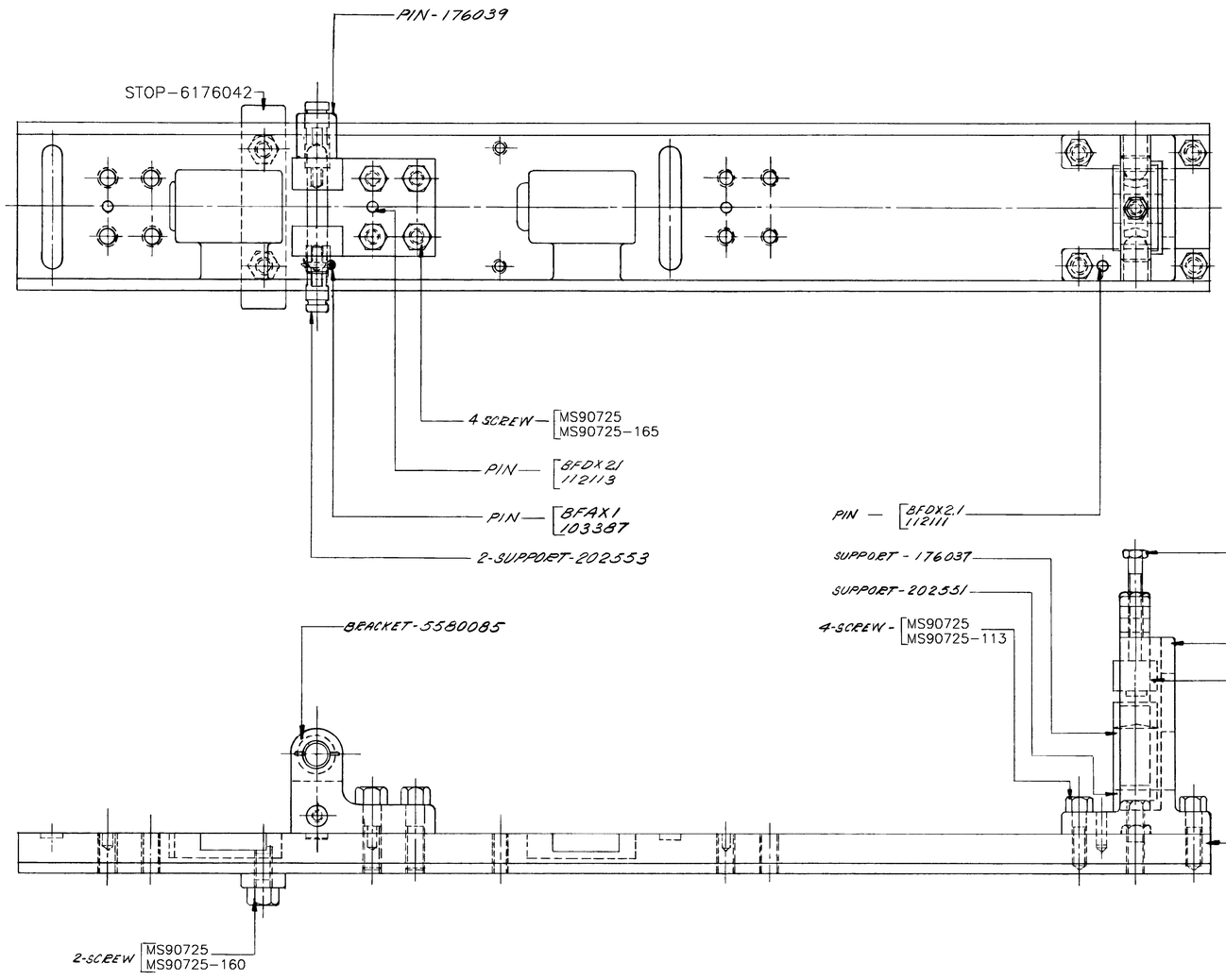
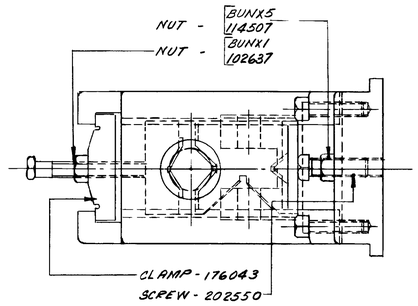
SCANNED DUPLICATE ORIGINAL

F/10521773





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PICATINNY ARSENAL, NEW JERSEY 07806-5000

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SYM	DESCRIPTION	DATE	APPROVAL
C	NOR R11S2020 110705	110718	RLV
B	NOR R08S2075/090623	090630	JTD
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REVISIONS

PHYSICAL PROPERTIES	
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NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 13

CLIMATIC STORAGE TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

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NATO STANDARDIZATION OFFICE (NSO)

13.1 Applicability

4.6mm, 5.56mm, 5.7mm, 7.62mm, 9mm and 12.7mm ammunition submitted for Qualification Approval testing shall be subjected to the Climatic Storage Test Procedure defined in this volume.

13.2 NATO Requirements

After the ammunition under test has been subjected to Climatic Conditioning as defined in paragraphs 13.5.1, 13.5.2 and 13.5.3 (Exposed Desert, Continuous Heating & Continuous Arctic) it shall meet the performance requirements listed in the table below:

Requirements	4.6mm	5.56mm	5.7mm	7.62mm	9mm	12.7mm
CASE MOUTH PRESSURE						
Maximum Corrected Mean Case Mouth Pressure + 3 Std Dev	480 MPa	465 MPa	370 MPa	465 MPa	305 MPa	470 MPa
Maximum Difference (∆) between Mean of Treated & Untreated Samples	+ 50 MPa to - 50 MPa	+ 50 MPa to - 50 MPa	+ 45 MPa to - 45 MPa	+ 50 MPa to - 50 MPa	+ 50 MPa to - 50 MPa	+ 50 MPa to - 50 MPa
VELOCITY						
Maximum Difference (∆) between Mean of Treated & Untreated Samples	+ 25 m/s to - 25 m/s	+ 20 m/s to - 20 m/s	+ 20 m/s to - 20 m/s	+ 20 m/s to - 20 m/s	+ 20 m/s to - 20 m/s	+ 20 m/s to - 20 m/s
ACTION TIME						
Maximum Mean Action Time + 5 Std Dev at - 54 °C	4 ms	3 ms	2 ms	4 ms	3 ms	4.5 ms
TERMINAL EFFECTS						
Minimum percentage of the treated sample that shall meet the requirements for Explosive Bullets as specified in AEP-97, Volume 19	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	80 %
Minimum percentage of the treated sample that shall meet the requirements for Incendiary Bullets as specified in AEP-97, Volume 19	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	80 %
TRACE						
Minimum percentage of the treated sample that shall meet both the Distance and Quality requirements as specified in AEP-97, Volume 22	No Require-ment	70 %	70 %	70 %	No Require-ment	70 %
WATERPROOF						
Maximum permitted percentage of the treated samples displaying leaks of any type as specified in AEP-97, Volume 26	15 %	15 %	15 %	15 %	15 %	15 %

13.3 Ammunition Quantity[1]

The tests to be conducted after climatic conditioning and the ammunition quantity to be used for each test are listed in the table below. If an ammunition quantity is not listed then the test is not required. NATO Reference Ammunition conditioned to + 21 °C is also required for the EPVAT tests to ensure correct functioning of equipment and to correct raw data where relevant.

Note: The quantities are the minimum required for a successful test. Additional quantities should be included to allow for test equipment problems and retesting where permitted. If it is anticipated that the 120 Day Continuous Heating test may be required, it is advised that this sample begin its storage period at the same time as the 30 Day storage ammunition or earlier if possible.

Calibre & Nature[1] / Climatic Condition	Electronic Pressure and Velocity	Action Time @ - 54 °C	Trace	Water Proof	Terminal Effects Incendiary Effects[2]	Terminal Effects Explosive Effects[2]	Totals
4.6mm Ball							
Exposed Desert	30	30	--	20	--	--	80
Continuous Heating	30	30	--	20	--	--	80
Continuous Arctic	30	30	--	20	--	--	80
Untreated Ammunition	30	--	--	--	--	--	30
5.56mm Ball							
Exposed Desert	30	30	--	20	--	--	80
Continuous Heating	30	30	--	20	--	--	80
Continuous Arctic	30	30	--	20	--	--	80
Untreated Ammunition	30	--	--	--	--	--	30
5.56mm Tracer							
Exposed Desert	30	30	100	20	--	--	180
Continuous Heating	30	30	100	20	--	--	180
Continuous Arctic	30	30	100	20	--	--	180
Untreated Ammunition	30	--	--		--	--	30
5.7mm Ball							
Exposed Desert	30	30	--	20	--	--	80
Continuous Heating	30	30	--	20	--	--	80
Continuous Arctic	30	30	--	20	--	--	80
Untreated Ammunition	30	--	--	--	--	--	30
5.7mm Tracer							
Exposed Desert	30	30	100	20	--	--	180
Continuous Heating	30	30	100	20	--	--	180
Continuous Arctic	30	30	100	20	--	--	180
Untreated Ammunition	30	--	--	--	--	--	30

Note 1: If other natures of ammunition with different combined effects are submitted for testing, then a decision will be made by the Superintendents of the RTC as to which tests the ammunition shall be subjected to after climatic conditioning. If the submitting nation does not agree with the decision of the Superintendents then it may appeal to SG/1 for a ruling.

Calibre & Nature[1] / Climatic Condition	Electronic Pressure and Velocity	Action Time @ - 54 °C	Trace	Water Proof	Terminal Effects Incendiary Effects[2]	Terminal Effects Explosive Effects[2]	Totals
7.62mm Ball							
Exposed Desert	30	30	--	20	--	--	80
Continuous Heating	30	30	--	20	--	--	80
Continuous Arctic	30	30	--	20	--	--	80
Untreated Ammunition	30	--	--	--	--	--	30
7.62mm Tracer							
Exposed Desert	30	30	100	20	--	--	180
Continuous Heating	30	30	100	20	--	--	180
Continuous Arctic	30	30	100	20	--	--	180
Untreated Ammunition	30	--	--	--	--	--	30
9mm Ball							
Exposed Desert	30	30	--	20	--	--	80
Continuous Heating	30	30	--	20	--	--	80
Continuous Arctic	30	30	--	20	--	--	80
Untreated Ammunition	30	--	--	--	--	--	30

Note 1: If other natures of ammunition with different combined effects are submitted for testing, then a decision will be made by the Superintendents of the RTC as to which tests the ammunition shall be subjected to after climatic conditioning. If the submitting nation does not agree with the decision of the Superintendents then it may appeal to SG/1 for a ruling.

Calibre & Nature[1] / Climatic Condition	Electronic Pressure and Velocity	Action Time @ - 54 °C	Trace	Water Proof	Terminal Effects Incendiary Effects[2]	Terminal Effects Explosive Effects[2]	Totals
12.7mm Ball							
Exposed Desert	30	30	--	20	--	--	80
Continuous Heating	30	30	--	20	--	--	80
Continuous Arctic	30	30	--	20	--	--	80
Untreated Ammunition	30	--	--	--	--	--	30
12.7mm Tracer							
Exposed Desert	30	30	100	20	--	--	180
Continuous Heating	30	30	100	20	--	--	180
Continuous Arctic	30	30	100	20	--	--	180
Untreated Ammunition	30	--	--	--	--	--	30
12.7mm Armour Piercing (AP							
Exposed Desert	30	30	--	20	--	--	80
Continuous Heating	30	30	--	20	--	--	80
Continuous Arctic	30	30	--	20	--	--	80
Untreated Ammunition	30	--	--	--	--	--	30
12.7mm Armour Piercing Incendiary (API)							
Exposed Desert	30	30	--	20	20	--	100
Continuous Heating	30	30	--	20	20	--	100
Continuous Arctic	30	30	--	20	20	--	100
Untreated Ammunition	30	--	--	--	--	--	30
12.7mm Armour Piercing Incendiary Tracer (APIT)							
Exposed Desert	30	30	100	20	20	--	200
Continuous Heating	30	30	100	20	20	--	200
Continuous Arctic	30	30	100	20	20	--	200
Untreated Ammunition	30	--	--	--	--	--	30
12.7mm Multi-Purpose (MP)							
Exposed Desert	30	30	--	20	20	20	120
Continuous Heating	30	30	--	20	20	20	120
Continuous Arctic	30	30	--	20	20	20	120
Untreated Ammunition	30	--	--	--	--	--	30
12.7mm Multi-Purpose (MPT)							
Exposed Desert	30	30	100	20	20	20	220
Continuous Heating	30	30	100	20	20	20	220
Continuous Arctic	30	30	100	20	20	20	220
Untreated Ammunition	30	--	--	--	--	--	30

Note 1: If other natures of ammunition with different combined effects are submitted for testing, then a decision will be made by the Superintendents of the RTC as to which tests the ammunition shall be subjected to after climatic conditioning. If the submitting nation does not agree with the decision of the Superintendents then it may appeal to SG/1 for a ruling.

Note 2: The Incendiary Effects and Explosive Effects test may be combined to reduce the ammunition quantity required. It should be noted, however, that additional cartridges may be required if a non-valid hit is encountered.

13.3.1 NATO Reference Ammunition Quantity

Test	4.6mm	5.56mm	5.7mm	7.62mm	9mm	12.7mm
EPVAT (Correction)	30	30	30	30	30	30

13.4 Equipment

The required equipment is specified below:

Test	Equipment - per AEP-97, Volume
EPVAT	12
Trace	22
Waterproof	26
Terminal Effects (12.7mm only)	19
Climatic conditioning containers capable of meeting the temperature and humidity requirements of paragraphs 13.5.1, 13.5.2 and 13.5.3.	
General constant temperature controlled container capable of maintaining temperature limits at a tolerance of ± 3 °C for post climatic storage.	

13.5 Climatic Conditioning Requirements

Prior to performance testing, ammunition under test shall be submitted to storage under the following conditions:

13.5.1 Exposed Desert Conditions

The test sample cartridges shall be placed in the temperature and humidity controlled container and subjected to the twenty-four (24) hour cyclic procedure shown in the table below for thirty (30) days. The cyclic procedure shall be:

30 Day Exposed Desert
3 hours heating[1] to + 65 °C ± 2 °C and 15 % RH
9 hours at + 65 °C ± 2 °C and 15 % RH ± 5% RH
3 hours cooling[1] to + 15 °C ± 2 °C and 90 % RH
9 hours at + 15 °C ± 2 °C and 90 % RH ± 5 % RH

Note 1: Heating and cooling is to be spread over the entire 3 hour period.

The ammunition shall be removed from conditioning after thirty (30) days at the end of a nine (9) hour period at + 65 °C ± 2 °C and 15 % RH ± 5 % RH.

13.5.2 Continuous Heating Conditions

The test sample cartridges shall be placed in the temperature and humidity controlled container and stored under the conditions specified below for thirty (30) days.

30 Day Continuous Heating
+ 65 °C ± 2 °C and 15 % RH ± 5 % RH

If an ammunition sample fails the Electronic Pressure and Velocity (EPV) test requirements after the thirty (30) Day Continuous Heating storage, a second sample shall be subjected to the 120 Day Continuous Heating Test in the table below. However, retesting using the 120 Day Test is not permitted for Action Time, Waterproof, Trace, or Terminal Effect failures following the thirty (30) day storage. Retesting of a sample that has failed the 30 Day Test and is now submitted for the 120 Day Test, will be at an additional cost. The test sample cartridges shall be placed in the temperature controlled container and stored under the conditions specified below for 120 days.

120 Day Continuous Heating
+ 50 °C ± 2 °C and 15 % RH ± 5 % RH

The EPV test requirements and acceptance criteria as specified in paragraph 13.2 remain the same for ammunition that has been subjected to the 120 Day Continuous Heating storage.

13.5.3 Continuous Arctic Conditions

The test sample cartridges shall be placed in the temperature controlled container and stored under the conditions specified below for thirty (30) days.

30 Day Continuous Arctic
- 40 °C ± 2 °C

13.5.4 Untreated Cartridges

Cartridges of the same lot that have not been subjected to storage under the conditions specified in paragraphs 13.5.1, 13.5.2 and 13.5.3 shall be conditioned for a minimum of 6 hours at 21 °C ± 3 °C before performance testing. These cartridges shall be considered untreated for purposes of comparison with the cartridges that have been subjected to climatic storage in accordance with paragraphs 13.5.1, 13.5.2 and 13.5.3.

13.6 Time Constraint after Removal from Climatic Storage

The performance testing shall be completed within thirty-six (36) hours of removal of the cartridges from the Continuous Heating, Exposed Desert and Continuous Arctic climatic storage containers.

13.6.1 Conditioning Requirements after Removal from Climatic Storage

Ammunition that has been removed from Climatic Storage is to be conditioned in accordance with tables below:

Serial	Conditioning Requirements for EPV (+21 °C Firings Only), Waterproof, Trace and Terminal Effects Test Samples
1	Remove from Climatic Storage
2	Immediately condition to + 21 °C ± 3 °C for a minimum of six (6) hours
3	Conditioning to be maintained until firing

Serial	Conditioning Requirements for - 54 °C Action Time Test Sample
1	Remove from Climatic Storage
2	Immediately condition to + 21 °C ± 3 °C for a minimum of six (6) hours (to avoid thermal shock effects, particularly on the hot samples)
3	Remove from + 21 °C conditioning and condition to - 54 °C ± 3 °C for a minimum of six (6) hours immediately prior to testing
4	Conditioning to be maintained until firing

13.7 Performance Test after Removal from Climatic Conditioning

The procedures and equipment to be used for all performance testing after Climatic Storage conditioning, along with the applicable definitions to be used, are contained in the relevant AEP-97 volumes. For example, the Action Time firing procedure and the relevant start and stop methods to be used for each calibre are contained in EPVAT (AEP-97, Volume 12). The temperature conditioning requirements contained in this volume take priority over those contained in the individual test volumes. The order in which the conditioned test samples are to be tested is left to the discretion of the RTC. However, the technical acceptance parameters and sentencing for all the tests are contained in this volume unless stated otherwise. The table contained in paragraph 13.3 should be consulted to establish which tests are relevant to the type of ammunition under test.

13.7.1 Procedure for Electronic Pressure, Velocity Test (EPV)

Whenever possible it is useful to record all EPVAT data for information purposes as it can provide useful supplementary information when unusual results occur.

13.7.1.1 Use of NATO Reference Ammunition

NATO Reference Ammunition is to be fired as shown in the table below. The results of the ammunition under test are only to be corrected with NATO Reference Ammunition where there is a requirement for an actual chamber pressure result such as for Maximum Corrected Mean + 3 SD Case Mouth Pressure. For checking differences between treated and untreated ammunition the results are not to be corrected as the test is a direct comparison in performance between treated and untreated ammunition.

13.7.1.2 Firing Order

NATO Reference Ammunition conditioned to +21 °C is also required for the EPV tests to ensure correct functioning of equipment and to correct raw data where relevant. Thirty (30) cartridges of untreated ammunition of the same lot and thirty (30) cartridges from each of the three conditions specified in paragraphs 13.5.1, 13.5.2 and 13.5.3 shall be subjected to the EPV test, in accordance with the procedures specified in AEP-97, Volume 12. If all three treated samples cannot be fired on the same day and the remaining treated sample(s) are fired on the following day, within the thirty-six (36) hour time constraint specified in paragraph 13.6, then another series of NATO Reference Ammunition must be fired to ensure correct functioning of the equipment and to correct raw data where relevant. Also, another series of untreated test sample must be fired for comparison with the treated sample.

Serial[2]	Firing Sequence[1]
1	Five (5) warmer/fouling cartridges (the last three (3) to be NATO Reference Ammunition) are to be fired.
2	Thirty (30) NATO Reference Cartridges are to be fired and the EPV[3] data recorded. If the requirements of paragraph 12.5.1 are met the test is to continue. If not the barrel; is to be changed and test procedure re-started.
3	Three (3) warmer cartridges from the untreated test ammunition lot are to be fired.
4	Thirty (30) untreated test cartridges are to be fired and the EPV[3] data recorded.
5	Transducer shall be removed, cleaned, re-inserted and torqued.
6	Three (3) warmer cartridges from the test ammunition lot. These warmers can be untreated.
7	Transducer shall be re-torqued.

8	Thirty (30) test cartridges from climatic storage are to be fired and the EPV[3] data recorded.
9	Transducer shall be removed, cleaned, re-inserted and torqued.
10	The firing sequence from serial 6 to serial 9 shall be repeated for each of the other two climatic storage samples.

Note 1: The order in which the treated test samples are to be tested is left to the discretion of the RTC.

Note 2: For the 120 Day Test, only serial 1 – 8 is required.

Note 3: If possible, the Action Time should also be recorded for information purposes.

13.7.2 Procedure for - 54 °C Action Time Test

To determine the action time, thirty (30) cartridges from each of the three (3) conditions shall be conditioned to - 54 °C ± 3 °C for a minimum of six (6) hours and fired at that temperature in accordance with the procedures specified in the EPVAT Test, AEP-97, Volume 12.

Serial	Firing Sequence[1]
1	Five (5) warmer/fouling cartridges (the last three (3) are to be NATO Reference ammunition[2]) are to be fired. Only to be fired if fired to condition barrel if testing is not continued immediately from the firing table in paragraph 13.7.1.2 and Action Time was not recorded in the EPV test.
2	Thirty (30) NATO Reference Cartridges are to be fired and the Action Time data recorded. This series is not needed if the Action Time was recorded during the EPV Test and the - 54 °C Action Time Test was conducted through the same barrel, on the same day.
3	Three (3) warmer cartridges from the test ammunition lot are to be fired. These warmers can be untreated.
4	Thirty (30) test cartridges from climatic storage are to be fired and the Action Time data recorded.
5	Serial 4 shall be repeated for each of the other two climatic storage samples.

Note 1: The order in which the treated test samples are to be tested is left to the discretion of the RTC.

Note 2: This is only applicable if firing serial 2. If not required, replace with the three (3) test cartridges from serial 3.

13.7.3 Procedure for Trace Test

The number of cartridges listed in the table below from each of the three conditions specified in paragraphs 13.5.1, 13.5.2 and 13.5.3 shall be subjected to the tests defined in the Trace Test, AEP-97, Volume 22.

Calibre	Exposed Desert	Continuous Heating	Continuous Arctic	Total
4.6mm	--	--	--	--
5.56mm	100	100	100	300
5.7mm	50	50	50	150
7.62mm	100	100	100	300
9mm	--	--	--	--
12.7mm	100	100	100	300

13.7.4 Waterproof Test

The number of cartridges listed in the table below from each of the three conditions specified in paragraphs 13.5.1, 13.5.2 and 13.5.3 shall be subjected to the tests defined in the Waterproof Test, AEP-97, Volume 26.

Calibre	Exposed Desert	Continuous Heating	Continuous Arctic	Total
4.6mm	20	20	20	60
5.56mm	20	20	20	60
5.7mm	20	20	20	60
7.62mm	20	20	20	60
9mm	20	20	20	60
12.7mm	20	20	20	60

13.7.5 Procedure for Terminal Effects Test (12.7mm Incendiary and Explosive Effects Only)

Twenty cartridges from each of the three conditions specified in paragraphs 13.5.1, 13.5.2 and 13.5.3 shall be subjected to the tests listed below as defined in the Terminal Effects Test, AEP-97, Volume 19. The table contained in paragraph 13.3 should be consulted to establish which tests are relevant to the ammunition nature under test.

Calibre	Test	Exposed Desert	Continuous Heating	Continuous Arctic	Total
12.7mm	**Explosive Effects**	20	20	20	60
12.7mm	**Incendiary Effects**	20	20	20	60

13.8 Recording of Results

The results of the tests for the three specified conditions; Exposed Desert, Continuous Heating and Continuous Arctic, shall be reported on Climatic Storage Test Forms located in Annex 13-A.

13.9 Sentencing

The test results from each Climatic Storage Condition shall be sentenced separately. The ammunition shall be considered to have met NATO requirements if it meets all the applicable requirements in the table below.

	4.6mm	5.56mm	5.7mm	7.62mm	9mm	12.7mm
CASE MOUTH PRESSURE						
Maximum Corrected Mean Case Mouth Pressure + 3 Std Dev	480 MPa	465 MPa	370 MPa	465 MPa	305 MPa	470 MPa
Maximum Difference (∆) between Mean of Treated & Untreated Samples	+ 50 MPa to - 50 MPa	+ 50 MPa to - 50 MPa	+ 45 MPa to - 45 MPa	+ 50 MPa to - 50 MPa	+ 50 MPa to - 50 MPa	+ 50 MPa to - 50 MPa
VELOCITY						
Maximum Difference (∆) between Mean of Treated & Untreated Samples	+ 25 m/s to - 25 m/s	+ 20 m/s to - 20 m/s	+ 20 m/s to - 20 m/s	+ 20 m/s to - 20 m/s	+ 20 m/s to - 20 m/s	+ 20 m/s to - 20 m/s
ACTION TIME						
Maximum Mean Action Time + 5 Std Dev at - 54 °C	4 ms	3 ms	2 ms	4 ms	3 ms	4.5 ms

	4.6mm	5.56mm	5.7mm	7.62mm	9mm	12.7mm
TERMINAL EFFECTS						
Minimum percentage of the treated sample that shall meet the requirements for Explosive Bullets as specified in AEP-97, Volume 19	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	80 %
Minimum percentage of the treated sample that shall meet the requirements for Incendiary Bullets as specified in AEP-97, Volume 19	No Require-ment	No Require-ment	No Require-ment	No Require-ment	No Require-ment	80 %
TRACE						
Minimum percentage of the treated sample that shall meet both the Distance and Quality requirements as specified in AEP-97, Volume 22	No Require-ment	70 %	70 %	70 %	No Require-ment	70 %
WATERPROOF						
Maximum permitted percentage of the treated samples displaying leaks of any type as specified in AEP-97, Volume 26	15 %	15 %	15 %	15 %	15 %	15 %

13.10 Re-Test Procedures

If the ammunition from Climatic Storage fails any of the post storage tests, it is only necessary to conduct a retest for the climatic condition concerned. The procedures detailed earlier in this volume for storage, conditioning and testing are to be followed where relevant. Using the 120 Day Continuous Heating test procedure for retesting because of either Action Time, Terminal Effects, Trace or Waterproof failures is not permitted. Retesting will normally only be conducted at an additional cost. This will be discussed between the RTC Superintendent and the submitting nation.

13.10.1 EPV Re-Test – Continuous Heating

If an ammunition sample fails any of the EPV test requirements after the 30 day Continuous Heating storage, a second sample of the same quantity shall be subjected to a retest using the 120 Day Continuous Heating storage procedure and the EPV test repeated. EPV sentencing parameters for the test are contained in the table at paragraph 13.9. No further retesting will be permitted.

13.10.2 EPV Re-Test – Exposed Desert and Continuous Arctic

It is permitted to conduct a retest for failures of either, or both, the 30 Day Exposed Desert and Continuous Arctic Tests. Retesting shall consist of conditioning a double size sample in accordance with the thirty (30) day conditioning procedures and sentencing on the retest sample alone. A double size untreated test sample shall be used for comparison

purposes. EPV sentencing parameters for the retest are contained in the table at paragraph 13.9. No further retesting will be permitted.

13.10.3 Re-Test of - 54 °C Action Time for All Climatic Conditions

It is permitted to conduct a retest for failures occurring in any of the climatic conditions. Retesting shall consist of conditioning a double size sample in accordance with the thirty (30) day conditioning procedures and sentencing on the retest sample alone. The - 54 °C Action Time sentencing parameters for the retest are contained in the table at paragraph 13.9. The samples from each of the climatic conditions shall be sentenced separately. No further retesting will be permitted.

13.10.4 Re-Test of Terminal Effects for all Climatic Conditions

A retest of Terminal Effects is permitted using a sample the same size as the original. The ammunition shall be submitted to the relevant thirty (30) day climatic storage prior to the retest. The results of the retest shall be combined with the results from the original test. Sentencing parameters of the combined sample are contained in the table at paragraph 13.9. The samples from each of the climatic conditions shall be sentenced separately. No further retesting will be permitted.

13.10.5 Re-Test of Tracer for all Climatic Conditions

Ammunition that exhibits less than 50 % satisfactory performance in either Trace Quality or Trace Distance testing shall be rejected outright. Ammunition with satisfactory performance between 50 % and 69 % shall be subjected to a re-test of the test that failed using a sample the same size as the original. The ammunition shall be submitted to the relevant thirty (30) day climatic storage prior to the retest. The results of the retest shall be combined with the results from the original test. Sentencing parameters of the combined sample are contained in the table at paragraph 13.9. The samples from each of the climatic conditions shall be sentenced separately. No further retesting will be permitted.

13.10.6 Re-Test of Waterproof for all Climatic Conditions

A Waterproof retest is permitted using a sample the same size as the original. The ammunition shall be submitted to the relevant thirty (30) day climatic storage prior to the retest. The results from the retest shall be combined with the results from the original test. Sentencing parameters of the combined sample are contained in the table at paragraph 13.9. The samples from each of the climatic conditions shall be sentenced separately. No further retesting will be permitted.

13.11 Other Defects and Incidents - Sentencing

During any test or retest, if any defects occur that are not related to this particular test, either during firing, or visually after firing, they shall be categorised in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

ANNEX 13-A
CLIMATIC STORAGE TEST FORMS

Per the applicable Recording of Results paragraph, the table below lists the required Climatic Storage Test Forms for recording of results for both NATO Reference and the test cartridges for the Climatic Storage Tests for the three specified conditions; Exposed Desert, Continuous Heating and Continuous Arctic. The forms are located on the next twenty-one (21) pages in this Annex.

13.A.1 FORM 13-1: CLIMATIC STORAGE TEST (SUMMARY)

Form Number 13-1	Page 1 of 1	CLIMATIC STORAGE TEST (SUMMARY)	
Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Test Statistics	30 Day Storage				120 Day Storage	
	A	B	C	D	A	C
Velocity (m/s)						
Mean						
SD						
Extreme Spread						
Highest Value						
Lowest Value						
Diff From Untreated						
Chamber Pressure (MPa)						
Mean						
Correction						
Corrected Mean						
SD						
Extreme Spread						
Highest Corr. Value						
Lowest Corr. Value						
Corr. Mean + 3SD's						
Diff From Untreated						
Action Time (ms)						
Mean						
SD						
Extreme Spread						
Highest Value						
Lowest Value						
Mean + 5SD's						

NOTE:
A = UNTREATED
B = EXPOSED DESERT
C = CONTINUOUS HEATING
D = CONTINUOUS ARCTIC

Units: (Pressure - MPa), (Velocity - m/s), (Time - ms)

Percentage Meeting the Requirement (%)			
Waterproof			
Trace Performance			
Trace Distance			
Trace Quality			
Terminal Effects			
Explosive Effects			
Incendiary Effects			

Remarks

13.A.2 FORM 13-2: CLIMATIC STORAGE TEST (PAGE 1 OF 2)

Form Number 13-2	Page 1of 2	30 DAY CLIMATIC STORAGE TEST

Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Individual Shot Data		30	Cartridges Fired @+21°C	
Cartridge No.	Chamber Pressure	Port Pressure	Velocity	Action Time
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

Units: (Pressure - MPa), (Velocity - m/s), (Time - ms)

Weapon Details			
Receiver Number		Life	
Barrel Number		Life	
Head Space		mm	
Pin Protrusion		mm	
Firing Pin Indent		mm	

Transducer Details	Chamber	Port
Type		
Serial Number		
Times Fired		
Sensitivity		
Low Pass Filter kHz		

Test Statistics		
Velocity (m/s)		
Mean		
Correction		
Corrected Mean		
SD		
Extreme Spread		
Highest Corr. Value		
Lowest Corr. Value		
Pressure (MPa)	**Chamber**	**Port**
Mean		
Correction		
Corrected Mean		
SD		
Extreme Spread		
Highest Corr. Value		
Lowest Corr. Value		

Current Assessed Values from NATO Reference Lot:			
Lot #:			
Velocity @	m		
Chamber Pressure			
Port Pressure			
Expected Action Time			

Action Time (ms)	
Mean	
SD	
Extreme Spread	
Highest Value	
Lowest Value	

Remarks

13.A.3 FORM 13-2: 30 DAY CLIMATIC STORAGE TEST - ELECTRONIC PRESSURE AND VELOCITY (PAGE 2 OF 2)

Form Number 13-2	Page 2 of 2	30 DAY CLIMATIC STORAGE TEST - ELECTRONIC PRESSURE & VELOCITY			
Test Centre			Test Reference		
Submitting Nation			Lot Number		
Manufacturer			Cartridge Type		
Date Fired			NATO Design No.		

Individual Shot Data	30	Cartridges Fired @+21°C			Individual Shot Data	30	Cartridges Fired @+21°C		
Cartridge No.	Chamber Pressure				Cartridge No.	Velocity			
	A	B	C	D		A	B	C	D
1					1				
2					2				
3					3				
4					4				
5					5				
6					6				
7					7				
8					8				
9					9				
10					10				
11					11				
12					12				
13					13				
14					14				
15					15				
16					16				
17					17				
18					18				
19					19				
20					20				
21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				

Units: (Velocity - m/s), (Pressure - MPa)

Current Assessed Values from NATO Reference Lot:

Lot #:		
Velocity @	m	
Chamber Pressure		
Port Pressure		
Expected Action Time		

NOTE:
A = UNTREATED
B = EXPOSED DESERT
C = CONTINUOUS HEATING
D = CONTINUOUS ARCTIC

Remarks

13.A.4 FORM 13-3: 30 DAY CLIMATIC STORAGE TEST - ACTION TIME

Form Number 13-3	Page 1of 1	30 DAY CLIMATIC STORAGE TEST - ACTION TIME

Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Individual Shot Data	30	Cartridges Fired @+21°C

Cartridge No.	Action Time		
	B	C	D
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

Units: (Velocity - m/s), (Pressure - MPa)

Weapon Details			
Receiver Number		Life	
Barrel Number		Life	
Head Space		mm	
Pin Protrusion		mm	
Firing Pin Indent		mm	

Transducer Details	Chamber	Port
Type		
Serial Number		
Times Fired		
Sensitivity		
Low Pass Filter kHz		

Test Statistics			
Action Time (ms)	**B**	**C**	**D**
Mean			
SD			
Extreme Spread			
Highest Value			
Lowest Value			
Mean +5SD's			

NOTE:
A = UNTREATED
B = EXPOSED DESERT
C = CONTINUOUS HEATING
D = CONTINUOUS ARCTIC

Remarks

13.A.5 FORM 13-4: 30 DAY CLIMATIC STORAGE TEST - TERMINAL EFFECTS - INCENDIARY EFFECTS

Form Number 13-4	Page 1 of 1	30 DAY CLIMATIC STORAGE TEST - TERMINAL EFFECTS - INCENDIARY EFFECTS

Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Test Sample Individual Shot Data

Cartridge No.	Acceptable Incendiary Flash (≤ 600m)		
	B	**C**	**D**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

NOTE:
B = EXPOSED DESERT
C = CONTINUOUS HEATING
D = CONTINUOUS ARCTIC

Weapon Details			
Barrel Number			Life
Head Space		mm	
Pin Protrusion		mm	
Firing Pin Indent		mm	

Plate Details*	**Penetration Plate**	**Witness Screen**
Type/Material		
Thickness (mm)		
Set @ (m)		

**Plates in accordance with AEP-97, Volume 19, Annex A*

Retest Sample Individual Shot Data

Cartridge No.	Acceptable Incendiary Flash (≤ 600m)		
	B	**C**	**D**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Remarks

13.A.6 FORM 13-5: 30 DAY CLIMATIC STORAGE TEST - TERMINAL EFFECTS - EXPLOSIVE EFFECTS

Form Number 13-5	Page 1 of 1	30 DAY CLIMATIC STORAGE TEST - TERMINAL EFFECTS - EXPLOSIVE EFFECTS

Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Test Sample Individual Shot Data

Cartridge No.	Perforations in Witness Plate (≥ 8)		
	B	**C**	**D**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Weapon Details

Barrel Number			Life
Head Space		mm	
Pin Protrusion		mm	
Firing Pin Indent		mm	

Plate Details*	**Penetration Plate**	**Witness Screen**
Type/Material		
Thickness (mm)		
Set @ (m)		

**Plates in accordance with AEP-97, Volume 19, Annex A*

Retest Sample Individual Shot Data

Cartridge No.	Perforations in Witness Plate (≥ 8)		
	B	**C**	**D**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

NOTE:
B = EXPOSED DESERT
C = CONTINUOUS HEATING
D = CONTINUOUS ARCTIC

Remarks

13.A.7 FORM 13-6: CLIMATIC STORAGE TEST – TRACE DISTANCE (EXPOSED DESERT) (PAGE 1 OF 6)

Form Number 13-6	Page 1 of 6	CLIMATIC STORAGE TEST - TRACE DISTANCE (EXPOSED DESERT)			
Test Centre				Test Reference	
Submitting Nation				Lot Number	
Manufacturer				Cartridge Type	
Date Fired				NATO Design No.	

	Trace Distances					
Cartridge No.	Muzzle*	Dim or Invisible from Muzzle	Tracer Visible By	Continuous Visibility Between	Comments	Defect Code(s)
		(m)	(m)	(m)		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35+						

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*
+Cartridge No. 36-50 on Page 2 of 2

Remarks

13.A.8 FORM 13-6: CLIMATIC STORAGE TEST – TRACE DISTANCE (EXPOSED DESERT) (PAGE 2 OF 6)

Form Number 13-6	Page 2 of 6	**CLIMATIC STORAGE TEST - TRACE DISTANCE (EXPOSED DESERT)**			
Test Centre			Test Reference		
Submitting Nation			Lot Number		
Manufacturer			Cartridge Type		
Date Fired			NATO Design No.		

	Trace Distances					
Cartridge No.	Muzzle*	Dim or Invisible from Muzzle	Tracer Visible By	Continuous Visibility Between	Comments	Defect Code(s)
		(m)	(m)	(m)		
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*

Test Summary	Total Observed Defects
Defect Codes	
B-Blind	
S-Short	
SI-Short Igniter	
E-Early	
D-Delayed	
L-Long	
P-Partial	
BB-Bursting Bullet	
IMF-Igniter Muzzle Flash	
TMF-Tracer Muzzle Flash	
TFO-Tracer Falls Out	
IMT-Intermittent Trace	
EF-Erratic Flight	
Observation Codes	
GF-Gun Flash	

Weapon Details		
Weapon Type		
Weapon Number		
Weapon Life		
Head Space		mm
Pin Protrusion		mm
Firing Pin Indent		mm
Barrel Number		
Barrel Life		

Number Of Cartridges Meeting The Trace Distance Requirement

No. Cartridges Passed		Percentage (%)	

Remarks

13.A.9 FORM 13-6: CLIMATIC STORAGE TEST – TRACE DISTANCE (CONTINUOUS HEATING) (PAGE 3 OF 6)

Form Number 13-6	Page 3 of 6	CLIMATIC STORAGE TEST - TRACE DISTANCE (CONTINUOUS HEATING)		
Test Centre			Test Reference	
Submitting Nation			Lot Number	
Manufacturer			Cartridge Type	
Date Fired			NATO Design No.	

	Trace Distances					
Cartridge No.	Muzzle*	Dim or Invisible from Muzzle	Tracer Visible By	Continuous Visibility Between	Comments	Defect Code(s)
		(m)	(m)	(m)		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35+						

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*
+Cartridge No. 36-50 on Page 2 of 2

Remarks

13.A.10 FORM 13-6: CLIMATIC STORAGE TEST – TRACE DISTANCE (CONTINUOUS HEATING) (PAGE 4 OF 6)

Form Number 13-6	Page 4 of 6	**CLIMATIC STORAGE TEST - TRACE DISTANCE (CONTINUOUS HEATING)**			
Test Centre				Test Reference	
Submitting Nation				Lot Number	
Manufacturer				Cartridge Type	
Date Fired				NATO Design No.	

	Trace Distances					
Cartridge No.	Muzzle*	Dim or Invisible from Muzzle	Tracer Visible By	Continuous Visibility Between	Comments	Defect Code(s)
		(m)	(m)	(m)		
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*

Test Summary	Total Observed Defects
Defect Codes	
B-Blind	
S-Short	
SI-Short Igniter	
E-Early	
D-Delayed	
L-Long	
P-Partial	
BB-Bursting Bullet	
IMF-Igniter Muzzle Flash	
TMF-Tracer Muzzle Flash	
TFO-Tracer Falls Out	
IMT-Intermittent Trace	
EF-Erratic Flight	
Observation Codes	
GF-Gun Flash	

Weapon Details		
Weapon Type		
Weapon Number		
Weapon Life		
Head Space		mm
Pin Protrusion		mm
Firing Pin Indent		mm
Barrel Number		
Barrel Life		

Number Of Cartridges Meeting The Trace Distance Requirement

No. Cartridges Passed		Percentage (%)	

Remarks

13.A.11 FORM 13-6: CLIMATIC STORAGE TEST – TRACE DISTANCE (CONTINUOUS ARCTIC) (PAGE 5 OF 6)

Form Number 13-6	Page 5 of 6	CLIMATIC STORAGE TEST - TRACE DISTANCE (CONTINUOUS ARCTIC)			
Test Centre				Test Reference	
Submitting Nation				Lot Number	
Manufacturer				Cartridge Type	
Date Fired				NATO Design No.	

	Trace Distances					
Cartridge No.	Muzzle*	Dim or Invisible from Muzzle	Tracer Visible By	Continuous Visibility Between	Comments	Defect Code(s)
		(m)	(m)	(m)		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35+						

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*
+Cartridge No. 36-50 on Page 2 of 2

Remarks

13.A.12 FORM 13-6: CLIMATIC STORAGE TEST – TRACE DISTANCE (CONTINUOUS ARCTIC) (PAGE 6 OF 6)

Form Number 13-6	Page 6 of 6	**CLIMATIC STORAGE TEST - TRACE DISTANCE (CONTINUOUS ARCTIC)**			
Test Centre				Test Reference	
Submitting Nation				Lot Number	
Manufacturer				Cartridge Type	
Date Fired				NATO Design No.	

	Trace Distances					
Cartridge No.	Muzzle*	Dim or Invisible from Muzzle	Tracer Visible By	Continuous Visibility Between	Comments	Defect Code(s)
		(m)	(m)	(m)		
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*

Test Summary	Total Observed Defects
Defect Codes	
B-Blind	
S-Short	
SI-Short Igniter	
E-Early	
D-Delayed	
L-Long	
P-Partial	
BB-Bursting Bullet	
IMF-Igniter Muzzle Flash	
TMF-Tracer Muzzle Flash	
TFO-Tracer Falls Out	
IMT-Intermittent Trace	
EF-Erratic Flight	
Observation Codes	
GF-Gun Flash	

Weapon Details		
Weapon Type		
Weapon Number		
Weapon Life		
Head Space		mm
Pin Protrusion		mm
Firing Pin Indent		mm
Barrel Number		
Barrel Life		

Number Of Cartridges Meeting The Trace Distance Requirement

No. Cartridges Passed		Percentage (%)	

Remarks

13.A.13 FORM 13-7: CLIMATIC STORAGE TEST – TRACE QUALITY (EXPOSED DESERT) (PAGE 1 OF 6)

Form Number 13-7	Page 1of 6	**CLIMATIC STORAGE TEST - TRACE QUALITY (EXPOSED DESERT)**	
Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Cartridge No.	Trace Quality Observations		Defect Code(s)
	Muzzle*	Comments	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35+			

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*
+Cartridge No. 36-50 on Page 2 of 2

Remarks

13.A.14 FORM 13-7: CLIMATIC STORAGE TEST – TRACE QUALITY (EXPOSED DESERT) (PAGE 2 OF 6)

Form Number 13-7	Page 2 of 6	**CLIMATIC STORAGE TEST - TRACE QUALITY (EXPOSED DESERT)**		
Test Centre			Test Reference	
Submitting Nation			Lot Number	
Manufacturer			Cartridge Type	
Date Fired			NATO Design No.	

Cartridge No.	Trace Quality Observations		Defect Code(s)
	Muzzle*	Comments	
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*

Test Summary	Total Observed Defects
Defect Codes	
B-Blind	
S-Short	
SI-Short Igniter	
E-Early	
D-Delayed	
L-Long	
P-Partial	
BB-Bursting Bullet	
IMF-Igniter Muzzle Flash	
TMF-Tracer Muzzle Flash	
TFO-Tracer Falls Out	
IMT-Intermittent Trace	
EF-Erratic Flight	
Observation Codes	
GF-Gun Flash	

Weapon Details		
Weapon Type		
Weapon Number		
Weapon Life		
Head Space		mm
Pin Protrusion		mm
Firing Pin Indent		mm
Barrel Number		
Barrel Life		

Number Of Cartridges Meeting The Trace Distance Requirement

No. Cartridges Passed		Percentage (%)	

Remarks

13.A.15 FORM 13-7: CLIMATIC STORAGE TEST – TRACE QUALITY (CONTINUOUS HEATING) (PAGE 3 OF 6)

Form Number 13-7	Page 3 of 6	**CLIMATIC STORAGE TEST - TRACE QUALITY (CONTINUOUS HEATING)**		
Test Centre			Test Reference	
Submitting Nation			Lot Number	
Manufacturer			Cartridge Type	
Date Fired			NATO Design No.	

Cartridge No.	Trace Quality Observations		Defect Code(s)
	Muzzle*	Comments	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35+			

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*
+Cartridge No. 36-50 on Page 2 of 2

Remarks

13.A.16 FORM 13-7: CLIMATIC STORAGE TEST – TRACE QUALITY (CONTINUOUS HEATING) (PAGE 4 OF 6)

Form Number 13-7	Page 4 of 6	**CLIMATIC STORAGE TEST - TRACE QUALITY (CONTINUOUS HEATING)**		
Test Centre			Test Reference	
Submitting Nation			Lot Number	
Manufacturer			Cartridge Type	
Date Fired			NATO Design No.	

Cartridge No.	Trace Quality Observations		Defect Code(s)
	Muzzle*	Comments	
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*

Test Summary	Total Observed Defects
Defect Codes	
B-Blind	
S-Short	
SI-Short Igniter	
E-Early	
D-Delayed	
L-Long	
P-Partial	
BB-Bursting Bullet	
IMF-Igniter Muzzle Flash	
TMF-Tracer Muzzle Flash	
TFO-Tracer Falls Out	
IMT-Intermittent Trace	
EF-Erratic Flight	
Observation Codes	
GF-Gun Flash	

Weapon Details		
Weapon Type		
Weapon Number		
Weapon Life		
Head Space		mm
Pin Protrusion		mm
Firing Pin Indent		mm
Barrel Number		
Barrel Life		

Number Of Cartridges Meeting The Trace Distance Requirement

No. Cartridges Passed		Percentage (%)	

Remarks

13.A.17 FORM 13-7: CLIMATIC STORAGE TEST – TRACE QUALITY (CONTINUOUS ARCTIC) (PAGE 5 OF 6)

Form Number 13-7	Page 5 of 6	CLIMATIC STORAGE TEST - TRACE QUALITY (CONTINUOUS ARCTIC)		
Test Centre			Test Reference	
Submitting Nation			Lot Number	
Manufacturer			Cartridge Type	
Date Fired			NATO Design No.	

Cartridge No.	Trace Quality Observations		Defect Code(s)
	Muzzle*	Comments	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35+			

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*
+Cartridge No. 36-50 on Page 2 of 2

Remarks

13.A.18 FORM 13-7: CLIMATIC STORAGE TEST – TRACE QUALITY (CONTINUOUS ARCTIC) (PAGE 6 OF 6)

Form Number 13-7	Page 6 of 6	**CLIMATIC STORAGE TEST - TRACE QUALITY (CONTINUOUS ARCTIC)**		
Test Centre			Test Reference	
Submitting Nation			Lot Number	
Manufacturer			Cartridge Type	
Date Fired			NATO Design No.	

Cartridge No.	Trace Quality Observations		Defect Code(s)
	Muzzle*	Comments	
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*

Test Summary	Total Observed Defects
Defect Codes	
B-Blind	
S-Short	
SI-Short Igniter	
E-Early	
D-Delayed	
L-Long	
P-Partial	
BB-Bursting Bullet	
IMF-Igniter Muzzle Flash	
TMF-Tracer Muzzle Flash	
TFO-Tracer Falls Out	
IMT-Intermittent Trace	
EF-Erratic Flight	
Observation Codes	
GF-Gun Flash	

Weapon Details		
Weapon Type		
Weapon Number		
Weapon Life		
Head Space		mm
Pin Protrusion		mm
Firing Pin Indent		mm
Barrel Number		
Barrel Life		

Number Of Cartridges Meeting The Trace Distance Requirement

No. Cartridges Passed		Percentage (%)	

Remarks

13.A.19 FORM 13-8: WATERPROOF / CLIMATIC STORAGE

Form Number 13-8	Page 1of 1		**WATERPROOF / CLIMATIC STORAGE**
Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Tested		NATO Design No.	

	Ammunition Test Condition			
Sample Size				
Defects Recorded	**Local Ambient**	**Exposed Desert**	**Continuous Heating**	**Continuous Arctic**
Slow Leak Case Mouth				
Slow Leak Primer				
Fast Leak Case Mouth				
Fast Leak Primer				
No Leaks Total				
Total Percentage Waterproof				

	Ammunition Test Condition			
Retest Sample Size				
Cumulative Sample Size				
Defects Recorded	**Local Ambient**	**Exposed Desert**	**Continuous Heating**	**Continuous Arctic**
Slow Leak Case Mouth				
Slow Leak Primer				
Fast Leak Case Mouth				
Fast Leak Primer				
No Leaks Total				
Cumulative Percentage Waterproof				

NOTE: Primer means the interface between the Cartridge Case and the Primer

Remarks

13.A.20 FORM 13-9: 120 DAY CLIMATIC STORAGE TEST (PAGE 1 OF 2)

Form Number 13-9	Page 1of 2	120 DAY CLIMATIC STORAGE TEST

Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Individual Shot Data		30	Cartridges Fired @+21°C	
Cartridge No.	Chamber Pressure	Port Pressure	Velocity	Action Time
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

Units: (Pressure - MPa), (Velocity - m/s), (Time - ms)

Weapon Details			
Receiver Number		Life	
Barrel Number		Life	
Head Space		mm	
Pin Protrusion		mm	
Firing Pin Indent		mm	

Transducer Details	Chamber	Port
Type		
Serial Number		
Times Fired		
Sensitivity		
Low Pass Filter kHz		

Test Statistics	
Velocity (m/s)	
Mean	
Correction	
Corrected Mean	
SD	
Extreme Spread	
Highest Corr. Value	
Lowest Corr. Value	

Pressure (MPa)	**Chamber**	**Port**
Mean		
Correction		
Corrected Mean		
SD		
Extreme Spread		
Highest Corr. Value		
Lowest Corr. Value		

Current Assessed Values from NATO Reference Lot:

Lot #:			
Velocity @	m		
Chamber Pressure			
Port Pressure			
Expected Action Time			

Action Time (ms)	
Mean	
SD	
Extreme Spread	
Highest Value	
Lowest Value	

Remarks

13.A.21 FORM 13-9: 120 DAY CLIMATIC STORAGE TEST – ELECTRONIC PRESSURE & VELOCITY (PAGE 2 OF 2)

Form Number 13-9	Page 2 of 2	120 DAY CLIMATIC STORAGE TEST - ELECTRONIC PRESSURE & VELOCITY			
Test Centre			Test Reference		
Submitting Nation			Lot Number		
Manufacturer			Cartridge Type		
Date Fired			NATO Design No.		

Individual Shot Data	30	Cartridges Fired @+21°C			Individual Shot Data	30	Cartridges Fired @+21°C		
Cartridge No.	Chamber Pressure				Cartridge No.	Velocity			
	A	B	C	D		A	B	C	D
1					1				
2					2				
3					3				
4					4				
5					5				
6					6				
7					7				
8					8				
9					9				
10					10				
11					11				
12					12				
13					13				
14					14				
15					15				
16					16				
17					17				
18					18				
19					19				
20					20				
21					21				
22					22				
23					23				
24					24				
25					25				
26					26				
27					27				
28					28				
29					29				
30					30				

Units: (Velocity - m/s), (Pressure - MPa)

Current Assessed Values from NATO Reference Lot:

Lot #:		
Velocity @	m	
Chamber Pressure		
Port Pressure		
Expected Action Time		

NOTE:
A = UNTREATED
B = EXPOSED DESERT
C = CONTINUOUS HEATING
D = CONTINUOUS ARCTIC

Remarks

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 14

FUNCTION AND CASUALTY TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

14.1 Applicability

Ammunition submitted for NATO Qualification Approval Testing, NATO Production Testing and NATO Surveillance Testing shall be subjected to the Function and Casualty Test.

14.2 NATO Requirements

14.2.1 Function & Casualty Requirements – NATO Qualification Approval, NATO Production and NATO Surveillance Tests

The ammunition shall perform satisfactorily in the NATO Nominated Weapons listed in AEP-97, Volume 10 when fired in accordance with the test requirements defined in this volume. The Function and Casualty firing defects shall not exceed the permitted number defined in the relevant table for any NATO Nominated Weapon type[1].

Note 1: "NATO Nominated Weapon type" means either one or a pair of weapons of the same type used for the test. Although it is recommended to use two weapons of each type where possible to lessen the risk of a defective weapon inadvertently being the cause of stoppages resulting in the fault being attributable to the ammunition, it is permitted to conduct the test with only one weapon of that type, obviously firing the full quantity of cartridges through the one weapon.

14.3 Ammunition Quantity

Each NATO Nominated Weapon type shall fire the quantity of cartridges in accordance with firing order defined for that weapon type in the appropriate annex to this volume. Any necessary re-tests conducted in accordance with the acceptance or rejection conditions contained later in this volume will require an additional quantity of cartridges. It should be noted that Category 1 defects do not permit a retest and results in immediate failure of the ammunition. Where there is only one type of NATO Nominated Weapon in a particular calibre then it will be necessary to repeat the test a second time, to ensure that at least 1000 cartridges are tested for Function & Casualty (630 cartridges for Pistols). The following paragraphs display the nominal ammunition quantities for the Function & Casualty Test (without retest).

14.3.1 4.6 mm x 30

4.6 mm x 30	Ammunition Format	Basic Function & Casualty Test			Totals
		+ 52 °C	+ 21 °C	- 54 °C	
Gun, Sub-Machine, MP7 (Wpn No. 1)[2]	Single Cartridges	125	250	125	500
Gun, Sub-Machine, MP7 (Wpn No. 2)[2]	Single Cartridges	125	250	125	500
Conditioned Quantity		**250**	**500**	**250**	
Total Quantity without Re-test					**1000**

Note 2: As there is currently only one NNW, the Function and Casualty Test shall be fired twice to ensure a reasonable quantity of ammunition is tested. This requirement will be reviewed if further NNWs are added to the list.

14.3.2 5.56 mm x 45

5.56 mm x 45	Ammunition Format	Basic Function & Casualty Test			Totals
		+ 52 °C	+ 21 °C	- 54 °C	
Gun, Machine, Minimi, Mk1 (Free Hanging Belt)	Linked Cartridges	150	200	150	500
Rifle, L85A2 (Wpn No. 1)	Single Cartridges	80	90	80	250
Rifle, L85A2 (Wpn No. 2)	Single Cartridges	80	90	80	250
Rifle, M16A2/A4 (Wpn No. 1)	Single Cartridges	80	90	80	250
Rifle, M16A2/A4 (Wpn No. 2)	Single Cartridges	80	90	80	250
Rifle, AR 70/90 (Wpn No. 1)	Single Cartridges	80	90	80	250
Rifle, AR 70/90 (Wpn No. 2)	Single Cartridges	80	90	80	250
Rifle, G36/A1 (Wpn No. 1)	Single Cartridges	80	90	80	250
Rifle, G36/A1 (Wpn No. 2)	Single Cartridges	80	90	80	250
Conditioned Quantity		**790**	**920**	**790**	
Total Quantity without Re-test					**2500**

Additional Test for 5.56 mm Linked Pack Ammunition					
5.56 mm x 45	**Ammunition Format**	**Additional Function & Casualty Test through NATO Chute**			**Totals**
		+ 52 °C	**+ 21 °C**	**- 54 °C**	
Gun, Machine, Minimi, Mk1 (Wpn No. 1) - (NATO Chute)	Linked Cartridges	100	100	100	300
Gun, Machine, Minimi, Mk1 (Wpn No. 2) - (NATO Chute)	Linked Cartridges	50	100	50	200
Total Quantity without Re-test					**500**

14.3.3 5.7 mm x 28

5.7 mm x 28	Ammunition Format	Basic Function & Casualty Test			Totals
		+ 52 °C	+ 21 °C	- 54 °C	
Gun, Sub-Machine, P90 (Wpn No. 1)	Single Cartridges	62	64	62	188
Gun, Sub-Machine, P90 (Wpn No. 2)	Single Cartridges	62	64	62	188
Gun, Sub-Machine, P90 (Wpn No. 1) (**Depressed Position**)	Single Cartridges	--	62	--	62
Gun, Sub-Machine, P90 (Wpn No. 2) (**Depressed Position**)	Single Cartridges	--	62	--	62
Pistol, Five-seveN (Wpn No. 1)	Single Cartridges	40	40	40	120
Pistol, Five-seveN (Wpn No. 2)	Single Cartridges	40	40	40	120
Pistol, Five-seveN (Wpn No. 1) (**Depressed Position**)	Single Cartridges	--	40	--	40
Pistol, Five-seveN (Wpn No. 2) (**Depressed Position**)	Single Cartridges	--	35	--	40
Conditioned Quantity		**204**	**407**	**204**	
Total Quantity without Re-test					**815**

14.3.4 7.62 mm x 51

7.62 mm x 51	Ammunition Format	Basic Function & Casualty Test			Totals
		+ 52 °C	+ 21 °C	- 54 °C	
Gun, Machine, L7A2 (Wpn No. 1) (Free Hanging Belt)	Linked Cartridges	75	100	75	250
Gun, Machine, L7A2 (Wpn No. 2) (Free Hanging Belt)	Linked Cartridges	75	100	75	250
Gun, Machine, M240B (Wpn No. 1) (Free Hanging Belt)	Linked Cartridges	75	100	75	250
Gun, Machine, M240B (Wpn No. 2) (Free Hanging Belt)	Linked Cartridges	75	100	75	250
Conditioned Quantity		**300**	**400**	**300**	
Total Quantity without Re-test					**1000**

14.3.5 9 mm x 19

9 mm x 19	Ammunition Format	Basic Function & Casualty Test			Totals
		+ 52 °C	+ 21 °C	- 54 °C	
Gun, Sub-Machine, PM12S/S2 (Wpn No. 1)	Single Cartridges	62	64	62	188
Gun, Sub-Machine, PM12S/S2 (Wpn No. 2)	Single Cartridges	62	64	62	188
Gun, Sub-Machine, PM12S/S2 (Wpn No. 1) (**Depressed Position**)	Single Cartridges	--	62	--	62
Gun, Sub-Machine, PM12S/S2 (Wpn No. 2) (**Depressed Position**)	Single Cartridges	--	62	--	62
Pistol, 92F/92FS (Wpn No. 1)	Single Cartridges	40	40	40	120
Pistol, 92F/92FS (Wpn No. 2)	Single Cartridges	40	40	40	120
Pistol, 92F/92FS (Wpn No. 1) (**Depressed Position**)	Single Cartridges	--	40	--	40
Pistol, 92F/92FS (Wpn No. 2) (**Depressed Position**)	Single Cartridges	--	35	--	35
Conditioned Quantity		**204**	**407**	**204**	
Total Quantity without Re-test					**815**

14.3.6 12.7 mm x 99

12.7 mm x 99	Ammunition Format	Basic Function & Casualty Test			Totals
		+ 52 °C	+ 21 °C	- 54 °C	
Gun, Machine, M2HB (Wpn No. 1)[2]	Linked Cartridges	150	200	150	500
Gun, Machine, M2HB (Wpn No. 2)[2]	Linked Cartridges	150	200	150	500
Conditioned Quantity		**300**	**400**	**300**	
Total Quantity without Re-test					**1000**

Note 2: As there is currently only one NNW, the Function and Casualty Test shall be fired twice to ensure a reasonable quantity of ammunition is tested. This requirement will be reviewed if further NNWs are added to the list.

14.3.7 Non-Tactical Pack Ammunition

5.56mm and 7.62mm QA, PT and ST samples submitted as “ammunition only” will be tested through the NATO Nominated Machine Guns using links either supplied with the ammunition or else with links provided by the test centre. This is to ensure interchangeability throughout the complete family of NNW. Stoppages that are link related will not be considered attributable to the ammunition for sentencing purposes.

14.4 Minimum Required Equipment

The minimum required equipment is listed below.

Minimum Basic Equipment List[3]
One (preferably two) of each type of the relevant calibre nominated weapons as detailed in AEP-97, Volume 10.
Sufficient quantity of ammunition magazines appropriate for the weapon
NATO 1980 Weapon Mount, Mk2 (Sketch) Drawing No. 14-(MC)-1
Suitable Rigid Base for the NATO 1980 Weapon Mount for both horizontal and -80° (depressed) firing (5.7mm, 9mm)
For Pistols only – Ransome Rest or Apparatus, Mounting, Pistol (Sketch) Drawing No.14-(MC)-2
For 12.7mm only – Fixture, Test for F&C 12.7 mm - Figure No. 6-B-7
For 5.56mm only - NATO Chute Drawing No. 14-(5.56 mm)-1, Figure No. 6-B-6
Sufficient quantity of 5.56mm dummy cartridges for use with Gun, Machine, Minimi, Mk1 for the Free Hanging Belt Test
Link type appropriate for the calibre/weapon based on: 5.56mm - M27 type 7.62mm - M13 type 12.7mm - M9 type
NATO Qualified Links for establishing the validity of link related stoppages.
Witness Screen, paper/card, 1.2 mm maximum thickness, approximately 2 m x 2 m. (Three (3) required plus additional paper/card for re-covering when necessary).
Cyclic-Rate Timer. A suitable recording instrument that permits measurements of the rate of fire to within ± 2 % of the true rate of fire.
Velocity recording equipment for checking barrel serviceability if required.
Temperature controlled container(s) capable of maintaining temperatures within a tolerance of ± 3 °C. For compressed storage conditioning, the temperature controlled container(s) should be of the circulating air type to assure uniform conditioning of the ammunition.
Insulated boxes (if required).
Bore Sight
Compressed air system for barrel cooling (optional).

Note 3: Drawings and figures are contained in AEP-97, Volume 6.

14.5 Preparation for Testing

14.5.1 Inspection for Defects

Prior to being loaded into the appropriate magazines or links, the test cartridges shall be examined for obvious defects. If a visual defect is found, the defective cartridge shall be replaced and the defect photographed and reported to the Superintendent of the RTC. Any defects are to be noted under "Remarks" on the Function & Casualty Report Form Number 14 (Annex 14-G).

14.5.2 Ammunition Conditioning

All ammunition submitted for testing shall be stored for 12 hours at + 21 °C ± 5 °C prior to conditioning. The ammunition to be used for the F&C Test shall be loaded in linked belts and/or magazines, as applicable, prior to being conditioned at the specified temperature according to the period of time specified below. The temperature controlled container(s) shall have been brought to the specified temperature and maintained at that temperature prior to conditioning the ammunition:

Calibre	+21 °C	+ 52 °C	- 54 °C
4.6 mm	2 hours minimum (1 hour minimum under accelerated storage conditions[4])	4-24 hours (1 hour minimum under accelerated storage conditions[4])	6-24 hours (1 hour minimum under accelerated storage conditions[4])
5.56 mm	2 hours minimum (1 hour minimum under accelerated storage conditions[4])	4-24 hours (1 hour minimum under accelerated storage conditions[4])	6-24 hours (1 hour minimum under accelerated storage conditions[4])
5.7 mm	2 hours minimum (1 hour minimum under accelerated storage conditions[4])	4-24 hours (1 hour minimum under accelerated storage conditions[4])	6-24 hours (1 hour minimum under accelerated storage conditions[4])
7.62 mm	2 hours minimum (1 hour minimum under accelerated storage conditions[4])	4-24 hours (1 hour minimum under accelerated storage conditions[4])	6-24 hours (1 hour minimum under accelerated storage conditions[4])
9 mm	2 hours minimum (1 hour minimum under accelerated storage conditions[4])	4-24 hours (1 hour minimum under accelerated storage conditions[4])	6-24 hours (1 hour minimum under accelerated storage conditions[4])
12.7 mm	6 hours minimum (2 hours minimum under accelerated storage conditions[4])	6-24 hours (2 hours minimum under accelerated storage conditions[4])	6-24 hours (2 hours minimum under accelerated storage conditions[4])

Note 4: See paragraph 14.5.2.1 below for details.

14.5.2.1 Accelerated Storage Conditions

Conditioning times for the ammunition test samples may be shortened to periods of at least 1 hour (2 hours for 12.7 mm) at + 21 °C ± 3 °C, at least 1 hour (2 hours for 12.7 mm) at + 52 °C ± 3 °C and at least 1 hour (2 hours for 12.7 mm) at – 54 °C ± 3 °C when the conditions below are met:

a. The temperature controlled container(s) shall be of the circulating air type to assure uniform conditioning of the ammunition.

b. The temperature controlled container(s) shall have been brought to the specified temperature and maintained at that temperature prior to conditioning the ammunition.

14.5.3 Placement of Ammunition in Temperature Containers

14.5.3.1 Ammunition in magazines shall be placed on end in the temperature controlled container, maintaining a uniform spacing of not less than 25 mm in any direction. It may be necessary to use low level racks to support the magazines in a vertical plane. It is not permitted to store the magazines in a container within the conditioning cabinet as it would not allow proper circulation around the magazines.

14.5.3.2 Ammunition in linked belts shall be placed with the ammunition “primer end” down. If it is necessary to coil the linked belt, it is to be loosely coiled, ensuring there is at least 25 mm between the coils. It is not permitted to store the linked belts in a container within the conditioning cabinet as it would not allow proper circulation around the linked belts.

14.5.4 Use of Insulation Boxes

Insulated boxes that have been brought to the required temperature may be used to transfer ammunition from the controlled temperature container to the test weapons if portable temperature controlled cabinets are not available. Any such transfers are to be made immediately prior to firing to minimize temperature change.

14.5.5 Weapon Checks and Adjustments

Weapons to be used for the F&C test shall be prepared and thoroughly checked by a competent armourer. Headspace, firing pin protrusion and barrel gauging shall conform to the dimensions given in the relevant weapon characteristics annex of AEP-97, Volume 10. On weapons with multiple gas settings the normal gas setting shall be used and the rate of fire shall comply with the range specified in AEP-97, Volume 10. “Adverse” or “Excess” gas settings shall not be used.

14.5.6 Barrel Serviceability

Weapons employed in this test must have barrels in serviceable condition. To ensure this, all barrels shall be inspected visually and gauged to determine the state of wear in cases where limits have been established by a gauge measurement. In the event of a defect or incident which might be attributable to the condition of the barrel, the serviceability of the barrel shall be established by firing twenty (20) cartridges of

previously accepted ammunition of the same design, or if unavailable, twenty (20) NATO Reference Cartridges, single shot, measuring the velocity of each cartridge at 24 m (16 m for 9mm). A second series of twenty (20) cartridges of previously accepted ammunition of the same design, or if unavailable, NATO Reference Cartridges, shall be fired, where possible, on full automatic at two witness screens placed at 5 m ± 1 m and 40 m ± 5 m from the weapon. The 5 m witness screen shall have a 125 mm diameter hole through which the ammunition is to be fired. The barrel shall be considered unserviceable (and the Function and Casualty Test invalid) if:

a. the average velocity drop is more than 60 m/s than that obtained with the cartridge lot in a new barrel (less than 500 cartridges fired) of the particular model, or

b. if NATO Reference Ammunition has been fired through the barrel within its first 500 fired of life and current firing of the same NATO Reference Ammunition Lot gives an average velocity drop of more than 60 m/s, or

c. if four (4) or more shots on the witness screen at 40 metres indicate yaw of 15° or more

d. evidence of any bullet integrity defects

14.5.7 Installation of Weapon in the Mount

The weapons shall be installed in the appropriate mount as defined below ensuring correctly formed moulds are used as required by the mount user instructions:

Weapon	Weapon Mount	Mount Setting	Drawing/Figure No.[5]
4.6mm, Gun, Sub-Machine, MP7	NATO 1980 Weapon Mount Mk 2	Air 20 psi Hydraulic 5	14-(MC)-1 Figure. 6-B-5
5.56mm, Gun, Machine, Minimi, Mk1	NATO 1980 Weapon Mount Mk 2	Air 10 psi Hydraulic 8.5	14-(MC)-1 Figure. 6-B-6
5.56mm, Rifle, L85A2	NATO 1980 Weapon Mount Mk 2	Air 15 psi Hydraulic 5	14-(MC)-1
5.56mm, Rifle, M16A2/A4	NATO 1980 Weapon Mount Mk 2	Air 20 psi Hydraulic 5	14-(MC)-1
5.56mm, Rifle, AR70/90	NATO 1980 Weapon Mount Mk 2	Air 10 psi Hydraulic 5	14-(MC)-1
5.56mm, Rifle, G36/A1	NATO 1980 Weapon Mount Mk 2	Air 15 psi Hydraulic 5	14-(MC)-1
5.7mm, Gun, Sub-Machine, P90	NATO 1980 Weapon Mount Mk 2	Air 5 psi Hydraulic 8.5	14-(MC)-1
5.7mm, Pistol, Five-seveN	Ransome Rest or Apparatus, Mounting, Pistol	Not Applicable	14-(MC)-2
7.62mm, Gun, Machine, L7A2	NATO 1980 Weapon Mount Mk 2	Air 30 psi Hydraulic 3	14-(MC)-1
7.62mm, Gun, Machine, M240B	NATO 1980 Weapon Mount Mk 2	Air 30 psi Hydraulic 3	14-(MC)-1
9mm, Gun, Sub-Machine, PM12S/S2	NATO 1980 Weapon Mount Mk 2	Air 5 psi Hydraulic 9	14-(MC)-1
9mm, Pistol, 92F/92FS	Ransome Rest or Apparatus, Mounting, Pistol	Not Applicable	14-(MC)-2
12.7mm, Gun, Machine, M2HB	Fixture, Test, F&C, 12.7mm	Not Applicable	Figure. 6-B-7

Note 5: Drawings and Figures are contained in AEP-97, Volume 6.

14.5.8 Witness Screens

14.5.8.1 Close Witness Screen

Except for 5.7mm and 9mm depressed firings, the witness screen shall be erected at a distance of 5 metres ± 1 metres from the weapon so that the bullets will pass through a 125 mm diameter hole in the screen near its centre. The witness screen is to be inspected after each firing series in accordance with the details contained in paragraph 14.6.4. It shall be re-covered or replaced after each firing series, if necessary. A suitable material shall be used behind this witness screen to capture and identify the cause of perforations in the witness screen.

14.5.8.2 Intermediate Witness Screen

Except for 5.7mm and 9mm depressed firings, a second witness screen shall be erected at a distance of 15 metres ± 1 metres from the weapon so that the bullets will pass through a 250 mm diameter hole in the screen near its centre. The witness screen is to be inspected after each firing series in accordance with the details contained in paragraph 14.6.4. It shall be re-covered or replaced after each firing series, if necessary.

14.5.8.3 Far Witness Screen

Except for 5.7mm and 9mm depressed firings, a third witness screen shall be erected at a distance of 40 metres ± 5 metres from the weapon so that the bullets will pass through the screen near its centre. The witness screen is to be inspected after each firing series in accordance with the details contained in paragraph 14.6.4. It shall be re-covered or replaced after each firing series, as necessary, to allow clear observation of the pattern of shots.

14.5.9 5.7mm and 9mm Depression Firings

For the –80° (depressed) firings, the NATO 1980 Weapon Mount Mk 2 and the Ransome Rest or Apparatus, Mounting, Pistol, as appropriate, shall be mounted on a suitable fixture to achieve the –80° depression angle. A witness screen is not required.

14.6 Firing the Test

14.6.1 General firing Conditions

The number of cartridges to be fired, along with the firing requirements relevant to the calibre, is listed in the appropriate Annex at the end of this volume. The following conditions are also to be followed:

a. **It is strongly recommended that the EPVAT Test at high and low temperature have been successfully conducted prior to performing the Function & Casualty Test. This is to check that excessive pressures are not likely to be encountered when firing the Function & Casualty Test. It is also recommended that the Function & Casualty test is conducted remotely where possible for operator safety.**

b. If more than one ammunition sample is to be evaluated concurrently, either separate weapons are to be used for each sample, or if the same weapon is used, it shall be thoroughly cleaned and re-inspected prior to firing additional samples.

c. When a cooling interval is specified in the firing order, the barrels shall be cooled by air/compressed air to approximately ambient temperature or capable of being held by a bare hand.

d. The procedure for firing each of the weapons shall be uniform as far as is practical, taking into account the requirements listed in the firing matrices.

e. The ammunition shall be kept at the required conditioning temperature until immediately prior to firing.

f. The weapon shall be observed during the firing and in the event that excessive muzzle flash, breech flash or smoke occurs in comparison to NATO Reference Ammunition, a Smoke and/or Flash Test shall be conducted and sentenced in accordance with AEP-97, Volume 17.

g. When firing in the full automatic mode or 3-round burst mode, the time interval between bursts shall be approximately 3-5 seconds for 4.6mm, 5.56mm, 5.7mm, 7.62mm and 9mm. For 12.7mm, the time interval between bursts shall be approximately 10 to 15 seconds. For weapons with a single shot capability the time interval between shots shall be approximately one (1) second.

h. The Rate of Fire shall be recorded for each temperature condition for information when firing automatic. This shall be taken at least twice when the weapon has warmed up and repeated if it obvious that the weapon firing rate has changed substantially during testing.

14.6.2 Weapon Maintenance During Firing

At all times, cleaning, lubrication, adjustment and maintenance of each weapon shall conform to the technical instructions provided by the nation that provided the weapon. In the absence of specific instructions, cleaning, lubrication, adjustment and maintenance shall be consistent with good practice for all small arms, taking into account of any special conditions associated with peculiarities of the weapon, the test and the nature of ammunition being tested. In general, the weapons shall be examined frequently for accumulation of brass debris around the extractor, combustion residue in the gas system or other mechanism, excessive fouling in the barrel, and broken, loose or excessively worn parts.

14.6.3 Action in the Event of a Defect or Incident

In the event of any defect or incident occurring during firing of the test, a detailed check shall be made to determine whether the ammunition/links, magazine, weapon, mount or ancillary equipment or operator is at fault. If the stoppage or defect was caused by a misfire, the check of the weapon shall include measurement of the firing pin protrusion and firing pin indent. To assist in determining whether ammunition or equipment is responsible for a stoppage, it is good practice to test the weapon in question using ammunition that has been accepted previously as a NATO Qualified Design and to test the ammunition in question by firing in another weapon of the same type. If stoppages occur with linked ammunition, and poor performance of the link is suspected, the ammunition shall be tested with other NATO Qualified Links to establish the suitability of the link. If it is established that some faulty condition of the weapon is responsible for the stoppage or incident the test shall be disregarded, the weapon shall be corrected or replaced, and the test with that type of weapon shall be re-fired.

14.6.3.1 Re-conditioning of Ammunition in the Event of a Firing Delay

If a defect or incident occurs during the firing of the test and the delay exceeds sixty (60) seconds, the ammunition is to be immediately placed back into the conditioning chamber for at least fifteen (15) minutes until it is established that the weapon is functioning correctly and testing resumes.

14.6.4 Examination of Witness Screens and Fired Cases

The witness screens and fired cases from each temperature/weapon firing series are to be segregated. Upon completion of each temperature firing series (120 cartridges max.), the fired cases and screens shall be carefully examined for defects in accordance with AEP-97, Volume 11. If any defect is found that could be caused by a defective weapon, a detailed check of the weapon shall be made to determine whether the ammunition or the weapon is at fault. If it is established that a faulty weapon is responsible for the defect then the test shall be disregarded, the weapon shall be corrected or replaced, and tests with that type of weapon shall be re-fired. If it cannot be established that the weapon or other equipment is at fault, then the defects shall be charged against the ammunition. It is only necessary to conduct a visual inspection of the links if stoppages have occurred that could be deemed to be link related.

14.7 Recording of Results

a. All firing defects shall be reported on the Function and Casualty Form Number 14 (Annex 14-G) by individual category using terminology in accordance with AEP-97, Volume 11. The number of defects in each category shall be recorded, together with the total number of test cartridges fired in valid Function and Casualty Tests.

b. Any unusual conditions associated with weapon functioning, test ammunition, appearance of fired cases or other pertinent details should be recorded on Function and Casualty Form No. 14 under “Remarks.”

c. The Mean Rate of Fire shall be recorded for each temperature condition.

d. All entries on Function and Casualty Form No.14 shall be completed.

14.8 Sentencing - NATO Qualification Approval, NATO Production Test and NATO Surveillance Tests

Sentencing is applied individually to each weapon type[6] from the family of NATO Nominated Weapons. The ammunition must pass in all NNW types for it to be acceptable. It must also pass the separate test types[7]. If a cartridge exhibits one or more of the defects listed in AEP-97, Volume 11 either during firing, or visually after firing, it will be counted as a defect in accordance with the appropriate category. The stoppage and casualty codes defined Annex 11-B of AEP-97, Volume 11 are to be used when applicable. Visual standards contained in AEP-97, Volume 6 (Annex 6-C) are to be used where appropriate. A re-test with an equivalent quantity of cartridges is to be conducted in the same NNW weapon type if the acceptance figure in the first sample is exceeded but the reject figure has not been reached. It is not necessary to repeat the test in all the family of NATO Nominated Weapons. If the number of defects permitted by the

appropriate table below is exceeded for any of the weapon types, the test sample shall be rejected. If **any** critical defects occur, the test sample shall be rejected

Note 6: A weapon type shall be regarded as the pair of weapons of the same type used for the test.

Note 7: The 5.56mm, Gun, Machine, Minimi, Mk1, Free Hanging Belt Test and if applicable the NATO Chute Test shall be sentenced separately.

Sentencing Table for 4.6mm, 5.56mm, 5.7mm (SMG only), 7.62mm, 9mm (SMG only) and 12.7mm					
The definitions of the defect categories are listed in AEP-97, Vol. 11 - Annex 11-B, Appendix 1	**Test Sample Number**	**Sample size**	**Cumulative Sample size**	**Accept**	**Reject**
Category 1 Defects Critical	**1st 2nd**	**500 NOT**	**500 PERMITTED**	**0**	**1**
Category 2 Defects	**1st 2nd**	**500 500**	**500 1000**	**0 3**	**3 4**
Category 3 Defects	**1st 2nd**	**500 500**	**500 1000**	**2 6**	**5 7**
Category 4 Defects[8]	**1st 2nd**	**500 500**	**500 1000**	**7 18**	**11 19**
5.56mm, Gun, Machine, Minimi, Mk1 – Pierced Primer Defects	**1st 2nd**	**500 500**	**500 1000**	**11 26**	**16 27**

Note 8: For Function and Casualty testing conducted in the 5.56mm, Gun, Machine, Minimi, Mk1 only, Pierced Primers (caused by firing pin) shall be sentenced according to the 5.56mm, Gun, Machine, Minimi, Mk1 Pierced Primer Defects category in the table above.

Sentencing Table for 5.7mm and 9mm Pistols					
The definitions of the defect categories are listed in AEP-97, Vol. 11 - Annex 11-B, Appendix 1	**Test Sample Number**	**Sample size**	**Cumulative Sample size**	**Accept**	**Reject**
Category 1 Defects Critical	**1st 2nd**	**315 NOT**	**315 PERMITTED**	**0**	**1**
Category 2 Defects	**1st 2nd**	**315 315**	**315 630**	**0 1**	**2 2**
Category 3 Defects	**1st 2nd**	**315 315**	**315 630**	**1 4**	**4 5**
Category 4 Defects	**1st 2nd**	**315 315**	**315 630**	**5 12**	**9 13**

14.8.1 Results Within Acceptable Limits

If the number of defects observed does not exceed the acceptance level of the above categories for the complete family of NATO Nominated Weapons of the calibre under test, the ammunition shall be considered to have met the requirements of the Function & Casualty Test.

ANNEX 14-A
4.6mm FUNCTION AND CASUALTY FIRING ORDER

14.A.1 Firing Requirements

The following detailed procedures are to be followed when conducting the Function & Casualty Test listed in the table below:

a. The firing order listed in the table is to be followed when firing a particular temperature/attitude sequence. For example, all + 52 ºC firing in one weapon must be completed in one sequence.

b. Full magazines are to be used where quantity permits with the interval between magazines being as short as possible except where a cooling interval occurs.

c. It is recommended that one weapon barrel with a low round count and one weapon barrel with a high round count be utilized for the test.

d. Barrel is to be cooled to ambient after each cartridge firing cycle for Sub-Machine Guns and additionally after each different temperature firing sequence is completed.

e. If a retest is required then the complete firing sequence is to be repeated a second time in the NNW weapon type that failed. It is not necessary to repeat the test in all the family of NATO Nominated Weapons.

4.6mm, Gun, Sub-Machine, MP7 Function and Casualty Firing Order

Weapon	Firing Series	Temp	Qty	Weapon Attitude	Firing Mode See "Firing Requirements" above
Gun, Sub-Machine, MP7	1	+ 21 ºC	125	Horizontal	Single shot (semi auto)
Gun, Sub-Machine, MP7	2	+ 21 ºC	125	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd SMG or repeat w/ 1st SMG)	3	+ 21 ºC	125	Horizontal	Single shot (semi auto)
(2nd SMG or repeat w/ 1st SMG)	4	+ 21 ºC	125	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Gun, Sub-Machine, MP7	5	+ 52 ºC	63	Horizontal	Single shot (semi auto)
Gun, Sub-Machine, MP7	6	+ 52 ºC	62	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd SMG or repeat w/ 1st SMG)	7	+ 52 ºC	63	Horizontal	Single shot (semi auto)
(2nd SMG or repeat w/ 1st SMG)	8	+ 52 ºC	62	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Gun, Sub-Machine, MP7	9	- 54 ºC	63	Horizontal	Single shot (semi auto)
Gun, Sub-Machine, MP7	10	- 54 ºC	62	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd SMG or repeat w/ 1st SMG)	11	- 54 ºC	63	Horizontal	Single shot (semi auto)
(2nd SMG or repeat w/ 1st SMG)	12	- 54 ºC	62	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					

ANNEX 14-B
5.56mm FUNCTION AND CASUALTY FIRING ORDER

14.B.1 Firing Requirements

The following detailed procedures are to be followed when conducting the Function & Casualty Test listed in the table below:

a. The firing order listed in the table is to be followed when firing a particular temperature sequence. For example, all 5.56mm, Rifle, M16A2/A4, + 52 ºC firings on one weapon must be completed in one sequence. The Free Hanging Belt and NATO Chute Tests, are to be treated as separate sequences.

b. For Rifle firings, full magazines are to be used where quantity permits with the interval between magazines being as short as possible except where a cooling interval occurs.

c. It is recommended that one weapon barrel with a low round count and one weapon barrel with a high round count be utilized for the test.

d. The barrel is to be cooled to ambient after a maximum of 120 cartridges firing cycle for Machine Guns and Rifles with the exception of the Free Hanging Belt Test where cooling is to take place at the end of each firing sequence.

e. Where the Gun, Machine, Minimi, Mk1 linked pack firing is to be conducted through the NATO Chute, the ammunition is to be supported on the integral feed channel of the NATO Chute.

f. For all free hanging belt firings it may not be possible for the full length of belt to hang freely due to height restrictions on the weapon mount set-up. However, the belt is to hang down as far as possible and the remainder coiled up and attached to the rest of the belt to ensure that, initially, the complete weight of the full 100 cartridge belt is lifted and fed correctly by the functioning of the weapon. The objective is for the weapon functioning to continually lift the remaining weight of the belt, firing in bursts of approximately 5-7 cartridges. If necessary a guide chute with a low resistance surface, may be used to prevent the belt snagging on the mount. It must, however, be as near vertical as possible.

g. If a retest is required then the complete firing sequence is to be repeated a second time in the NNW weapon type that failed. It is not necessary to repeat the test in all the family of NATO Nominated Weapons.

5.56mm, Gun, Machine, Minimi, Mk1 Function and Casualty Firing Order

Weapon	Firing Series	Temp.	Qty	Firing Mode (See "Firing Requirements" above)
Gun, Machine, Minimi, Mk1 (Wpn No. 1) Free Hanging Belt	1	+ 21 ºC	100	Automatic Approx. 5-7 round bursts
Gun, Machine, Minimi, Mk1 (Wpn No. 2) Free Hanging Belt	2	+ 21 ºC	100	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, Minimi, Mk1 (Wpn No. 1) Free Hanging Belt	3	+ 52 ºC	100	Automatic Approx. 5-7 round bursts
Gun, Machine, Minimi, Mk1 (Wpn No. 2) Free Hanging Belt	4	+ 52 ºC	50 [9]	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, Minimi, Mk1 (Wpn No. 1) Free Hanging Belt	5	- 54 ºC	100	Automatic Approx. 5-7 round bursts
Gun, Machine, Minimi, Mk1 (Wpn No. 2) Free Hanging Belt	6	- 54 ºC	50 [9]	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				

Note 9: Fifty (50) Dummy Cartridges shall be added to these belts to achieve the weight of a 100-cartridge free hanging belt.

Gun, Machine, Minimi, Mk1 Additional Function and Casualty Firings for Linked Pack Ammunition

Weapon	Firing Series	Temp.	Qty	Firing Mode (See "Firing Requirements" above)
Gun, Machine, Minimi, Mk1 (Wpn No. 1) NATO Chute	7	+ 21 ºC	100	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, Minimi, Mk1 (Wpn No. 2) NATO Chute	8	+ 21 ºC	100	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, Minimi, Mk1 (Wpn No. 1) NATO Chute	9	+ 52 ºC	100	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, Minimi, Mk1 (Wpn No. 2) NATO Chute	10	+ 52 ºC	50 [10]	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, Minimi, Mk1 (Wpn No. 1) NATO Chute	11	- 54 ºC	100	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, Minimi, Mk1 (Wpn No. 2) NATO Chute	12	- 54 ºC	50 [10]	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				

Note 10: Fifty (50) Dummy Cartridges shall be added to these belts to simulate the weight of a 100-cartidge belt for each portion of the NATO Chute Test.

5.56mm, Rifle, L85A2 Function and Casualty Firing Order

Weapon	Firing Series	Temp.	Qty	Firing Mode)See "Firing Requirements" above)
Rifle, L85A2	1	+ 21 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, L85A2	2	+ 21 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, L85A2	3	+ 21 ºC	30	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
(2nd Rifle or repeat w/ 1st Rifle)	4	+ 21 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	5	+ 21 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	6	+ 21 ºC	30	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Rifle, L85A2	7	+ 52 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, L85A2	8	+ 52 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, L85A2	9	+ 52 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
(2nd Rifle or repeat w/ 1st Rifle)	10	+ 52 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	11	+ 52 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	12	+ 52 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Rifle, L85A2	13	- 54 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, L85A2	14	- 54 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, L85A2	15	- 54 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
(2nd Rifle or repeat w/ 1st Rifle)	16	- 54 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	17	- 54 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	18	- 54 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				

5.56mm, Rifle, M16A2/A4 Function and Casualty Firing Order

Weapon	Firing Series	Temp.	Qty	Firing Mode (See "Firing Requirements" above)
Rifle, M16A2/A4	1	+ 21 ºC	30	3-round burst
Rifle, M16A2/A4	2	+ 21 ºC	30	3-round burst
Rifle, M16A2/A4	3	+ 21 ºC	30	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
(2nd Rifle or repeat w/ 1st Rifle)	4	+ 21 ºC	30	3-round burst
(2nd Rifle or repeat w/ 1st Rifle)	5	+ 21 ºC	30	3-round burst
(2nd Rifle or repeat w/ 1st Rifle)	6	+ 21 ºC	30	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Rifle, M16A2/A4	7	+ 52 ºC	30	3-round burst
Rifle, M16A2/A4	8	+ 52 ºC	30	3-round burst
Rifle, M16A2/A4	9	+ 52 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
(2nd Rifle or repeat w/ 1st Rifle)	10	+ 52 ºC	30	3-round burst
(2nd Rifle or repeat w/ 1st Rifle)	11	+ 52 ºC	30	3-round burst
(2nd Rifle or repeat w/ 1st Rifle)	12	+ 52 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Rifle, M16A2/A4	13	- 54 ºC	30	3-round burst
Rifle, M16A2/A4	14	- 54 ºC	30	3-round burst
Rifle, M16A2/A4	15	- 54 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
(2nd Rifle or repeat w/ 1st Rifle)	16	- 54 ºC	30	3-round burst
(2nd Rifle or repeat w/ 1st Rifle)	17	- 54 ºC	30	3-round burst
(2nd Rifle or repeat w/ 1st Rifle)	18	- 54 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				

5.56mm, Rifle, AR70/90 Function and Casualty Firing Order

Weapon	Firing Series	Temp.	Qty	Firing Mode (See "Firing Requirements" above)
Rifle, AR70/90	1	+ 21 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, AR70/90	2	+ 21 ºC	30	3-round burst
Rifle, AR70/90	3	+ 21 ºC	30	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
(2nd Rifle or repeat w/ 1st Rifle)	4	+ 21 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	5	+ 21 ºC	30	3-round burst
(2nd Rifle or repeat w/ 1st Rifle)	6	+ 21 ºC	30	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Rifle, AR70/90	7	+ 52 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, AR70/90	8	+ 52 ºC	30	3-round burst
Rifle, AR70/90	9	+ 52 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
(2nd Rifle or repeat w/ 1st Rifle)	10	+ 52 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	11	+ 52 ºC	30	3-round burst
(2nd Rifle or repeat w/ 1st Rifle)	12	+ 52 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Rifle, AR70/90	13	- 54 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, AR70/90	14	- 54 ºC	30	3-round burst
Rifle, AR70/90	15	- 54 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
(2nd Rifle or repeat w/ 1st Rifle)	16	- 54 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	17	- 54 ºC	30	3-round burst
(2nd Rifle or repeat w/ 1st Rifle)	18	- 54 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				

5.56mm, Rifle, G36/A1 Function and Casualty Firing Order

Weapon	Firing Series	Temp.	Qty	Firing Mode (See "Firing Requirements" above)
Rifle, G36/A1	1	+ 21 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, G36/A1	2	+ 21 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, G36/A1	3	+ 21 ºC	30	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
(2nd Rifle or repeat w/ 1st Rifle)	4	+ 21 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	5	+ 21 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	6	+ 21 ºC	30	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Rifle, G36/A1	7	+ 52 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, G36/A1	8	+ 52 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, G36/A1	9	+ 52 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
(2nd Rifle or repeat w/ 1st Rifle)	10	+ 52 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	11	+ 52 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	12	+ 52 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Rifle, G36/A1	13	- 54 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, G36/A1	14	- 54 ºC	30	Automatic Approx. 5-7 round bursts
Rifle, G36/A1	15	- 54 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
(2nd Rifle or repeat w/ 1st Rifle)	16	- 54 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	17	- 54 ºC	30	Automatic Approx. 5-7 round bursts
(2nd Rifle or repeat w/ 1st Rifle)	18	- 54 ºC	20	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				

ANNEX 14-C

5.7mm FUNCTION AND CASUALTY FIRING ORDER

14.C.1 Firing Requirements

The following detailed procedures are to be followed when conducting the Function & Casualty Test listed in the table below:

a. The firing order listed in the table is to be followed when firing a particular temperature/attitude sequence. For example, all Pistol, Five-seveN, + 21 ºC horizontal firings in one weapon must be completed in one sequence.

b. Depressed firings are to be at 80º from horizontal.

c. Full magazines are to be used where quantity permits with the interval between magazines being as short as possible except where a cooling interval occurs.

d. It is recommended that one weapon barrel with a low round count and one weapon barrel with a high round count be utilized for the test.

e. The barrel is to be cooled to ambient after each 150 cartridge firing cycle for Sub-Machine Guns, a 60 cartridge cycle for Pistols and additionally after each different temperature firing sequence is completed for both Sub-Machine Guns and Pistols. Barrels are also to be cooled between the horizontal and depressed firings.

f. If a retest is required then the complete firing sequence (Sub-Machine Guns - 500 cartridges or Pistol - 315 cartridges) is to be repeated a second time in the NNW weapon type that failed. It is not necessary to repeat the test in all the family of NATO Nominated Weapons.

5.7mm, Gun, Sub-Machine, P90 Function and Casualty Firing Order

Weapon	Firing Series	Temp	Qty	Weapon Attitude	Firing Mode See "Firing Requirements" above
Gun, Sub-Machine, P90	1	+ 21 ºC	32	Horizontal	Single shot (semi auto)
Gun, Sub-Machine, P90	2	+ 21 ºC	32	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd SMG or repeat w/ 1st SMG)	3	+ 21 ºC	32	Horizontal	Single shot (semi auto)
(2nd SMG or repeat w/ 1st SMG)	4	+ 21 ºC	32	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Gun, Sub-Machine, P90	5	+ 52 ºC	32	Horizontal	Single shot (semi auto)
Gun, Sub-Machine, P90	6	+ 52 ºC	30	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd SMG or repeat w/ 1st SMG)	7	+ 52 ºC	32	Horizontal	Single shot (semi auto)
(2nd SMG or repeat w/ 1st SMG)	8	+ 52 ºC	30	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Gun, Sub-Machine, P90	9	- 54 ºC	32	Horizontal	Single shot (semi auto)
Gun, Sub-Machine, P90	10	- 54 ºC	30	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd SMG or repeat w/ 1st SMG)	11	- 54 ºC	32	Horizontal	Single shot (semi auto)
(2nd SMG or repeat w/ 1st SMG)	12	- 54 ºC	30	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Gun, Sub-Machine, P90	9	+ 21 ºC	32	Depressed	Single shot (semi auto)
Gun, Sub-Machine, P90	10	+ 21 ºC	30	Depressed	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd SMG or repeat w/ 1st SMG)	11	+ 21 ºC	32	Depressed	Single shot (semi auto)
(2nd SMG or repeat w/ 1st SMG)	12	+ 21 ºC	320	Depressed	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					

5.7mm, Pistol, Five-seveN Function and Casualty Firing Order

Weapon	Firing Series	Temp	Qty	Weapon Attitude	Firing Mode See "Firing Requirements" above
Pistol, Five-seveN	1	+ 21 ºC	40	Horizontal	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd Pistol or repeat w/ 1st Pistol)	2	+ 21 ºC	40	Horizontal	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Pistol, Five-seveN	3	+ 52 ºC	40	Horizontal	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd Pistol or repeat w/ 1st Pistol)	4	+ 52 ºC	40	Horizontal	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Pistol, Five-seveN	5	- 54 ºC	40	Horizontal	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd Pistol or repeat w/ 1st Pistol)	6	- 54 ºC	40	Horizontal	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Pistol, Five-seveN	7	+ 21 ºC	40	Depressed	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd Pistol or repeat w/ 1st Pistol)	8	+ 21 ºC	35	Depressed	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					

ANNEX 14-D
7.62mm FUNCTION AND CASUALTY FIRING ORDER

14.D.1 Firing Requirements

The following detailed procedures are to be followed when conducting the Function & Casualty Test listed in the table below:

a. The firing order listed in the table is to be followed when firing a particular temperature sequence. For example, all + 52 ºC firing in one weapon must be completed in one sequence.

b. It is recommended that one weapon barrel with a low round count and one weapon barrel with a high round count be utilized for the test.

c. Barrel is to be cooled to ambient after a maximum of 120 cartridges firing cycle.

d. Machine Gun firings are to be conducted with a free hanging belt. The belt is to hang down as far as possible with at least 75 cartridges free hanging and the remainder coiled up to ensure a large portion of belt is lifted and fed correctly by the functioning of the weapon. If necessary a guide chute with a low resistance surface, may be used to avoid the belt snagging on the mount. It must, however, be as near vertical as possible.

e. If a retest is required then the complete firing sequence is to be repeated a second time in the NNW weapon type that failed. It is not necessary to repeat the test in all the family of NATO Nominated Weapons.

7.62mm, Guns, Machine, L7A2 and M240B Function and Casualty Firing Order

Weapon	Firing Series	Temp.	Qty	Firing Mode (See "Firing Requirements" above)
Gun, Machine, L7A2 (Wpn No. 1)	1	+ 21 ºC	100	Automatic Approx. 20-round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, L7A2 (Wpn No. 2)	2	+ 21 ºC	100	Automatic Approx. 20-round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				

Weapon	Firing Series	Temp.	Qty	Firing Mode (See "Firing Requirements" above)
Gun, Machine, M240B (Wpn No. 1)	3	+ 21 ºC	100	Automatic Approx. 20-round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M240B (Wpn No. 2)	4	+ 21 ºC	100	Automatic Approx. 20-round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, L7A2 (Wpn No. 1)	5	+ 52 ºC	75	Automatic Approx. 20-round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, L7A2 (Wpn No. 2)	6	+ 52 ºC	75	Automatic Approx. 20-round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M240B (Wpn No. 1)	7	+ 52 ºC	75	Automatic Approx. 20-round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M240B (Wpn No. 2)	8	+ 52 ºC	75	Automatic Approx. 20-round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, L7A2 (Wpn No. 1)	9	- 54 ºC	75	Automatic Approx. 20-round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, L7A2 (Wpn No. 2)	10	- 54 ºC	75	Automatic Approx. 20-round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M240B (Wpn No. 1)	11	- 54 ºC	75	Automatic Approx. 20-round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M240B (Wpn No. 2)	12	- 54 ºC	75	Automatic Approx. 20-round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				

ANNEX 14-E

9mm FUNCTION AND CASUALTY FIRING ORDER

14.E.1 Firing Requirements

The following detailed procedures are to be followed when conducting the Function & Casualty Test listed in the table below:

a. The firing order listed in the table is to be followed when firing a particular temperature/attitude sequence. For example, all Pistol, 92F/FS, + 21 ºC horizontal firings in one weapon must be completed in one sequence.

b. Depressed firings are to be at 80º from horizontal.

c. It is recommended that one weapon barrel with a low round count and one weapon barrel with a high round count be utilized for the test.

d. Full magazines are to be used where quantity permits with the interval between magazines being as short as possible except where a cooling interval occurs.

e. Barrel is to be cooled to ambient after each 130 cartridge firing cycle for Sub-Machine Guns, 50 cartridge cycle for Pistols and additionally after each different temperature firing sequence is completed for both Sub-Machine Guns and Pistols. Barrels are also to be cooled between the horizontal and depressed firings.

f. If a retest is required then the complete firing sequence (Sub-Machine Guns - 500 cartridges or Pistol - 315 cartridges) is to be repeated a second time in the NNW weapon type that failed. It is not necessary to repeat the test in all the family of NATO Nominated Weapons.

9mm, Gun, Sub-Machine, PM12S/S2 Function and Casualty Firing Order

Weapon	Firing Series	Temp	Qty	Weapon Attitude	Firing Mode See "Firing Requirements" above
Gun, Sub-Machine, PM12S/S2	1	+ 21 ºC	32	Horizontal	Single shot (semi auto)
Gun, Sub-Machine, PM12S/S2	2	+ 21 ºC	32	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd SMG or repeat w/ 1st SMG)	3	+ 21 ºC	32	Horizontal	Single shot (semi auto)
(2nd SMG or repeat w/ 1st SMG)	4	+ 21 ºC	32	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Gun, Sub-Machine, PM12S/S2	5	+ 52 ºC	30	Horizontal	Single shot (semi auto)
Gun, Sub-Machine, PM12S/S2	6	+ 52 ºC	32	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd SMG or repeat w/ 1st SMG)	7	+ 52 ºC	30	Horizontal	Single shot (semi auto)
(2nd SMG or repeat w/ 1st SMG)	8	+ 52 ºC	32	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Gun, Sub-Machine, PM12S/S2	9	- 54 ºC	30	Horizontal	Single shot (semi auto)
Gun, Sub-Machine, PM12S/S2	10	- 54 ºC	32	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd SMG or repeat w/ 1st SMG)	11	- 54 ºC	30	Horizontal	Single shot (semi auto)
(2nd SMG or repeat w/ 1st SMG)	12	- 54 ºC	32	Horizontal	Automatic Approx. 5-7 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Gun, Sub-Machine, PM12S/S2	13	+ 21 ºC	30	Depressed	Single shot (semi auto)
Gun, Sub-Machine, PM12S/S2	14	+ 21 ºC	32	Depressed	Automatic Approx. 5-7 round bursts
Inspect Fired Cases, Cool Weapon					
(2nd SMG or repeat w/ 1st SMG)	15	+ 21 ºC	30	Depressed	Single shot (semi auto)
(2nd SMG or repeat w/ 1st SMG)	16	+ 21 ºC	32	Depressed	Automatic Approx. 5-7 round bursts
Inspect Fired Cases, Cool Weapon					

9mm, Pistol, Model 92F/FS Function and Casualty Firing Order

Weapon	Firing Series	Temp	Qty	Weapon Attitude	Firing Mode See "Firing Requirements" above
Pistol, Model 92F/FS	1	+ 21 ºC	40	Horizontal	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd Pistol or repeat w/ 1st Pistol)	2	+ 21 ºC	40	Horizontal	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Pistol, Model 92F/FS	3	+ 52 ºC	40	Horizontal	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd Pistol or repeat w/ 1st Pistol)	4	+ 52 ºC	40	Horizontal	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Pistol, Model 92F/FS	5	- 54 ºC	40	Horizontal	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd Pistol or repeat w/ 1st Pistol)	6	- 54 ºC	40	Horizontal	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
Pistol, Model 92F/FS	7	+ 21 ºC	40	Depressed	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					
(2nd Pistol or repeat w/ 1st Pistol)	8	+ 21 ºC	35	Depressed	Single shot (semi auto)
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon					

ANNEX 14-F
12.7mm FUNCTION AND CASUALTY FIRING ORDER

14.F.1 Firing Requirements

The following detailed procedures are to be followed when conducting the Function & Casualty Test listed in the table below:

a. The firing order listed in the table is to be followed when firing a particular temperature sequence. For example, all + 52 ºC firing in one weapon must be completed in one sequence.

b. It is recommended that one weapon barrel with a low round count and one weapon barrel with a high round count be utilized for the test.

c. Barrel is to be cooled to ambient after a maximum of 120 cartridges firing cycle.

d. All Machine Gun firings are to be conducted with the belt feeding from a suitable ammunition container adjacent to the mount.

e. If a retest is required then the complete firing sequence is to be repeated a second time in the NNW weapon type that failed. It is not necessary to repeat the test in all the family of NATO Nominated Weapons.

12.7mm, Gun, Machine, M2HB Function and Casualty Firing Order

Weapon	Firing Series	Temp.	Qty	Firing Mode (See "Firing Requirements" above)
Gun, Machine, M2HB (Wpn No. 1)	1	+ 21 ºC	100	Automatic Approx. 6-9 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M2HB (Wpn No. 1)	2	+ 21 ºC	100	Automatic Approx. 6-9 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M2HB (Wpn No. 2)	1	+ 21 ºC	100	Automatic Approx. 6-9 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M2HB (Wpn No. 2)	4	+ 21 ºC	100	Automatic Approx. 6-9 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M2HB (Wpn No. 1)	5	+ 52 ºC	75	Automatic Approx. 6-9 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M2HB (Wpn No. 1)	6	+ 52 ºC	75	Automatic Approx. 6-9 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M2HB (Wpn No. 2)	7	+ 52 ºC	75	Automatic Approx. 6-9 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M2HB (Wpn No. 2)	8	+ 52 ºC	75	Automatic Approx. 6-9 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M2HB (Wpn No. 1)	9	- 54 ºC	75	Automatic Approx. 6-9 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M2HB (Wpn No. 1)	10	- 54 ºC	75	Automatic Approx. 6-9 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M2HB (Wpn No. 2)	11	- 54 ºC	75	Automatic Approx. 6-9 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				
Gun, Machine, M2HB (Wpn No. 2)	12	- 54 ºC	75	Automatic Approx. 6-9 round bursts
Inspect/Change Witness Screens and Inspect Fired Cases, Cool Weapon				

ANNEX 14-G

FORM NUMBER 14 - FUNCTION AND CASUALTY TEST

Per paragraph 14.7, Form Number 14 for recording of results and remarks for the Function and Casualty (F&C) Testing is presented on the next page found in Annex 14-G (pages 14-G-2).

14.G.1 FORM 14: FUNCTION AND CASUALTY TEST (F&C)

Form Number 14	Page 1 of 1							**FUNCTION and CASUALTY (F&C)**
Test Centre				Test Reference				
Submitting Nation				Lot Number				
Manufacturer				Cartridge Type				
Date Fired				NATO Design No.				
Sample Size				Weapon Type				
	1st Weapon				2nd Weapon (if applicable)			
				Weapon Serial Number				
				Weapon Life				
				Barrel Serial Number				
				Barrel Life				
mm				Head Space				mm
mm				Pin Protrusion				mm
mm				Firing Pin Indent				mm
Cumulative	+21 °C	+52 °C	-54 °C	Temperature	+21 °C	+52 °C	-54 °C	Cumulative
				Total Rounds Fired				
	Mean Rate of Fire (if applicable			**Firing Mode (Horizontal)**	Mean Rate of Fire (if applicable)			
	Firing Modes: Approx 5-7 round bursts; 3 round burst; Single shot (semi auto)							
Cumulative	+21 °C			Temperature	+21 °C			Cumulative
				Total Rounds Fired				
	Mean Rate of Fire (if applicable			**Firing Mode (Depressed)**	Mean Rate of Fire (if applicable)			
	Firing Modes: Approx 5-7 round bursts; Single shot (semi auto) or Not Applicable (N/A)							
	+21 °C	+52 °C	-54 °C	**Total Defects / Temperature**	+21 °C	+52 °C	-54 °C	
				Category 1 (Cat 1)				
				Category 2 (Cat 2)				
				Category 3 (Cat 3)				
				Category 4 (Cat 4)				
Cumulative Defects	**Cat 1**		**Cat 2**		**Cat 3**		**Cat 4**	
Defect Codes	*For Defects Codes Used, See AEP-97, Volume 11 (No Entry = No Defects)*							
Observations								

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 15

LINK TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

15.1 Applicability

5.56 mm, 7.62 mm and 12.7 mm ammunition submitted in link pack for Qualification Approval or Production testing shall be subjected to the Link Test Procedure defined in this volume. Annex 15-A contains the procedures for 5.56 mm linked ammunition. Annex 15-B contains the procedures for 7.62 mm linked ammunition. Annex 15-C contains the procedures for 12.7 mm linked ammunition.

15.2 NATO Requirements

Linked ammunition shall function satisfactorily in the NATO Nominated machinegun(s) and shall meet the requirements of the tests contained in the applicable annex. The following table lists the specific tests for each calibre. For the tests that are listed as "Nationally Certified," the submitting nation shall provide a Certificate of Conformity indicating that the individual tests have met its own national requirements.

Test	5.56 mm	7.62 mm	12.7 mm
NATO Chute[1]	Yes	No Requirement	No Requirement
Free Hanging[1]	Yes	Yes	No Requirement
Free Helical Flexibility	No Requirement	Yes	No Requirement
Free Fanwise Flexibility	No Requirement	Yes	No Requirement
Belt Strength (and Firing)	Yes	Yes	Yes
Free Hinging	Yes	Yes	Yes
Cartridge and Link Extractor Pull	No Requirement	No Requirement	Yes
Dimensional Characteristics	Nationally Certified	Nationally Certified	Nationally Certified
Visual Inspection	Nationally Certified	Nationally Certified	Nationally Certified
Salt Corrosion Test	Nationally Certified	Nationally Certified	Nationally Certified

Note 1. The test is conducted and sentenced as part of the Function and Casualty Test.

15.3 Test Ammunition Quantity

Test	5.56 mm	7.62 mm	12.7 mm
NATO Chute[1]	AEP-97, Vol. 14	No Requirement	No Requirement
Free Hanging[1]	AEP-97, Vol. 14	AEP-97, Vol. 14	No Requirement
Free Helical Flexibility	No Requirement	5 belts of 30 cartridges each	No Requirement
Free Fanwise Flexibility	No Requirement	5 belts of 30 cartridges each	No Requirement
Belt Strength (and Firing)	5 belts of 5 cartridges each[2]	5 belts of 5 cartridges each[2]	2 belts of 25 cartridges each[2]
Free Hinging	1 belt of 100 cartridges	1 belt of 100 cartridges	2 belts of 25 cartridges each
Cartridge and Link Extractor Pull	No Requirement	No Requirement	2 belts of 16 cartridges each
Dimensional Characteristics	per National Requirement	per National Requirement	per National Requirement
Visual Inspection	per National Requirement	per National Requirement	per National Requirement
Salt Corrosion Test	per National Requirement	per National Requirement	per National Requirement

Note 1. The ammunition quantities specified shall be fired in each NATO Nominated Machine Gun.

Note 2. If mandrels are used, two additional links per belt are necessary to attach the mandrels to the test fixture.

15.4 Equipment

As specified in the appropriate annex in this volume.

15.5 Equipment Set-up

As specified in the appropriate annex in this volume.

15.6 Method of Conducting the Test

As specified in the appropriate annex in this volume.

15.7 Recording of Results

As specified in the appropriate annex in this volume.

15.8 Sentencing

The linked ammunition shall be considered to have met the NATO requirements if the linked belts function satisfactorily in the NATO Nominated Machine Gun(s) and meet the requirements of the tests contained in the applicable annex.

15.9 Re-Test Procedures for NATO Chute and Free Hanging Tests

The retest procedures and retest sentencing specified in the Function and Casualty Test Volume shall be followed.

15.10 Retest Procedures for All Other Link Tests

If the linked belts and/or links fail to meet the requirements of any individual test(s), a retest shall be conducted. The retest sample size shall be double the original sample size. The linked belts or links shall be considered to have met NATO requirements if the retest sample(s) meet the requirements of each test that originally failed.

15.11 Other Defects and Incidents - Sentencing

During any test or retest, if any defects occur that are not related to this particular test, either during firing, or visually after firing, they shall be categorised in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

ANNEX 15-A
5.56 mm LINKED BELTS

15.A.1 NATO Chute Test

The test ammunition quantity, equipment, method of conducting test, recording of results and sentencing for the NATO Chute Test are contained in the Function and Casualty Test, AEP-97, Volume 14.

15.A.2 Free Hanging Test

The test ammunition quantity, equipment, method of conducting test, recording of results and sentencing for the Free Hanging Test are contained in the Function and Casualty Test, AEP-97, Volume 14.

15.A.3 Belt Strength Test

15.A.3.1 NATO Requirements

The linked belt shall withstand a force of 147 newtons (N) ± 3 % applied for a minimum of thirty (30) seconds and be able to be fired successfully in the NATO Nominated Machine Gun(s).

15.A.3.2 Ammunition Quantity

Five (5) belts of 5-cartridges (also referred to as rounds) for each NATO Nominated Machine Gun. If mandrels are used to attach the belt to the test fixture, additional links, one (1) at each end of each belt, will be necessary.

15.A.3.3 Equipment

a. Suitable tensile testing machine or fixture to permit the continuous application of the specified force to the linked belt. Test fixture as shown on Drawing No. 15-(5.56mm)-1 (AEP-97, Volume 6).

b. Timer/clock.

c. Mandrels to attach linked belt to test fixture (if necessary).

d. NATO Nominated Machine Gun(s).

15.A.3.4 Method of Conducting the Test

15.A.3.4.1 The first 5-round belt shall be visually examined to ensure that each link is correctly positioned on each cartridge and that there are no obvious defects with the links.

Any link with an obvious defect shall be removed from the test and the defect noted on the test report. The defective link shall be replaced with a new link.

15.A.3.4.2 The technician shall attach the first 5-round belt to the tensile testing machine/fixture. If necessary, steel mandrels may be used to attach the linked belt to the test fixture. The specified force of 147 N shall be applied gradually until the belt is completely under tension.

15.A.3.4.3 The linked belt shall remain under the 147 N load for thirty (30) seconds. The technician shall note any belt separation during the thirty second period.

15.A.3.4.4 At the end of the thirty second period, the linked belt shall be removed from the tensile testing machine/fixture.

15.A.3.4.5 The procedures in paragraphs 15.A.3.4.1 through 15.A.3.4.4 shall be repeated on the remaining four linked belts.

15.A.3.4.6 After the application of the 147 N load to the linked belts, each belt shall be visually inspected (without disassembling) for defects including cracks and loop stretching. The technician shall note any defects.

15.A.3.4.7 If the linked belts have not separated, each of the five belts shall be fired separately in each NATO Nominated machinegun. The firing portion of the test should be conducted as soon as possible after the application of the 147 N load. In any event, the time between the application of the load and the firing portion of the test shall not exceed twenty-four (24) hours. Each belt shall be fired in one burst. The weapon shall be checked beforehand by firing a belt of 5-rounds (from the same lot) that has not been subjected to the 147 N load[1]. The technician shall note any weapon stoppages and determine whether the stoppages are attributable to the links.

Note 1. This weapon check is not necessary if the Function and Casualty Test (for the same lot) has been conducted immediately prior to the firing portion of the Belt Strength Test.

15.A.3.5 Recording of Results

The technician shall record any belt separation(s), the results of the visual inspections and any stoppages that occur during the firing of the linked belts. The technician shall determine if the stoppages are attributable to the links or to some other cause. The results of the test shall be recorded on Form No. 15-1 (Annex 15-D).

15.A.3.6 Sentencing

The linked belts meet NATO requirements if none of the linked belts separate under the tensile load and no weapon functioning defects attributable to the links are noted.

15.A.3.7 Re-Test Procedure

In the event of a failure in either the tensile load portion of the test or the firing portion of the test, a retest shall be conducted using ten (10) 5-round belts of linked ammunition for each NATO Nominated Machine Gun.

15.A.3.8 Re-Test Sentencing

The linked belts meet NATO requirements if none of the linked belts separate under the tensile load and no weapon functioning defects attributable to the links are noted.

15.A.3.9 Other Defects and Incidents - Sentencing

During any test or retest, if any defects occur that are not related to this particular test, either during firing, or visually after firing, they shall be categorised in accordance with Volume 11 and sentenced in accordance with the cumulative sentencing requirements of Volume 7 of AEP-97.

15.A.4 Free Hinging Test

15.A.4.1 NATO Requirements

The linked belt must hinge without binding or grabbing.

15.A.4.2 Ammunition Quantity

One (1) 100-round belt of linked ammunition.

15.A.4.3 Equipment

a. A table long enough to permit the linked belt to be pulled over itself.

b. A channel, or guide, to restrict the linked belt from sliding across the table top which may induce binding on an otherwise free-hinging belt.

15.A.4.4 Method of Conducting the Test

15.A.4.4.1 To make it easier to identify the position of the individual link that causes binding or grabbing in the linked belt, the links shall be identified as one (1) through one hundred (100) with the link that the technician grasps defined as link number one (1).

15.A.4.4.2 The linked belt shall be visually examined to ensure that each link is correctly positioned on each cartridge and that there are no obvious defects with the links. Any link with an obvious defect shall be removed from the test and the defect noted on the test report. The defective link shall be replaced with a new link.

15.A.4.4.3 The linked belt shall be positioned in the channel/guide on the table with the loop gaps down and the bases of the cartridges adjacent to the technician. The linked belt shall be positioned in a straight line and extended to remove any slack.

15.A.4.4.4 The technician shall grasp the connecting loop of the left end of the belt and draw the end portion of the belt over the remainder of the belt ensuring that the linked cartridges being drawn remain in contact with the remainder of the belt. As the technician is pulling the belt over itself, they should note any occurrence of binding or grabbing,

including the number of individual occurrences and the position of the link that caused the binding or grabbing.

15.A.4.4.5 The linked belt shall be again positioned as per paragraph 15.A.4.4.3.

15.A.4.4.6 The technician shall grasp the right end of the belt and draw the end portion of the belt over the remainder of the belt ensuring that the linked cartridges being drawn remain in contact with the remainder of the belt. As the technician is pulling the belt over itself, they should note any occurrence of binding or grabbing, including the number of individual occurrences and the position of the link that caused the binding or grabbing.

15.A.4.4.7 The linked belt shall be positioned in the channel/guide on the table with the loop gaps up and the bases of the cartridges adjacent to the technician. The linked belt shall be positioned in a straight line and extended to remove any slack.

15.A.4.4.8 The technician shall grasp the left end of the belt and draw the end portion of the belt over the remainder of the belt ensuring that the linked cartridges being drawn remain in contact with the remainder of the belt. As the technician is pulling the belt over itself, they should note any occurrence of binding or grabbing, including the number of individual occurrences and the position of the link that caused the binding or grabbing.

15.A.4.4.9 The linked belt shall be again positioned as per paragraph 15.A.4.4.7.

15.A.4.4.10 The technician shall grasp the connecting loop of the right end of the belt and draw the end portion of the belt over the remainder of the belt ensuring that the linked cartridges being drawn remain in contact with the remainder of the belt. As the technician is pulling the belt over itself, they should note any occurrence of binding or grabbing, including the number of individual occurrences and the position of the link that caused the binding or grabbing.

15.A.4.5 Recording of Results

The technician shall record the identity of each defective link and the number of times each link caused binding or grabbing during the four (4) portions of the test on Form No. 15-2 (Annex 15-D).

15.A.4.6 Sentencing

The linked belt meets NATO requirements if no binding or grabbing is observed in any portion of the test.

15.A.5 Cartridge Stripping

15.A.5.1 NATO Requirements

There are no specific NATO cartridge stripping requirements for linked ammunition to be considered NATO interchangeable. The nation submitting its linked ammunition for NATO interchangeability shall provide a Certificate of Conformity indicating that the links meet all cartridge stripping requirements of its national specification for links. The number of

links tested, the equipment used and the method of conducting the test shall be determined by national specifications and requirements.

15.A.6 Dimensional Characteristics

15.A.6.1 NATO Requirements

There are no specific NATO dimensional requirements for linked ammunition to be considered NATO interchangeable. The nation submitting its linked ammunition for NATO interchangeability shall provide a Certificate of Conformity indicating that the links meet all dimensional requirements of its national specification for links. The number of links tested, the equipment used and the method of conducting the test shall be determined by national specifications and requirements.

15.A.7 Visual Inspection

15.A.7.1 NATO Requirements

There are no specific NATO requirements for visual inspection of the links for the linked ammunition to be considered NATO interchangeable. The nation submitting its linked ammunition for NATO interchangeability shall provide a Certificate of Conformity indicating that the links meet the visual inspection requirements of its national specification for links. The number of links tested, the equipment used and the method of conducting the test shall be determined by national specifications and requirements.

15.A.8 Salt Corrosion

15.A.8.1 NATO Requirements

There are no specific NATO requirements for salt corrosion of links for the linked ammunition to be considered NATO interchangeable. The nation submitting its linked ammunition for NATO interchangeability shall provide a Certificate of Conformity indicating that the links meet the salt corrosion requirements of its national specification for links. The number of links tested, the equipment used and the method of conducting the test shall be determined by national specifications and requirements.

ANNEX 15-B
7.62 mm LINKED BELTS

15.B.1 Free Hanging Test

The test ammunition quantity, equipment, method of conducting test, recording of results and sentencing for the Free Hanging Test are contained in the Function and Casualty Test, Volume 14, of AEP-97.

15.B.2 Free Helical Flexibility Test

15.B.2.1 NATO Requirements

The linked belt must maintain a 90° helix in ten (10) to thirty (30) cartridges for both loop gaps up and loop gaps down.

15.B.2.2 Ammunition Quantity

Five (5) 30-cartridges (also referred to as rounds) belts of linked ammunition.

15.B.2.3 Equipment

Test fixture as shown on Drawing No. 15-(7.62mm)-1, (AEP-97, Volume 6).

15.B.2.4 Equipment Set-up

The figure “R” inscribed on the base plate in the bracket area defines the rear end of the fixture and the figure “F” inscribed on the base plate at the opposite end defines the front end. The test fixture shall be positioned in the horizontal plane with the front end of the fixture directly in front of the technician.

15.B.2.5 Method of Conducting the Test

15.B.2.5.1 The first 30-round belt shall be visually examined to ensure that each link is correctly positioned on each cartridge and that there are no obvious defects with the links. Any link with an obvious defect shall be removed from the test and the defect noted on the test report. The defective link shall be replaced with a new link.

15.B.2.5.2 The linked belt shall be secured in the test fixture by inserting the first cartridge, within a double loop, in the recess of the bracket at the base and the bullet nose inserted into the hollow cone in the head of the bracket.

15.B.2.5.3 The linked belt shall be aligned in the vertical position between the two (2) scribed lines on the base and the slack shall be removed by gently stretching the linked belt.

15.B.2.5.4 The free end of the linked belt shall be rotated by exerting a minimum force, to the last free cartridge, necessary to collapse the belt with the loop gaps up. The technician shall determine the number of cartridges in the helix according to the following method: The first cartridge that moves freely under finger pressure applied on the bullet without reaction on the helix of the linked belt shall be defined as the first free cartridge. The technician shall determine the number of cartridges composing the helix including the first free horizontal cartridge and the vertical cartridge held by the bracket.

15.B.2.5.5 The linked belt shall be realigned as per paragraph 15.B.2.5.3 and the procedures in paragraph 15.B.2.5.4 shall be repeated except that the direction of belt rotation shall be with the loop gaps down.

15.B.2.5.6 The four (4) additional 30-round belts shall be tested as per paragraphs 15.B.2.5.1 through 15.B.2.5.5.

15.B.2.6 Recording of Results

For each of the 30-round belts, the technician shall record the number of cartridges in each helix (loop gaps up/loop gaps down) on Form No. 15-3 (Annex 15-D).

15.B.2.7 Sentencing

The linked belts meet NATO requirements if all five linked belts maintain a 90° helix angle (as determined in paragraph 15.B.2.5.4) in ten (10) to thirty (30) cartridges for both loop gaps up and loop gaps down.

15.B.2.8 Re-Test Procedure

In the event of a failure in the test, a retest shall be conducted using ten (10) 30-round belts of linked ammunition.

15.B.2.9 Re-Test Sentencing

The linked belts meet NATO requirements if all ten linked belts maintain a 90° helix angle (as determined in paragraph 15.B.2.5.4) in ten (10) to thirty (30) cartridges for both loop gaps up and loop gaps down.

15.B.3 Free Fanwise Flexibility Test

15.B.3.1 NATO Requirements

For a linked belt of thirty (30) cartridges, the radius of the arc circumscribed by the bullet tips (arc with bullets inward) shall be 318 mm maximum **and** the radius of the arc circumscribed by the base of the cartridges (arc with bullets outward) shall be 356 mm maximum.

15.B.3.2 Ammunition Quantity

Five (5) 30-round belts of linked ammunition.

15.B.3.3 Equipment

A radial diagram (template) with a series of arcs drawn on it to facilitate measurement of the radius of the arc formed by the linked belt of ammunition being tested. It is recommended that the template be protected from wear by a covering of glass or plastic.

15.B.3.4 Equipment Set-up

The radial diagram, covered by the protective covering of glass or plastic, shall be placed on a level surface. The surface shall be of sufficient height so that the technician can observe the test directly over the radial diagram in order to eliminate error due to parallax.

15.B.3.5 Method of Conducting the Test

15.B.3.5.1 The first 30-round belt shall be visually examined to ensure that each link is correctly positioned on each cartridge and that there are no obvious defects with the links. Any link with an obvious defect shall be removed from the test and the defect noted on the test report. The defective link shall be replaced with a new link.

15.B.3.5.2 The linked belt shall be placed on the radial diagram with the loop gaps face down and the bullets positioned inward.

15.B.3.5.3 The technician shall position the belt by exerting force on the bases of the end cartridges forming an arc with the belt until the belt begins to offer resistance to further decrease of the radius of the arc.

15.B.3.5.4 The linked belt shall be moved slowly into a position where the arc formed by the bullet noses is concentric with the arc on the diagram. **The technician shall ensure that the linked belt is still under maximum deflection without being restrained and that they are observing the arc directly over the radial diagram.**

15.B.3.5.5 The technician shall note the radius of the bullet noses.

15.B.3.5.6 The linked belt shall be placed on the radial diagram with the loop gaps face down and the bullets positioned outward.

15.B.3.5.7 The technician shall position the belt by exerting force on the bullet noses of the end cartridges forming an arc with the belt until the belt begins to offer resistance to further decrease of the radius of the arc.

15.B.3.5.8 The linked belt shall be moved slowly into a position where the arc formed by the bases of the cartridges is concentric with the arc on the diagram. **The technician shall ensure that the linked belt is still under maximum deflection without being restrained and that they are observing the arc directly over the radial diagram.**

15.B.3.5.9 The technician shall note the radius of the bases of the cartridges.

15.B.3.5.10 The four (4) additional 30-round belts shall be tested as per paragraphs 15.B.3.5.1 through 15.B.3.5.9.

15.B.3.6 Recording of Results

For each of the five (5) linked belts, the technician shall record the bullet inward and bullet outward radii on Form No. 15-4 (Annex 15-D).

15.B.3.7 Sentencing

The linked belts meet NATO requirements if all five belts each have a maximum radius of arc (bullet noses inward) of 318 mm and a maximum radius of arc (base of cartridges, bullet noses outward) of 356 mm.

15.B.3.8 Re-Test Procedure

In the event of a failure in the test, a retest shall be conducted using ten (10) 30-round belts of linked ammunition.

15.B.3.9 Re-Test Sentencing

The linked belts meet NATO requirements if all ten belts each have a maximum radius of arc (bullet noses inward) of 318 mm and a maximum radius of arc (base of cartridges, bullet noses outward) of 356 mm.

15.B.4 Belt Strength Test

15.B.4.1 NATO Requirements

The linked belt shall withstand a force of 245 newtons (N) ± 3 % applied for a minimum of thirty (30) seconds and be able to be fired successfully in the NATO Nominated Machine Gun(s).

15.B.4.2 Ammunition Quantity

Five (5) belts of 5-rounds each for each NATO Nominated machinegun. If mandrels are used to attach the belt to the test fixture, additional links, one at each end of each belt, will be necessary.

15.B.4.3 Equipment

Suitable tensile testing machine or fixture to permit the continuous application of the specified force to the linked belt. Test fixture as shown on Drawing No. 15-(7.62mm)-2 (AEP-97, Volume 6).

a. Mandrels to attach linked belt to test fixture (if necessary).

b. Timer/clock.

c. NATO Nominated Machine Gun(s).

15.B.4.4 Method of Conducting the Test

15.B.4.4.1 The first 5-round belt shall be visually examined to ensure that each link is correctly positioned on each cartridge and that there are no obvious defects with the links. Any link with an obvious defect shall be removed from the test and the defect noted on the test report. The defective link shall be replaced with a new link.

15.B.4.4.2 The technician shall attach the first 5-round belt to the tensile testing machine/fixture. If necessary, steel mandrels may be used to attach the linked belts to the test fixture. The specified force of 245 N shall be applied gradually until the belt is completely under tension.

15.B.4.4.3 The linked belt shall remain under the 245 N load for thirty (30) seconds. The technician shall note any belt separation during the thirty second period.

15.B.4.4.4 At the end of the thirty (30) second period, the linked belt shall be removed from the tensile testing machine/fixture.

15.B.4.4.5 The procedures in paragraphs 15.B.4.4.1 through 15.B.4.4.4 shall be repeated on the remaining four linked belts.

15.B.4.4.6 After the application of the 245 N load to the linked belts, each belt shall be visually inspected (without disassembling) for defects including cracks and loop stretching. The technician shall note any defects.

15.B.4.4.7 If the linked belts have not separated, each of the five belts shall be fired separately in each NATO Nominated Machine Gun. The firing portion of the test should be conducted as soon as possible after the application of the 245 N load. In any event, the time between the application of the load and the firing portion of the test shall not exceed twenty-four (24) hours. Each belt shall be fired in one (1) burst. The weapon shall be checked beforehand by firing a belt of 5-rounds (from the same lot) that has not been subjected to the 245 N load[1]. The technician shall note any weapon stoppages and determine whether the stoppages are attributable to the links.

Note 1. This weapon check is not necessary if the Function and Casualty Test (for the same lot) has been conducted immediately prior to the firing portion of the Belt Strength Test.

15.B.4.5 Recording of Results

The technician shall record any belt separation(s), the results of the visual inspections and any stoppages that occur during the firing of the linked belts. The technician shall determine if the stoppages are attributable to the links or to some other cause. The results of the test shall be recorded on Form No. 15-1 (Annex 15-D).

15.B.4.6 Sentencing

The linked belts meet NATO requirements if none of the linked belts separate under the tensile load and no weapon functioning defects attributable to the links are noted.

15.B.4.7 Re-Test Procedure

In the event of a failure in either the tensile load portion of the test or the firing portion of the test, a retest shall be conducted using ten (10) 5-round belts of linked ammunition for each NATO Nominated Machine Gun.

15.B.4.8 Re-Test Sentencing

The linked belts meet NATO requirements if none of the linked belts separate under tensile load and no weapon functioning defects attributable to the links are noted.

15.B.4.9 Other Defects and Incidents - Sentencing

During any test or retest, if any defects occur that are not related to this particular test, either during firing, or visually after firing, they shall be categorised in accordance with Volume 11 and sentenced in accordance with the cumulative sentencing requirements of Volume 7 of AEP-97.

15.B.5 Free Hinging Test

15.B.5.1 NATO Requirements

The linked belt must hinge without binding or grabbing.

15.B.5.2 Ammunition Quantity

One (1) 100-round belt of linked ammunition.

15.B.5.3 Equipment

a. A table long enough to permit the linked belt to be pulled over itself.

b. A channel, or guide, to restrict the linked belt from sliding across the table top which may induce binding on an otherwise free-hinging belt.

15.B.5.4 Method of Conducting the Test

15.B.5.4.1 To make it easier to identify the position of the individual link that causes binding or grabbing in the linked belt, the links shall be identified as one (1) through one hundred (100) with the link that the technician grasps defined as link number one (1).

15.B.5.4.2 The linked belt shall be visually examined to ensure that each link is correctly positioned on each cartridge and that there are no obvious defects with the links. Any link with an obvious defect shall be removed from the test and the defect noted on the test report. The defective link shall be replaced with a new link.

15.B.5.4.3 The linked belt shall be positioned in the channel/guide on the table with the loop gaps down and the bases of the cartridges adjacent to the technician. The belt shall be positioned in a straight line and extended to remove any slack.

15.B.5.4.4 The technician shall grasp the connecting loop of the left end of the belt and draw the end portion of the belt over the remainder of the belt ensuring that the linked cartridges being drawn remain in contact with the remainder of the belt. As the technician is pulling the belt over itself, they should note any occurrence of binding or grabbing, including the number of individual occurrences and the position of the link that caused the binding or grabbing.

15.B.5.4.5 The linked belt shall be again positioned as per paragraph 15.B.5.4.3.

15.B.5.4.6 The technician shall grasp the right end of the belt and draw the end portion of the belt over the remainder of the belt ensuring that the linked cartridges being drawn remain in contact with the remainder of the belt. As the technician is pulling the belt over itself, they should note any occurrence of binding or grabbing, including the number of individual occurrences and the position of the link that caused the binding or grabbing.

15.B.5.4.7 The linked belt shall be positioned in the channel/guide on the table with the loop gaps up and the bases of the cartridges adjacent to the technician. The belt shall be positioned in a straight line and extended to remove any slack.

15.B.5.4.8 The technician shall grasp the left end of the belt and draw the end portion of the belt over the remainder of the belt ensuring that the linked cartridges being drawn remain in contact with the remainder of the belt. As the technician is pulling the belt over itself, they should note any occurrence of binding or grabbing, including the number of individual occurrences and the position of the link that caused the binding or grabbing.

15.B.5.4.9 The linked belt shall be again positioned as per paragraph 15.B.5.4.7.

15.B.5.4.10 The technician shall grasp the connecting loop of the right end of the belt and draw the end portion of the belt over the remainder of the belt ensuring that the linked cartridges being drawn remain in contact with the remainder of the belt. As the technician is pulling the belt over itself, they should note any occurrence of binding or grabbing, including the number of individual occurrences and the position of the link that caused the binding or grabbing.

15.B.5.5 Recording of Results

The technician shall record the identity of each defective link and the number of times each link caused binding or grabbing during the four (4) portions of the test on Form No. 15-2 (Annex 15-D).

15.B.5.6 Sentencing

The linked belt meets NATO requirements if no binding or grabbing is observed in any portion of the test.

15.B.5.7 Re-Test Procedure

In the event of a failure in the test, a retest shall be conducted using two (2) 100-round belts of linked ammunition.

15.B.5.8 Re-Test Sentencing

The linked belts meet NATO requirements if no binding or grabbing is observed in any portion of the test.

15.B.6 Cartridge Stripping

15.B.6.1 NATO Requirements

There are no specific NATO cartridge stripping requirements for linked ammunition to be considered NATO interchangeable. The nation submitting its linked ammunition for NATO interchangeability shall provide a Certificate of Conformity indicating that the links meet all cartridge stripping requirements of its national specification for links. The number of links tested, the equipment used and the method of conducting the test shall be determined by national specifications and requirements.

15.B.7 Dimensional Characteristics

15.B.7.1 NATO Requirements

There are no specific NATO dimensional requirements for linked ammunition to be considered NATO interchangeable. The nation submitting its linked ammunition for NATO interchangeability shall provide a Certificate of Conformity indicating that the links meet all dimensional requirements of its national specification for links. The number of links tested, the equipment used and the method of conducting the test shall be determined by national specifications and requirements.

15.B.8 Visual Inspection

15.B.8.1 NATO Requirements

There are no specific NATO requirements for visual inspection of the links for the linked ammunition to be considered NATO interchangeable. The nation submitting its linked ammunition for NATO interchangeability shall provide a Certificate of Conformity indicating that the links meet the visual inspection requirements of its national specification for links. The number of links tested, the equipment used and the method of conducting the test shall be determined by national specifications and requirements.

15.B.9 Salt Corrosion

15.B.9.1 NATO Requirements

There are no specific NATO requirements for salt corrosion of links for the linked ammunition to be considered NATO interchangeable. The nation submitting its linked

ammunition for NATO interchangeability shall provide a Certificate of Conformity indicating that the links meet the salt corrosion requirements of its national specification for links. The number of links tested, the equipment used and the method of conducting the test shall be determined by national specifications and requirements.

ANNEX 15-C
12.7 mm LINKED BELTS

15.C.1 Belt Strength Test

15.C.1.1 NATO Requirements

The linked belt shall withstand a force of 370 newtons (N) ± 3 % applied for a minimum of five (5) minutes and be able to be fired successfully in the NATO Nominated Machine Gun(s).

15.C.1.2 Ammunition Quantity

Two (2) belts of twenty-five (25) cartridges (also referred to as rounds) each for each NATO Nominated Machine Gun. If mandrels are used to attach the belt to the test fixture, additional links, one at each end of each belt, will be necessary.

15.C.1.3 Equipment

a. Suitable tensile testing machine or fixture to permit the continuous application of the specified force to the linked belt. Test fixture as shown on Drawing No. 15-(12.7mm)-1 (AEP-97, Volume 6).

b. Timer/clock.

c. NATO Nominated Machine Gun(s).

15.C.1.4 Method of Conducting the Test

15.C.1.4.1 The first 25-round belt shall be visually examined to ensure that each link is correctly positioned on each cartridge and that there are no obvious defects with the links. Any link with an obvious defect shall be removed from the test and the defect noted on the test report. The defective link shall be replaced with a new link.

15.C.1.4.2 The technician shall attach the first 25-round belt to the tensile testing machine/fixture. The specified force of 370 N shall be applied gradually until the belt is completely under tension.

15.C.1.4.3 The linked belt shall remain under the 370 N load for five (5) minutes. The technician shall note any belt separation during the five minute period.

15.C.1.4.4 At the end of the five (5) minute period, the linked belt shall be removed from the tensile testing machine/fixture.

15.C.1.4.5 The procedures in paragraphs 15.C.1.4.1 through 15.C.1.4.4 shall be repeated on the second 25-round belt.

15.C.1.4.6 After the application of the 370 N load to the linked belts, each belt shall be visually inspected (without disassembling) for defects including cracks and stretching. The technician shall note any defects.

15.C.1.4.7 If the linked belts have not separated, each of the two belts shall be fired separately in each NATO Nominated machinegun. The firing portion of the test should be conducted as soon as possible after the application of the 370 N load. In any event, the time between the application of the load and the firing portion of the test shall not exceed twenty-four (24) hours. Each belt shall be fired in short (4 to 5-round) bursts. The weapon shall be checked beforehand by firing a belt of 25-rounds (from the same lot) that has not been subjected to the 370 N load[1]. The firing shall be conducted in short (4 to 5-round) bursts. The technician shall note any weapon stoppages and determine whether the stoppages are attributable to the links.

Note 1. This weapon check is not necessary if the Function and Casualty Test (for the same lot) has been conducted immediately prior to the firing portion of the Belt Strength Test.

15.C.1.5 Recording of Results

The technician shall record any belt separation(s), the results of the visual inspections and any stoppages that occur during the firing of the linked belts. The technician shall determine if the stoppages are attributable to the links or to some other cause. The results of the test shall be recorded on Form No. 15-1 (Annex 15-D).

15.C.1.6 Sentencing

The linked belts meet NATO requirements if none of the linked belts separate under the tensile load and no weapon functioning defects attributable to the links are noted.

15.C.1.7 Re-Test Procedure

In the event of a failure in either the tensile load portion of the test or the firing portion of the test, a retest shall be conducted using four (4) twenty-five (25) round belts of linked ammunition for each NATO Nominated Machine Gun.

15.C.1.8 Re-Test Sentencing

The linked belts meet NATO requirements if none of the linked belts separate under the tensile load and no weapon functioning defects attributable to the links are noted.

15.C.1.9 Other Defects and Incidents - Sentencing

During any test or retest, if any defects occur that are not related to this particular test, either during firing, or visually after firing, they shall be categorised in accordance with Volume 11 and sentenced in accordance with the cumulative sentencing requirements of Volume 7 of AEP-97.

15.C.2 Free Hinging Test

15.C.2.1 NATO Requirements

The linked belt must hinge without binding or grabbing.

15.C.2.2 Ammunition Quantity

Two (2) 25-round belts of linked ammunition.

15.C.2.3 Equipment

a. A table long enough to permit the linked belt to be pulled over itself.

b. A channel, or guide, to restrict the linked belt from sliding across the table top which may induce binding on an otherwise free-hinging belt.

15.C.2.4 Method of Conducting the Test

15.C.2.4.1 To make it easier to identify the position of the individual link that causes binding or grabbing in the linked belt, the links shall be identified as one (1) through twenty-five (25) with the link that the technician grasps defined as link number one (1).

15.C.2.4.2 The linked belt shall be visually examined to ensure that each link is correctly positioned on each cartridge and that there are no obvious defects with the links. Any link with an obvious defect shall be removed from the test and the defect noted on the test report. The defective link shall be replaced with a new link.

15.C.2.4.3 The linked belt shall be positioned in the channel/guide on the table with bases of the cartridges adjacent to the technician. The belt shall be positioned in a straight line and extended to remove any slack.

15.C.2.4.4 The technician shall grasp the left end of the belt and draw the end portion of the belt over the remainder of the belt ensuring that the linked cartridges being drawn remain in contact with the remainder of the belt. As the technician is pulling the belt over itself, they should note any occurrence of binding or grabbing, including the number of individual occurrences and the position of the link that caused the binding or grabbing.

15.C.2.4.5 Upon completion of paragraph 15.C.2.4.4, the technician shall, without removing the belt from the channel/guide, position the belt in a straight line and extend it to remove any slack.

15.C.2.4.6 The technician shall grasp the right end of the belt and draw the end portion of the belt over the remainder of the belt ensuring that the linked cartridges being drawn remain in contact with the remainder of the belt. As the technician is pulling the belt over itself, they should note any occurrence of binding or grabbing, including the number of individual occurrences and the position of the link that caused the binding or grabbing.

15.C.2.4.7 The procedures in paragraphs 15.C.2.4.2 through 15.C.2.4.6 shall be repeated on the second 25-round belt.

15.C.2.5 Recording of Results

The technician shall record the identity of each defective link and the number of times each link caused binding or grabbing during the four (4) portions of the test on Form No. 15-2 (Annex 15-D).

15.C.2.6 Sentencing

The linked belts meet NATO requirements if no binding or grabbing is observed in any portion of the test.

15.C.2.7 Re-Test Procedures

In the event of a failure in the test, a retest shall be conducted using four (4) 25-round belts of linked ammunition.

15.C.2.8 Re-Test Sentencing

The linked belts meet NATO requirements if no binding or grabbing is observed in any portion of the test.

15.C.3 Cartridge and Link Extractor Pull Test

15.C.3.1 NATO Requirements

The linked cartridges must have an extractor pull force greater than 40 newtons (N) and less than 190 N.

15.C.3.2 Ammunition Quantity

Two (2) 16-round belts of ammunition.

15.C.3.3 Equipment

Cartridge and link extractor force tester as shown on Drawing No. 15-(12.7mm)-2 (AEP-97, Volume 6).

15.C.3.4 Method of Conducting the Test

15.C.3.4.1 The linked cartridges shall be visually examined to ensure that each link is correctly positioned on each cartridge and that there are no obvious defects with the links. Any link with an obvious defect shall be removed from the test and the defect noted on the test report. The defective linked cartridge shall be replaced with a new linked cartridge.

15.C.3.4.2 The technician shall position the first linked cartridge of the first 16-round belt in the force tester, ensuring that the cartridge is properly positioned with the base of the cartridge in the puller housing.

15.C.3.4.3 The technician shall turn the handle until the cartridge is extracted from the link.

15.C.3.4.4 The technician shall note the extraction pull force reading on the gauge.

15.C.3.4.5 The procedures in paragraphs 15.C.3.4.2 through 15.C.3.4.4 shall be repeated for each linked cartridge in the first linked belt.

15.C.3.4.6 The procedures in paragraphs 15.C.3.4.1 through 15.C.3.4.5 shall be repeated for the second 16-round belt.

15.C.3.5 Recording of Results

For each linked cartridge, the technician shall record the extractor pull force on Form No. 15-5 (Annex 15-D).

15.C.3.6 Sentencing

The linked cartridges meet NATO requirements if all cartridges have an extractor pull force greater than 40 N and less than 190 N.

15.C.3.7 Re-Test Procedures

In the event of a failure in the test, a retest shall be conducted using four (4) 16-round belts of linked ammunition.

15.C.3.8 Re-Test Sentencing

The linked cartridges meet NATO requirements if all cartridges have an extractor pull force greater than 40 N and less than 190 N.

15.C.4 Dimensional Characteristics

15.C.4.1 NATO Requirements

There are no specific NATO dimensional requirements for linked ammunition to be considered NATO interchangeable. The nation submitting its linked ammunition for NATO interchangeability shall provide a Certificate of Conformity indicating that the links meet all dimensional requirements of its national specification for links. The number of links tested, the equipment used and the method of conducting the test shall be determined by national specifications and requirements.

15.C.5 Visual Inspection

15.C.5.1 NATO Requirements

There are no specific NATO requirements for visual inspection of the links for the linked ammunition to be considered NATO interchangeable. The nation submitting its linked ammunition for NATO interchangeability shall provide a Certificate of Conformity indicating that the links meet the visual inspection requirements of its national specification for links. The number of links tested, the equipment used and the method of conducting the test shall be determined by national specifications and requirements.

15.C.6 Salt Corrosion

15.C.6.1 NATO Requirements

There are no specific NATO requirements for salt corrosion of links for the linked ammunition to be considered NATO interchangeable. The nation submitting its linked ammunition for NATO interchangeability shall provide a Certificate of Conformity indicating that the links meet the salt corrosion requirements of its national specification for links. The number of links tested, the equipment used and the method of conducting the test shall be determined by national specifications and requirements.

ANNEX 15-D
FORM NUMBER 15 – LINK TESTS

Per the applicable Recording of Results paragraphs in Volume 15, the following forms for the specific link tests are presented on the pages 15-D-2, 15-D-3, 15-D-4, 15-D-4 and 15-D-5 of this Annex.

FORM NUMBER 15-1: BELT STRENGTH

FORM NUMBER 15-2: FREE HINGING

FORM NUMBER 15-3: FREE HELICAL FLEXIBILITY

FORM NUMBER 15-4: FREE FANWISE FLEXIBILITY

FORM NUMBER 15-5: CARTRIDGE AND LINK EXTRACTOR PULL

15.D.1 FORM 15-1 – LINKS - BELT STRENGTH

Form Number 15-1	Page 1of 1		**LINKS - BELT STRENGTH**
Test Centre		Test Reference	
Submitting Nation		Ammo Lot Number	
Manufacturer		Cartridge Type	
Date Tested		Link Manufacturer	

Belt No.	Ambient Temperature (oC)		Force Applied		Newtons (N)
Weapon Check	Strength Observations	Fired (Y/N)	Firing Observations		
1					
2					
3					
4					
5					

Retest

Belt No.	Ambient Temperature ^{o}C		Force Applied		Newtons (N)
Weapon Check	Strength Observations	Fired (Y/N)	Firing Observations		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

	Time Force		Seconds (s)

Weapon Type		
Weapon Serial No.		
Weapon Life		
Barrel Serial No.		
Barrel Life		
Head Space		mm
Pin Protrusion		mm
Firing Pin Indent		mm

Remarks

15.D.2 FORM 15-2 – LINKS - FREE HINGING

Form Number 15-2	Page 1of 1		**LINKS - FREE HINGING**
Test Centre		Test Reference	
Submitting Nation		Ammo Lot Number	
Ammo Manufacturer		Cartridge Type	
Date Tested		Link Manufacturer	

Serial No.	Ambient Temperature °C			# of Belts		# of Ctgs in	
	Type of Pull	# of times defect found	Link No. w/defect(s)	Observations			
1							
2							
3							
4							

Retest

Serial No.	Ambient Temperature °C			# of Belts		# of Ctgs in	
	Type of Pull	# of times defect found	Link No. w/defect(s)	Observations			
1	.						
2	.						
3	.						
4	.						
5	.						
6	.						
7	.						
8	.						

Remarks

15.D.3 FORM 15-3 – LINKS - FREE HELICAL FLEXIBILITY

Form Number 15-3	Page 1 of 1		**LINKS - FREE HELICAL FLEXIBILITY**
Test Centre		Test Reference	
Submitting Nation		Ammo Lot Number	
Ammo Manufacturer		Cartridge Type	
Date Tested		Link Manufacturer	

	Ambient Temperature °C				
Belt No.	Number of Cartridges in Helix Link Gap Up	Acceptable (Y/N)		Number of Cartridges in Helix Link Gap Down	Acceptable (Y/N)
1					
2					
3					
4					
5					

Retest

	Ambient Temperature °C				
Belt No.	Number of Cartridges in Helix Link Gap Up	Acceptable (Y/N)		Number of Cartridges in Helix Link Gap Down	Acceptable (Y/N)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Remarks

15.D.4 FORM 15-4 – LINKS - FREE FANWISE FLEXIBILITY

Form Number 15-4	Page 1of 1		**LINKS - FREE FANWISE FLEXIBILITY**
Test Centre		Test Reference	
Submitting Nation		Ammo Lot Number	
Ammo Manufacturer		Cartridge Type	
Date Tested		Link Manufacturer	

	Ambient Temperature ^{o}C	

Radius of Inner Arc

Belt No.	Loop Gaps Down (Bullet Inward)			Loop Gaps Down (Bullet Outward)	
	Radial Measurement (mm)	Radius Acceptable (Y/N)		Radial Measurement (mm)	Radius Acceptable (Y/N)
1					
2					
3					
4					

Retest

	Ambient Temperature ^{o}C	

Radius of Inner Arc

Belt No.	Loop Gaps Down (Bullet Inward)			Loop Gaps Down (Bullet Outward)	
	Radial Measurement (mm)	Radius Acceptable (Y/N)		Radial Measurement (mm)	Radius Acceptable (Y/N)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Remark

15.D.5 FORM 15-5 – LINKS - CARTRIDGE AND LINK EXTRACTOR PULL

Form Number 15-5	Page 1of 1	**LINKS - CARTRIDGE & LINK EXTRACTOR PULL**	
Test Centre		Test Reference	
Submitting Nation		Ammo Lot Number	
Ammo Manufacturer		Cartridge Type	
Date Tested		Link Manufacturer	

Ambient Temperature °C							
Belt 1		Belt 1		Belt 2		Belt 2	
Link No.	Extractor Pull (N)	Link No.	Extractor Pull (N)	Link No.	Extractor Pull (N)	Link No.	Extractor Pull (N)
1		9		1		9	
2		10		2		10	
3		11		3		11	
4		12		4		12	
5		13		5		13	
6		14		6		14	
7		15		7		15	
8		16		8		16	
Minimum Extractor Pull (N)				**Minimum Extractor Pull (N)**			
Maximum Extractor Pull (N)				**Maximum Extractor Pull (N)**			
Percentage Meeting Extractor Pull Between 40 N – 190 N:							

Retest

Ambient Temperature °C							
Belt 1		Belt 2		Belt 3		Belt 4	
Link No.	Extractor Pull (N)	Link No.	Extractor Pull (N)	Link No.	Extractor Pull (N)	Link No.	Extractor Pull (N)
1		1		1		1	
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	
9		9		9		9	
10		10		10		10	
11		11		11		11	
12		12		12		12	
13		13		13		13	
14		14		14		14	
15		15		15		15	
16		16		16		16	
Min (N)		**Min (N)**		**Min (N)**		**Min (N)**	
Max (N)		**Max (N)**		**Max (N)**		**Max (N)**	

Minimum Extractor Pull (N)	
Maximum Extractor Pull (N)	
Percentage Meeting Extractor Pull Between 40 N – 190 N:	

Remarks

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 16

BARREL EROSION TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

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16.1 Applicability

4.6 mm Ball ammunition, 5.56 mm Ball ammunition, 5.7 mm Ball ammunition, 7.62 mm Ball ammunition and 12.7 mm ammunition of all types submitted for NATO Qualification Approval testing shall be subjected to the Barrel Erosion Test Procedure defined in this volume. Annex 16-A contains the procedures for 5.56 mm ammunition. Annex 16-B contains the procedures for 7.62 mm ammunition. Annex 16-C contains the procedures for 12.7 mm ammunition. Annex 16-D contains the procedures for 4.6 mm and 5.7 mm ammunition.

16.2 NATO Requirements

The ammunition specified in the table below shall be free from design features which render barrels unserviceable due to erosion based on the criteria listed.

Calibre	Ammunition Nature	Minimum Barrel Life	Bullet Yaw Criteria	Velocity Drop Criteria
4.6 mm	Ball Only	5000 cartridges	20 % or more bullets in any 100-round group of consecutive shots showing keyholing (yaw exceeding 15° @ 25 metres)	An average velocity drop of **60 m/s** or more below the initial velocity level obtained at the start of the test.
5.56 mm	Ball Only	5000 cartridges	20 % or more bullets in any 100-round group of consecutive shots showing keyholing (yaw exceeding 15° @ 25 metres)	An average velocity drop of **60 m/s** or more below the initial velocity level obtained at the start of the test.
5.7 mm	Ball Only	5000 cartridges	20 % or more bullets in any 100-round group of consecutive shots showing keyholing (yaw exceeding 15° @ 25 metres)	An average velocity drop of **60 m/s** or more below the initial velocity level obtained at the start of the test.
7.62 mm	Ball Only	5000 cartridges	20 % or more bullets in any 100-round group of consecutive shots showing keyholing (yaw exceeding 15° @ 25 metres)	An average velocity drop of **60 m/s** or more below the initial velocity level obtained at the start of the test
12.7 mm	All Ammunition Natures	2000 cartridges	20 % or more bullets in any 100-round group of consecutive shots showing keyholing (yaw exceeding 15° @ 25 metres)	An average velocity drop of **30 m/s** or more below the initial velocity level obtained at the start of the test

Additionally, during the Barrel Erosion Test, the amount of smoke, flash and fouling produced by the ammunition under test shall be observed to determine if it is considered

excessive compared to that produced by the NATO Reference Ammunition. If either smoke, flash or fouling are considered excessive, additional tests to compare the test ammunition with the NATO Reference Ammunition shall be conducted based on the appropriate volumes of AEP-97.

16.3 Ammunition Quantity[1]

Calibre	Test Ammunition Quantity
4.6 mm	17140
5.56 mm	17140
5.7 mm	17140
7.62 mm	17140
12.7 mm	4080

Note 1: The test ammunition quantities specified above are based on the maximum number of cartridges to be fired according to the test procedures specified for each calibre. The actual number of cartridges fired may be less depending on the test results.

16.4 Equipment

As specified in the appropriate annex.

16.5 Equipment Set-Up

As specified in the appropriate annex. An example of a typical firing range set up for Barrel Erosion is shown in Figure 16-1.

16.6 Method of Conducting the Test

As specified in the appropriate annex.

16.7 Recording of Results

As specified in the appropriate annex.

16.8 Sentencing

The ammunition shall be considered to have met the NATO requirements if the barrels remain serviceable, based on the criteria specified in paragraph 16.2, after firing the required number of cartridges.

16.9 Re-Test Procedures

The testing in additional barrels if the first barrel fails to meet the requirements is considered as a retest. This additional barrel retest procedure and retest sentencing is specified in each appropriate annex.

16.10 Other Defects and Incidents - Sentencing

During any test or retest, if any defects occur that are not related to this particular test, either during firing or visually after firing, they shall be categorized in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

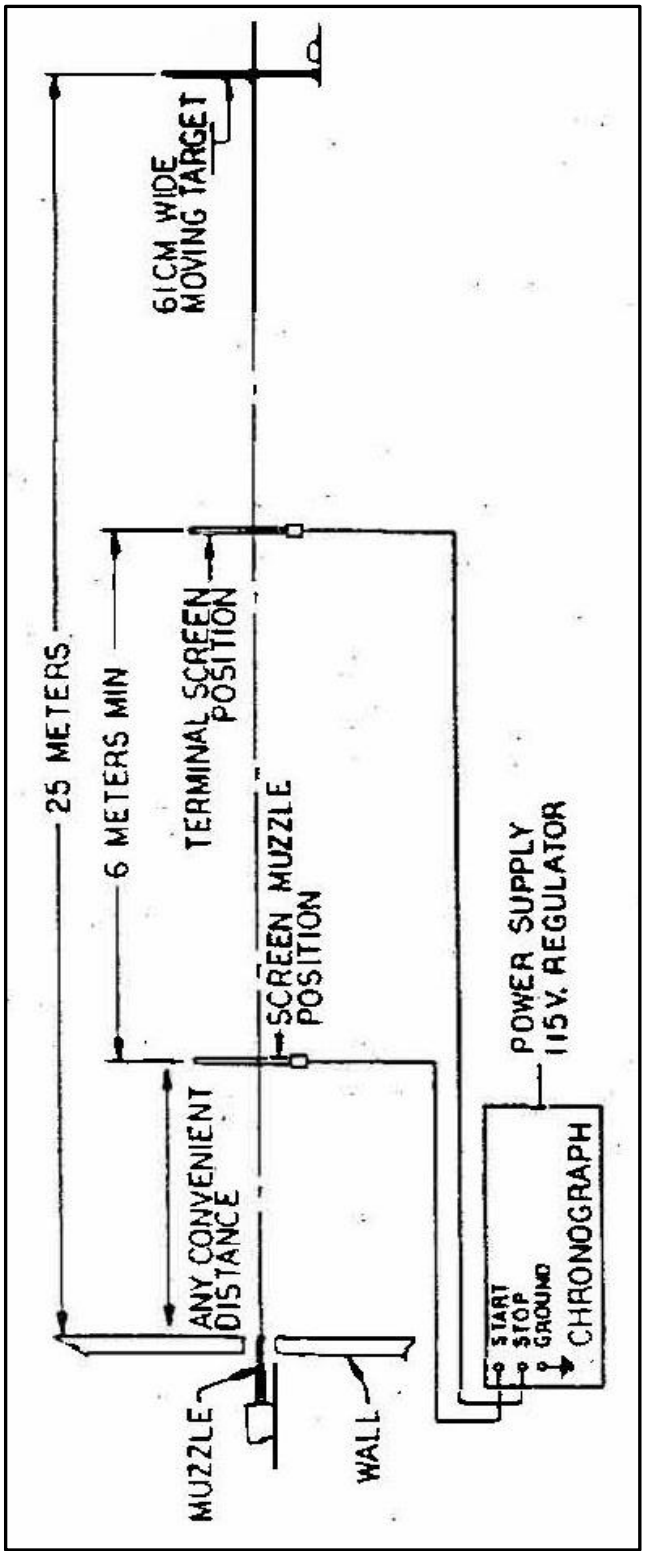

Figure 16-1. Barrel Erosion Test Equipment and Range Set-Up

ANNEX 16-A
5.56 mm BARREL EROSION TEST PROCEDURE

16.A.1 NATO Requirements

Ammunition with all metal bullets, excluding tracer ammunition, shall be free from design features which render barrels unserviceable because of erosion in less than 5000 cartridges fired.

16.A.2 Ammunition Quantity

A maximum of 17140 cartridges is required to conduct the test. The actual number of cartridges fired may be less depending on the test results.

16.A.3 Equipment

a. Gun, Machine, Minimi, Mk1.

b. Maximum of three (3) barrels with chrome plated bores.

c. M27 type links.

d. NATO 1980 Weapon Mount, Mk 2 with suitable rigid base.

e. Velocity measurement equipment capable of maintaining measurement errors of less than ± 1 m/s. The measurement method and length between sensors (if used) is optional.

f. Moving target system with paper roll at least 60 cm wide and of sufficient length to allow for completion of the test on one (1) barrel between roll changes. The movement of the paper should be approximately 20 cm per second.

g. Compressed air system for cooling.

h. Boresight.

i. Insulated boxes (if required).

j. Temperature recording device.

k. Adverse weather protection for the firing position (if required).

16.A.4 Equipment Set-Up

16.A.4.1 The test ammunition shall be visually examined for obvious defects. If a defect is found, the defective cartridge shall be replaced and the defect shall be categorized in accordance with AEP-97, Volume 11 and sentenced in accordance with the sentencing requirements of AEP-97, Volume 7.

16.A.4.2 The ammunition for the first barrel (5000 cartridges) shall be linked in 400-round belts, except for the last belt which will be 200 cartridges. An additional quantity of 2000 cartridges shall be linked in 400-round belts in the event that the first barrel is capable of being fired (based on the erosion failure criteria) to a total of 7000 cartridges. If the first barrel does not meet the 7000 cartridge requirement, it will be necessary to link additional ammunition to conduct the complete Barrel Erosion Test of 5000 cartridges each in two (2) additional barrels.

16.A.4.3 The linked belts shall be visually examined to ensure that each link is correctly positioned on each cartridge and that there are no obvious defects with the links. Any link with an obvious defect shall be removed from the test and replaced with a new link.

16.A.4.4 The weapon shall be checked thoroughly and the following measurements complied with:

Firing pin protrusion	0.76 mm – 1.12 mm
Headspace (to 7.663 mm datum diameter)	37.95 mm – 38.05 mm

The normal gas setting shall be used for the test.

16.A.4.5 The weapon shall be installed in the NATO 1980 Mark 2 Weapon Mount, boresighted into position, and the mount setting adjusted to 10 psi (air)/8.5 hydraulic.

16.A.4.6 The velocity measurement equipment shall be positioned at a convenient distance between the weapon and the moving target system and the position noted for subsequent velocity measurements (refer to Figure 16-1).

16.A.4.7 The moving target system shall be positioned 25 metres from the muzzle of the weapon. Adequate movement of the target during the burst firing is necessary to allow clear observation of individual shots. This is necessary to assess the degree of bullet yaw, if present. A minimum movement rate of 20 cm per second is known to be adequate. The volume of the paper on the roll is to be sufficient to complete the test on one (1) barrel as there will normally be insufficient time during cooling intervals to change the roll. Control of the movement of the paper during firing may be controlled by acoustic sensors if desired.

16.A.5 Method of Conducting the Test

16.A.5.1 The firing room and test area in the immediate vicinity of the test weapon should be of sufficient size to preclude the development of undesirable temperature increases which may affect the validity of the Barrel Erosion Test. Adequate ventilation of the firing area should be available; however, in any event, the ambient temperature in the test area shall be maintained within a range of + 5 °C and + 30 °C during the firing schedule. A temperature recording device shall be used to record the ambient temperature of the range. Care shall be taken that it is not influenced by being placed too close to the weapon or other heat generating equipment.

16.A.5.2 It is not necessary to condition the ammunition for the Barrel Erosion portion prior to testing if it has been stored between + 5 °C and + 30 °C for at least five (5) hours immediately prior to firing. The ammunition used for the Velocity portion shall be

conditioned to + 21 ºC ± 3 ºC for a minimum of two (2) hours. The use of insulated boxes that have been brought to the required temperature shall be used to transfer the ammunition from the storage area to the test weapon to meet the temperature requirements.

16.A.5.3 As this test is usually conducted on external ranges to alleviate the ventilation problems, precautions must be taken to avoid rain falling on the barrel as this would cause cooling during firing and invalidate the test. It is recommended that testing is only conducted when there is a high degree of confidence that there will be no rainfall. An alternative is to construct an open sided shelter that will protect the barrel from direct rainfall but still allow adequate ventilation.

16.A.5.4 It is strongly recommended that the EPVAT Test be conducted prior to performing the Barrel Erosion Test. This is to check that excessive pressures are not likely to be encountered. It is also recommended that the Barrel Erosion Test be conducted remotely where possible for technician safety.

16.A.5.5 At all times, cleaning, lubrication, adjustment and maintenance of the weapon shall conform to the technical instructions provided by the country that provided the weapon. In the absence of specific instructions, cleaning, lubrication, adjustment and maintenance shall be consistent with good practice for all small arms, taking account of any special conditions associated with peculiarities of the weapon, the test and the nature of ammunition being tested. In general, the weapon shall be examined frequently for accumulation of brass debris around the extractor, combustion residue in the gas system or other mechanism, and broken or excessively worn parts.

16.A.5.6 Prior to the start of the Barrel Erosion portion of the test with the first barrel, twenty (20) test cartridges shall be fired in the single shot mode, measuring velocity on each cartridge. The average of the twenty (20) cartridges shall be recorded for comparison to the end of test velocity.

16.A.5.7 After the velocity measurement portion of the test is completed, the erosion portion of the test shall commence. The test cartridges shall be fired in bursts of twenty (20) cartridges at twelve (12) second intervals until 400 cartridges have been fired in a four (4) minute period. The firing cycle shall then be suspended to permit cooling of the barrel until it can be grasped by the bare hand. Cooling can be assisted by natural or compressed air. This firing and cooling cycle shall be repeated until 3600 cartridges have been fired.

16.A.5.8 The paper roll shall be left stationary until 3600 cartridges have been fired unless there is obvious evidence from increasing dispersion that yaw may be occurring. If this happens then the rolling target is to be activated for all further bursts. Activation of the paper roll during firing is mandatory from the 3600 cartridge point.

16.A.5.9 In the event of any defect or incident occurring during the test, an assessment shall be made to determine whether the ammunition, links, weapon, mount, ancillary equipment or operator is at fault. Any such cause shall be rectified as quickly as possible taking into account the time constraints of the test. If it is established that some faulty condition of the weapon is responsible for the stoppage, defect or incident, the barrel shall be assembled onto a replacement weapon and the headspace and other relevant

technical parameters shall be correctly adjusted. Firing shall recommence as quickly as possible.

16.A.5.10 The firing and cooling cycles specified in paragraph 16.A.5.7 shall be repeated until 5000 cartridges have been fired through the first barrel. The final belt of the 5000 cartridge cycle shall be 200 cartridges, fired in bursts of twenty (20) cartridges at twelve (12) second intervals in a period of two (2) minutes. At the completion of the 5000 cartridges, the barrel shall be cooled. Twenty (20) test cartridges shall be fired in the single shot mode, measuring velocity on each cartridge. The average of the twenty (20) cartridges shall be recorded for comparison to the start of test velocity.

16.A.5.11 The moving target system paper shall be examined to determine if bullet keyholing has occurred and what percentage of keyholing is present.

16.A.5.12 If both the velocity drop criteria and the bullet yaw criteria are met with the first barrel, an additional 2000 cartridges shall be fired through this barrel according to the firing and cooling cycle specified is paragraph 16.A.5.7. The moving target system shall be used for this additional 2000 cartridges. At the completion of the 7000 cartridges, the barrel shall be cooled. Twenty (20) test cartridges shall be fired in the single shot mode, measuring velocity on each cartridge. The average of the twenty (20) cartridges shall be recorded for comparison to the start of test velocity.

16.A.6 Sentencing

16.A.6.1 If both the velocity drop criteria and the bullet yaw criteria are met, the Barrel erosion Test is complete, the ammunition meets NATO requirements and no additional barrels will be tested.

16.A.7 Re-Test Procedures

16.A.7.1 If either the velocity drop criteria or the bullet yaw criteria are not met either at the end of 5000 cartridges or 7000 cartridges with the first barrel, the remaining two (2) barrels shall be tested according to the procedures specified in this annex with 5000 cartridges being fired in each of the remaining two (2) barrels.

16.A.8 Re-Test Sentencing

16.A.8.1 If both of the additional two (2) barrels meet the velocity drop criteria and the bullet yaw criteria, the ammunition meets NATO requirements. If one (1) of the additional two (2) barrels fails to meet the velocity drop criteria or the bullet yaw criteria, the ammunition sample does not meet NATO requirements.

16.A.9 Smoke and Flash Observation

16.A.9.1 During firing of the Barrel Erosion Test, visual observations shall be made as to smoke and flash produced by the test ammunition. This shall be observed during the firing of the first one-hundred (100) cartridges while the barrel is nearly new and relatively cool. In the event that the smoke or flash appears excessive, a comparison test with NATO Reference Ammunition shall be conducted. For purposes of comparison, at least

one-hundred (100) cartridges of NATO Reference Ammunition shall be fired in another barrel which has fired no more than 500 cartridges. This shall be fired from a cool barrel under the same conditions as the Barrel Erosion Test. On the basis of this visual comparison, the test ammunition shall be judged as producing "appreciably more", "appreciably less" or "equivalent to" amounts of smoke and flash. In the event that the test ammunition appears to produce "appreciably more" smoke or flash than the NATO Reference Ammunition (which might result in rejection of the lot), the RTC shall conduct a more extensive investigation augmented by photographic/video data according to the Smoke and Flash Test Procedure (AEP-97, Volume 17) in order to provide evidence upon which SG/1 can render a decision as to sentencing.

16.A.10 Fouling Observation

16.A.10.1 During firing of the Barrel Erosion Test, observations shall be made as to the degree of fouling produced by the test ammunition. If the degree of fouling encountered causes repeated weapon stoppages, further investigation shall be conducted using a new barrel and NATO Reference Ammunition to determine if the degree of fouling of the test ammunition causes “appreciably more,” “appreciably less” or “equivalent to” that produced by the NATO Reference Ammunition.

16.A.11 Other Defects and Incidents Sentencing

During the test, if any defects occur that are not related to this particular test, either during firing, or visually after firing, they shall be categorised in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

16.A.12 Recording of Results

Average velocity measurements, bullet yawing results and all relevant test data for each barrel shall be recorded on Form No. 16 (Annex 16-E)

ANNEX 16-B

7.62 mm BARREL EROSION TEST PROCEDURE

16.B.1 NATO Requirements

Ammunition with all metal bullets, excluding tracer ammunition, shall be free from design features which render barrels unserviceable because of erosion in less than 5000 cartridges fired.

16.B.2 Ammunition Quantity

A maximum of 17140 cartridges is required to conduct the test. The actual number of cartridges fired may be less depending on the test results.

16.B.3 Equipment

a. Gun, Machine, T65E1.

b. Maximum of three (3) barrels with chrome plated bores.

c. T65 type links.

d. Suitable mount with rigid base.

e. Velocity measurement equipment capable of maintaining measurement errors of less than ± 1 m/s. The measurement method and length between sensors (if used) is optional.

f. Moving target system with paper roll at least 60 cm wide and of sufficient length to allow for completion of the test on one (1) barrel between roll changes. The movement of the paper should be approximately 20 cm per second.

g. Boresight.

h. Insulated boxes (if required).

i. Temperature recording device.

j. Adverse weather protection for the firing position (if required).

16.B.4 Equipment Set-Up

16.B.4.1 The test ammunition shall be visually examined for obvious defects. If a defect is found, the defective cartridge shall be replaced and the defect shall be categorized in accordance with AEP-97, Volume 11 and sentenced in accordance with the sentencing requirements of AEP-97, Volume 7.

16.B.4.2 The ammunition for the first barrel (5000 cartridges) shall be linked in 500-round belts. An additional quantity of 2000 cartridges shall be linked in 500-round belts in the event that the first barrel is capable of being fired (based on the erosion failure criteria) to a total of 7000 cartridges. If the first barrel does not meet the 7000 cartridge requirement, it will be necessary to link additional ammunition to conduct the complete Barrel Erosion Test of 5000 cartridges each in two (2) additional barrels.

16.B.4.3 The linked belts shall be visually examined to ensure that each link is correctly positioned on each cartridge and that there are no obvious defects with the links. Any link with an obvious defect shall be removed from the test and replaced with a new link.

16.B.4.4 The weapon shall be checked thoroughly and the following measurements complied with:

Firing pin protrusion	1.52 mm – 1.73 mm
Headspace (to 10.16 mm datum diameter)	41.38 mm – 41.66 mm

16.B.4.5 The weapon shall be installed in the mount and boresighted into position.

16.B.4.6 The velocity measurement equipment shall be positioned at a convenient distance between the weapon and the moving target system and the position noted for subsequent velocity measurements (refer to Figure 16-1).

16.B.4.7 The moving target system shall be positioned 25 metres from the muzzle of the weapon. Adequate movement of the target during the burst firing is necessary to allow clear observation of individual shots. This is necessary to assess the degree of bullet yaw, if present. A minimum movement rate of 20 cm per second is known to be adequate. The volume of the paper on the roll is to be sufficient to complete the test on one (1) barrel as there will normally be insufficient time during cooling intervals to change the roll. Control of the movement of the paper during firing may be controlled by acoustic sensors if desired.

16.B.5 Method of Conducting the Test

16.B.5.1 The firing room and test area in the immediate vicinity of the test weapon should be of sufficient size to preclude the development of undesirable temperature increases which may affect the validity of the Barrel Erosion Test. Adequate ventilation of the firing area should be available; however, in any event, the ambient temperature in the test area shall be maintained within a range of + 5 °C and + 30 °C during the firing schedule. A temperature recording device shall be used to record the ambient temperature of the range. Care shall be taken that it is not influenced by being placed too close to the weapon or other heat generating equipment.

16.B.5.2 It is not necessary to condition the ammunition for the Barrel Erosion portion prior to testing if it has been stored between + 5 °C and + 30 °C for at least five (5) hours immediately prior to firing. The ammunition used for the Velocity portion shall be conditioned to + 21 ºC ± 3 ºC for a minimum of two (2) hours. The use of insulated boxes that have been brought to the required temperature shall be used to transfer the

ammunition from the storage area to the test weapon to meet the temperature requirements.

16.B.5.3 As this test is usually conducted on external ranges to alleviate the ventilation problems, precautions must be taken to avoid rain falling on the barrel as this would cause cooling during firing and invalidate the test. It is recommended that testing is only conducted when there is a high degree of confidence that there will be no rainfall. An alternative is to construct an open sided shelter that will protect the barrel from direct rainfall but still allow adequate ventilation.

16.B.5.4 It is strongly recommended that the EPVAT Test be conducted prior to performing the Barrel Erosion Test. This is to check that excessive pressures are not likely to be encountered. It is also recommended that the Barrel Erosion Test be conducted remotely where possible for technician safety.

16.B.5.5 At all times, cleaning, lubrication, adjustment and maintenance of the weapon shall conform to the technical instructions provided by the country that provided the weapon. In the absence of specific instructions, cleaning, lubrication, adjustment and maintenance shall be consistent with good practice for all small arms, taking account of any special conditions associated with peculiarities of the weapon, the test and the nature of ammunition being tested. In general, the weapon shall be examined frequently for accumulation of brass debris around the extractor, combustion residue in the gas system or other mechanism, and broken or excessively worn parts.

16.B.5.6 Prior to the start of the Barrel Erosion portion of the test with the first barrel, twenty (20) test cartridges shall be fired in the single shot mode, measuring velocity on each cartridge. The average of the twenty (20) cartridges shall be recorded for comparison to the end of test velocity.

16.B.5.7 After the velocity measurement portion of the test is completed, the erosion portion of the test shall commence. The test cartridges shall be fired in bursts of twenty-five (25) cartridges at twelve (12) second intervals until 500 cartridges have been fired in a four (4) minute period. The firing cycle shall then be suspended for four (4) minutes during which time the barrel is permitted to cool. Cooling is not assisted in any way. Should a firing period exceed the four (4) minute schedule because of stoppages in the firing, the cooling period immediately following shall be reduced accordingly. This firing and cooling cycle shall be repeated until 3500 cartridges have been fired.

16.B.5.8 The paper roll shall be left stationary until 3500 cartridges have been fired unless there is obvious evidence from increasing dispersion that yaw may be occurring. If this happens then the rolling target is to be activated for all further bursts. Activation of the paper roll during firing is mandatory from the 3500 cartridge point.

16.B.5.9 In the event of any defect or incident occurring during the test, an assessment shall be made to determine whether the ammunition, links, weapon, mount, ancillary equipment or operator is at fault. Any such cause shall be rectified as quickly as possible taking into account the time constraints of the test. If it is established that some faulty condition of the weapon is responsible for the stoppage, defect or incident, the barrel shall be assembled onto a replacement weapon and the headspace and other relevant

technical parameters shall be correctly adjusted. Firing shall recommence as quickly as possible.

16.B.5.10 The firing and cooling cycles specified in paragraph 16.B.5.7 shall be repeated until 5000 cartridges have been fired through the first barrel. At the completion of the 5000 cartridges, the barrel shall be cooled. Twenty (20) test cartridges shall be fired in the single shot mode, measuring velocity on each cartridge. The average of the twenty (20) cartridges shall be recorded for comparison to the start of test velocity.

16.B.5.11 The moving target system paper shall be examined to determine if bullet keyholing has occurred and what percentage of keyholing is present.

16.B.5.12 If both the velocity drop criteria and the bullet yaw criteria are met with the first barrel, an additional 2000 cartridges shall be fired through this barrel according to the firing and cooling cycle specified is paragraph 16.B.5.7. The moving target system shall be used for this additional 2000 cartridges. At the completion of the 7000 cartridges, the barrel shall be cooled. Twenty (20) test cartridges shall be fired in the single shot mode, measuring velocity on each cartridge. The average of the twenty (20) cartridges shall be recorded for comparison to the start of test velocity.

16.B.6 Sentencing

16.B.6.1 If both the velocity drop criteria and the bullet yaw criteria are met, the Barrel erosion Test is complete, the ammunition meets NATO requirements and no additional barrels will be tested.

16.B.7 Re-Test Procedures

16.B.7.1 If either the velocity drop criteria or the bullet yaw criteria are not met either at the end of 5000 cartridges or 7000 cartridges with the first barrel, the remaining two (2) barrels shall be tested according to the procedures specified in this annex with 5000 cartridges being fired in each of the remaining two (2) barrels.

16.B.8 Re-Test Sentencing

16.B.8.1 If both of the additional two (2) barrels meet the velocity drop criteria and the bullet yaw criteria, the ammunition meets NATO requirements. If one (1) of the additional two (2) barrels fails to meet the velocity drop criteria or the bullet yaw criteria, the ammunition sample does not meet NATO requirements.

16.B.9 Smoke and Flash Observation

16.B.9.1 During firing of the Barrel Erosion Test, visual observations shall be made as to smoke and flash produced by the test ammunition. This shall be observed during the firing of the first one-hundred (100) cartridges while the barrel is nearly new and relatively cool. In the event that the smoke or flash appears excessive, a comparison test with NATO Reference Ammunition shall be conducted. For purposes of comparison, at least one-hundred (100) cartridges of NATO Reference Ammunition shall be fired in another barrel which has fired no more than 500 cartridges. This shall be fired from a cool barrel

under the same conditions as the Barrel Erosion Test. On the basis of this visual comparison, the test ammunition shall be judged as producing "appreciably more", "appreciably less" or "equivalent to" amounts of smoke and flash. In the event that the test ammunition appears to produce "appreciably more" smoke or flash than the NATO Reference Ammunition (which might result in rejection of the lot), the RTC shall conduct a more extensive investigation augmented by photographic/video data according to the Smoke and Flash Test Procedure (AEP-97, Volume 17) in order to provide evidence upon which SG/1 can render a decision as to sentencing.

16.B.10 Fouling Observation

16.B.10.1 During firing of the Barrel Erosion Test, observations shall be made as to the degree of fouling produced by the test ammunition. If the degree of fouling encountered causes repeated weapon stoppages, further investigation shall be conducted using a new barrel and NATO Reference Ammunition to determine if the degree of fouling of the test ammunition causes “appreciably more,” “appreciably less” or “equivalent to” that produced by the NATO Reference Ammunition.

16.B.11 Other Defects and Incidents Sentencing

During the test, if any defects occur that are not related to this particular test, either during firing, or visually after firing, they shall be categorised in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

16.B.12 Recording of Results

Average velocity measurements, bullet yawing results and all relevant test data for each barrel shall be recorded on Form No. 16 (Annex 16-E)

ANNEX 16-C
12.7 mm BARREL EROSION TEST PROCEDURE

16.C.1 NATO Requirements

All ammunition natures shall be free from design features which render barrels unserviceable because of erosion in less than 2000 cartridges fired.

16.C.2 Ammunition Quantity

A maximum of 4080 cartridges is required to conduct the test. The actual number of cartridges fired may be less depending on the test results.

16.C.3 Equipment

a. Gun, Machine, Heavy Barrel (H.B.), M2.

b. Maximum of two (2) barrels all steel barrels based on FN Herstal drawings 366-110 A1-1156 and 366-0110 A3-622 (AEP-97, Volume 6, Annex 6-A, 6.A.3).

c. M9 type links.

d. Suitable mount with rigid base.

e. Velocity measurement equipment capable of maintaining measurement errors of less than ± 1 m/s. The measurement method and length between sensors (if used) is optional.

f. Moving target system with paper roll at least 60 cm wide and of sufficient length to allow for completion of the test on one (1) barrel between roll changes. The movement of the paper should be approximately 20 cm per second.

g. Boresight.

h. Insulated boxes (if required).

i. Temperature recording device.

j. Adverse weather protection for the firing position (if required).

16.C.4 Equipment Set-Up

16.C.4.1 The test ammunition shall be visually examined for obvious defects. If a defect is found, the defective cartridge shall be replaced and the defect shall be categorized in accordance with AEP-97, Volume 11 and sentenced in accordance with the sentencing requirements of AEP-97, Volume 7.

16.C.4.2 The ammunition (2000 cartridges) shall be linked in 100-round belts. If the first barrel does not meet the 2000 cartridge requirement, it will be necessary to link additional ammunition to conduct the complete Barrel Erosion Test with 2000 cartridges fired through a new barrel.

16.C.4.3 The linked belts shall be visually examined to ensure that each link is correctly positioned on each cartridge and that there are no obvious defects with the links. Any link with an obvious defect shall be removed from the test and replaced with a new link.

16.C.4.4 The weapon shall be checked thoroughly and the following measurements complied with:

Firing pin protrusion	1.83 mm – 2.01 mm
Headspace (to 18.16 mm datum diameter)	76.02 mm – 76.28 mm

16.C.4.5 The weapon shall be installed in the mount and boresighted into position.

16.C.4.6 The velocity measurement equipment shall be positioned at a convenient distance between the weapon and the moving target system and the position noted for subsequent velocity measurements (refer to Figure 16-1).

16.C.4.7 The moving target system shall be positioned 25 metres from the muzzle of the weapon. Adequate movement of the target during the burst firing is necessary to allow clear observation of individual shots. This is necessary to assess the degree of bullet yaw, if present. A minimum movement rate of 20 cm per second is known to be adequate. The volume of the paper on the roll is to be sufficient to complete the test on one (1) barrel as there will normally be insufficient time during cooling intervals to change the roll. Control of the movement of the paper during firing may be controlled by acoustic sensors if desired.

16.C.5 Method of Conducting the Test

16.C.5.1 The firing room and test area in the immediate vicinity of the test weapon should be of sufficient size to preclude the development of undesirable temperature increases which may affect the validity of the Barrel Erosion Test. Adequate ventilation of the firing area should be available; however, in any event, the ambient temperature in the test area shall be maintained within a range of + 5 °C and + 30 °C during the firing schedule. A temperature recording device shall be used to record the ambient temperature of the range. Care shall be taken that it is not influenced by being placed too close to the weapon or other heat generating equipment.

16.C.5.2 It is not necessary to condition the ammunition for the Barrel Erosion portion prior to testing if it has been stored between + 5 °C and + 30 °C for at least five (5) hours immediately prior to firing. The ammunition used for the Velocity portion shall be conditioned to + 21 ºC ± 3 ºC for a minimum of two (2) hours. The use of insulated boxes that have been brought to the required temperature shall be used to transfer the ammunition from the storage area to the test weapon to meet the temperature requirements.

16.C.5.3 As this test is usually conducted on external ranges to alleviate the ventilation problems, precautions must be taken to avoid rain falling on the barrel as this would cause cooling during firing and invalidate the test. It is recommended that testing is only conducted when there is a high degree of confidence that there will be no rainfall. An alternative is to construct an open sided shelter that will protect the barrel from direct rainfall but still allow adequate ventilation.

16.C.5.4 It is strongly recommended that the EPVAT Test be conducted prior to performing the Barrel Erosion Test. This is to check that excessive pressures are not likely to be encountered. It is also recommended that the Barrel Erosion Test be conducted remotely where possible for technician safety.

16.C.5.5 At all times, cleaning, lubrication, adjustment and maintenance of the weapon shall conform to the technical instructions provided by the country that provided the weapon. In the absence of specific instructions, cleaning, lubrication, adjustment and maintenance shall be consistent with good practice for all small arms, taking account of any special conditions associated with peculiarities of the weapon, the test and the nature of ammunition being tested. In general, the weapon shall be examined frequently for accumulation of brass debris around the extractor, combustion residue in the gas system or other mechanism, and broken or excessively worn parts.

16.C.5.6 Prior to the start of the Barrel Erosion portion of the test with the first barrel, twenty (20) test cartridges shall be fired in the single shot mode, measuring velocity on each cartridge. The average of the twenty (20) cartridges shall be recorded for comparison to the end of test velocity.

16.C.5.7 After the velocity measurement portion of the test is completed, the erosion portion of the test shall commence. The test cartridges shall be fired in bursts of ten (10) cartridges at fifteen (15) second intervals until one-hundred (100) cartridges have been fired in a two minute and thirty seconds (2.5 min) period.. The firing cycle shall then be suspended for five (5) minutes during which time the barrel is permitted to cool. Cooling is not assisted in any way. Should a firing period exceed the 2.5 minute schedule because of stoppages in the firing, the cooling period immediately following shall be reduced accordingly. This firing and cooling cycle shall be repeated until 100 cartridges have been fired.

16.C.5.8 The paper roll shall run from the start of the first burst and continue for each burst until the completion of the test.

16.C.5.9 In the event of any defect or incident occurring during the test, an assessment shall be made to determine whether the ammunition, links, weapon, mount, ancillary equipment or operator is at fault. Any such cause shall be rectified as quickly as possible taking into account the time constraints of the test. If it is established that some faulty condition of the weapon is responsible for the stoppage, defect or incident, the barrel shall be assembled onto a replacement weapon and the headspace and other relevant technical parameters shall be correctly adjusted. Firing shall recommence as quickly as possible.

16.C.5.10 The firing and cooling cycles specified in paragraph 16.C.5.7 shall be repeated until 1000 cartridges have been fired. At the completion of the first 1000 cartridge series, the barrel shall be cooled. Only the weapon shall be cleaned; the barrel shall not be cleaned. A second series of 1000 cartridges shall be fired through the same weapon/barrel according to the firing and cooling cycles specified in paragraph 16.C.5.7. At the completion of the 2000 cartridges the barrel shall be cooled. Twenty (20) test cartridges shall be fired in the single shot mode, measuring velocity on each cartridge. The average of the twenty (20) cartridges shall be recorded for comparison to the start of test velocity.

16.C.5.11 The moving target system paper shall be examined to determine if bullet keyholing has occurred and what percentage of keyholing is present.

16.C.6 Sentencing

16.C.6.1 If both the velocity drop criteria and the bullet yaw criteria are met, the Barrel erosion Test is complete, the ammunition meets NATO requirements and no additional barrels will be tested.

16.C.7 Re-Test Procedures

16.C.7.1 If either the velocity drop criteria or the bullet yaw criteria are not met, an additional test with a new barrel and 2000 cartridges shall be conducted according to the procedures of this annex.

16.C.8 Re-Test Sentencing

16.C.8.1 If both the velocity drop criteria and the bullet yaw criteria are met in the additional barrel, the ammunition meets NATO requirements. If the test in the additional barrel fails to meet the velocity drop criteria or the bullet yaw criteria, the ammunition does not meet NATO requirements.

16.C.9 Smoke and Flash Observation

16.C.9.1 During firing of the Barrel Erosion Test, visual observations shall be made as to smoke and flash produced by the test ammunition. This shall be observed during the firing of the first one-hundred (100) cartridges while the barrel is nearly new and relatively cool. In the event that the smoke or flash appears excessive, a comparison test with NATO Reference Ammunition shall be conducted. For purposes of comparison, at least one-hundred (100) cartridges of NATO Reference Ammunition shall be fired in another barrel which has fired no more than 500 cartridges. This shall be fired from a cool barrel under the same conditions as the Barrel Erosion Test. On the basis of this visual comparison, the test ammunition shall be judged as producing "appreciably more", "appreciably less" or "equivalent to" amounts of smoke and flash. In the event that the test ammunition appears to produce "appreciably more" smoke or flash than the NATO Reference Ammunition (which might result in rejection of the lot), the RTC shall conduct a more extensive investigation augmented by photographic/video data according to the Smoke and Flash Test Procedure (AEP-97, Volume 17) in order to provide evidence upon which SG/1 can render a decision as to sentencing.

16.C.10 Fouling Observation

16.C.10.1 During firing of the Barrel Erosion Test, observations shall be made as to the degree of fouling produced by the test ammunition. If the degree of fouling encountered causes repeated weapon stoppages, further investigation shall be conducted using a new barrel and NATO Reference Ammunition to determine if the degree of fouling of the test ammunition causes “appreciably more,” “appreciably less” or “equivalent to” that produced by the NATO Reference Ammunition.

16.C.11 Other Defects and Incidents Sentencing

During the test, if any defects occur that are not related to this particular test, either during firing, or visually after firing, they shall be categorised in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

16.C.12 Recording of Results

Average velocity measurements, bullet yawing results and all relevant test data for each barrel shall be recorded on Form No. 16 (Annex 16-E).

ANNEX 16-D

4.6 mm and 5.7 mm BARREL EROSION TEST PROCEDURE

16.D.1 NATO Requirements

Ammunition with all metal bullets, excluding tracer ammunition, shall be free from design features which render barrels unserviceable because of erosion in less than 5000 cartridges fired.

16.D.2 Ammunition Quantity

A maximum of 17140 cartridges is required to conduct the test. The actual number of cartridges fired may be less depending on the test results.

16.D.3 Equipment

a. Weapons:

1. For 4.6 mm testing: maximum of three (3) Gun, Sub-Machine, MP7

2. For 5.7 mm testing: maximum of three (3) Gun, Sub-Machine, P90

b. Magazines

1. For 4.6 mm testing: 20 cartridge magazine capacity

i. 7000 cartridges = 350 magazines
ii. 5000 cartridges = 250 magazines
iii. 3600 cartridges = 180 magazines
iv. (200 rds = 10 mags)

2. For 5.7 mm testing: 50 cartridge magazine capacity

i. 7000 cartridges = 140 magazines
ii. 5000 cartridges = 100 magazines
iii. 3600 cartridges = 72 magazines
iv. (200 rds = 4 mags)

c. NATO 1980 Weapon Mount, Mk 2 with suitable rigid base.

d. Velocity measurement equipment capable of maintaining measurement errors of less than ± 1 m/s. The measurement method and length between sensors (if used) is optional.

e. Moving target system with paper roll at least 60 cm wide and of sufficient length to allow for completion of the test on one (1) barrel between roll changes. The movement of the paper should be approximately 20 cm per second.

f. Compressed air system for cooling.

g. Boresight.

h. Insulated boxes (if required).

i. Temperature recording device.

j. Adverse weather protection for the firing position (if required).

16.D.4 Equipment Set-Up

16.D.4.1 The test ammunition shall be visually examined for obvious defects. If a defect is found, the defective cartridge shall be replaced and the defect shall be categorized in accordance with AEP-97, Volume 11 and sentenced in accordance with the sentencing requirements of AEP-97, Volume 7.

16.D.4.2 The ammunition for the first weapon (7000 cartridges) shall be loaded into the appropriate number of magazines prior to firing. If the first weapon does not meet the 7000 cartridge requirement, it will be necessary to fill additional magazines to conduct the complete Barrel Erosion Test of 5000 cartridges each in two (2) additional weapons.

16.D.4.3 A sufficient quantity of magazines must be made available in order to conduct the test to ensure the correct amount of cartridges is fired within the prescribed timeframe. Whenever possible use completely filled magazines.

16.D.4.4 The weapon shall be checked thoroughly and the following measurements complied with:

a. For 4.6 mm testing: maximum of three (3) Gun, Sub-Machine, MP7

Firing pin protrusion	0.80 mm – 1.1 mm
Headspace (to 7.663 mm datum diameter)	32.35 mm – 32.5 mm

b. For 5.7 mm testing: maximum of three (3) Gun, Sub-Machine, P90

Firing pin protrusion	1.17 mm – 1.53 mm

16.D.4.5 The weapon shall be installed in the NATO 1980 Mark 2 Weapon Mount, boresighted into position, and the mount setting adjusted to 20 psi (air)/5 hydraulic.

16.D.4.6 The velocity measurement equipment shall be positioned at a convenient distance between the weapon and the moving target system and the position noted for subsequent velocity measurements (refer to Figure 16-1).

16.D.4.7 The moving target system shall be positioned 25 metres from the muzzle of the weapon. Adequate movement of the target during the burst firing is necessary to allow clear observation of individual shots. This is necessary to assess the degree of bullet yaw, if present. A minimum movement rate of 20 cm per second is known to be adequate.

The volume of the paper on the roll is to be sufficient to complete the test on one (1) barrel as there will normally be insufficient time during cooling intervals to change the roll. Control of the movement of the paper during firing may be controlled by acoustic sensors if desired.

16.D.5 Method of Conducting the Test

16.D.5.1 The firing room and test area in the immediate vicinity of the test weapon should be of sufficient size to preclude the development of undesirable temperature increases which may affect the validity of the Barrel Erosion Test. Adequate ventilation of the firing area should be available; however, in any event, the ambient temperature in the test area shall be maintained within a range of + 5 °C and + 30 °C during the firing schedule. A temperature recording device shall be used to record the ambient temperature of the range. Care shall be taken that it is not influenced by being placed too close to the weapon or other heat generating equipment.

16.D.5.2 It is not necessary to condition the ammunition for the Barrel Erosion portion prior to testing if it has been stored between + 5 °C and + 30 °C for at least five (5) hours immediately prior to firing. The ammunition used for the Velocity portion shall be conditioned to + 21 ºC ± 3 ºC for a minimum of two (2) hours. The use of insulated boxes that have been brought to the required temperature shall be used to transfer the ammunition from the storage area to the test weapon to meet the temperature requirements.

16.D.5.3 As this test is usually conducted on external ranges to alleviate the ventilation problems, precautions must be taken to avoid rain falling on the barrel as this would cause cooling during firing and invalidate the test. It is recommended that testing is only conducted when there is a high degree of confidence that there will be no rainfall. An alternative is to construct an open sided shelter that will protect the barrel from direct rainfall but still allow adequate ventilation.

16.D.5.4 It is strongly recommended that the EPVAT Test be conducted prior to performing the Barrel Erosion Test. This is to check that excessive pressures are not likely to be encountered. It is also recommended that the Barrel Erosion Test be conducted remotely where possible for technician safety.

16.D.5.5 At all times, cleaning, lubrication, adjustment and maintenance of the weapon shall conform to the technical instructions provided by the country that provided the weapon. In the absence of specific instructions, cleaning, lubrication, adjustment and maintenance shall be consistent with good practice for all small arms, taking account of any special conditions associated with peculiarities of the weapon, the test and the nature of ammunition being tested. In general, the weapon shall be examined frequently for accumulation of brass debris around the extractor, combustion residue in the gas system or other mechanism, and broken or excessively worn parts.

16.D.5.6 Prior to the start of the Barrel Erosion portion of the test with the first barrel, twenty (20) test cartridges shall be fired in the single shot mode, measuring velocity on each cartridge. The average of the twenty (20) cartridges shall be recorded for comparison to the end of test velocity.

16.D.5.7 After the velocity measurement portion of the test is completed, the erosion portion of the test shall commence. Two-hundred (200) test cartridges shall be fired in a two (2) minute period alternating single shots and short bursts of five (5) to seven (7) cartridges. At least 75% of the test cartridges shall be fired in short bursts. The firing cycle shall then be suspended to permit cooling of the barrel until it can be grasped by the bare hand. Cooling can be assisted by natural or compressed air. This firing and cooling cycle shall be repeated until 3600 cartridges have been fired.

16.D.5.8 The paper roll shall be left stationary until 3600 cartridges have been fired unless there is obvious evidence from increasing dispersion that yaw may be occurring. If this happens then the rolling target is to be activated for all further bursts. Activation of the paper roll during firing is mandatory from the 3600 cartridge point.

16.D.5.9 In the event of any defect or incident occurring during the test, an assessment shall be made to determine whether the ammunition, magazines, weapon, mount, ancillary equipment or operator is at fault. Any such cause shall be rectified as quickly as possible taking into account the time constraints of the test. If it is established that some faulty condition of the weapon is responsible for the stoppage, defect or incident, the barrel shall be assembled onto a replacement weapon and the headspace and other relevant technical parameters shall be correctly adjusted. Firing shall recommence as quickly as possible.

16.D.5.10 The firing and cooling cycles specified in paragraph 16.D.5.7 shall be repeated until 5000 cartridges have been fired through the first weapon. At the completion of the 5000 cartridges, the weapon shall be cooled. Twenty (20) test cartridges shall be fired in the single shot mode, measuring velocity on each cartridge. The average of the twenty (20) cartridges shall be recorded for comparison to the start of test velocity.

16.D.5.11 The moving target system paper shall be examined to determine if bullet keyholing has occurred and what percentage of keyholing is present.

16.D.5.12 If both the velocity drop criteria and the bullet yaw criteria are met with the first weapon, an additional 2000 cartridges shall be fired through this barrel according to the firing and cooling cycle specified is paragraph 16.D.5.7. The moving target system shall be used for this additional 2000 cartridges. At the completion of the 7000 cartridges, the weapon shall be cooled. Twenty (20) test cartridges shall be fired in the single shot mode, measuring velocity on each cartridge. The average of the twenty (20) cartridges shall be recorded for comparison to the start of test velocity.

16.D.6 Sentencing

16.D.6.1 If both the velocity drop criteria and the bullet yaw criteria are met, the Barrel erosion Test is complete, the ammunition meets NATO requirements and no additional barrels will be tested.

16.D.7 Re-Test Procedures

16.D.7.1 If either the velocity drop criteria or the bullet yaw criteria are not met either at the end of 5000 cartridges or 7000 cartridges with the first weapon, the remaining two (2) weapons shall be tested according to the procedures specified in this annex with 5000 cartridges being fired in each of the remaining two (2) weapons.

16.D.8 Re-Test Sentencing

16.D.8.1 If both of the additional two (2) weapons meet the velocity drop criteria and the bullet yaw criteria, the ammunition meets NATO requirements. If one (1) of the additional two (2) weapons fails to meet the velocity drop criteria or the bullet yaw criteria, the ammunition sample does not meet NATO requirements.

16.D.9 Smoke and Flash Observation

16.D.9.1 During firing of the Barrel Erosion Test, visual observations shall be made as to smoke and flash produced by the test ammunition. This shall be observed during the firing of the first one-hundred (100) cartridges while the barrel is nearly new and relatively cool. In the event that the smoke or flash appears excessive, a comparison test with NATO Reference Ammunition shall be conducted. For purposes of comparison, at least one-hundred (100) cartridges of NATO Reference Ammunition shall be fired in another barrel which has fired no more than 500 cartridges. This shall be fired from a cool barrel under the same conditions as the Barrel Erosion Test. On the basis of this visual comparison, the test ammunition shall be judged as producing "appreciably more", "appreciably less" or "equivalent to" amounts of smoke and flash. In the event that the test ammunition appears to produce "appreciably more" smoke or flash than the NATO Reference Ammunition (which might result in rejection of the lot), the RTC shall conduct a more extensive investigation augmented by photographic/video data according to the Smoke and Flash Test Procedure (AEP-97, Volume 17) in order to provide evidence upon which SG/1 can render a decision as to sentencing.

16.D.10 Fouling Observation

16.D.10.1 During firing of the Barrel Erosion Test, observations shall be made as to the degree of fouling produced by the test ammunition. If the degree of fouling encountered causes repeated weapon stoppages, further investigation shall be conducted using a new barrel and NATO Reference Ammunition to determine if the degree of fouling of the test ammunition causes “appreciably more,” “appreciably less” or “equivalent to” that produced by the NATO Reference Ammunition.

16.D.11 Other Defects and Incidents Sentencing

During the test, if any defects occur that are not related to this particular test, either during firing, or visually after firing, they shall be categorised in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

16.D.12 Recording of Results

Average velocity measurements, bullet yawing results and all relevant test data for each barrel shall be recorded on Form No. 16 (Annex 16-E).

ANNEX 16-E

FORM NUMBER 16 – BARREL EROSION TEST

Per the applicable Recording of Results paragraphs in Volume 16, the following form for recording the Barrel Erosion Test results for the prescribed calibres on Form No. 16 is presented on page 16-E-2 of this Annex.

16.E.1 FORM 16: BARREL EROSION TEST RESULTS

Form Number 16	Page 1of 1			**BARREL EROSION**
Test Centre			Test Reference	
Submitting Nation			Lot Number	
Manufacturer			Cartridge Type	
Date Fired			NATO Design No.	

Weapon Type	Weapon Serial Number	Weapon Life	Barrel Serial Number	Barrel Start Life	Head Space (mm)	Pin Protrusion (mm)

Determination of Erosion Performance			1st Barrel	2nd Barrel	3rd Barrel
Mean Velocity in new barrel (after 20 cartridges)					
Mean Velocity after	7,000	test cartridges fired			
Mean Velocity loss in	7,000	test cartridges fired			
Total cartridges fired prior to 20% keyholing ≥ 15%					
Total cartridges fired per barrel					

Observation of Smoke & Flash in Comparison to NATO Reference Ammunition	IF APPRECIABLY MORE SMOKE OR FLASH IS OBSERVED SEE AEP-97, VOLUME 17.		
	Appreciably Less	Appreciably More	Comparable
Flash of test ammunition is:			
Smoke of test ammunition is:			

Observation of Fouling (Only required if weapon stoppages occur)			
	Appreciably Less	Appreciably More	Comparable
Fouling by Test Ammunition is:			

Smoke & Flash

Weapon Type	Weapon Serial Number	Weapon Life	Barrel Serial Number	Barrel Start Life	Head Space (mm)	Pin Protrusion (mm)

Units: Velocity - m/s

Remarks

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 17

SMOKE AND FLASH TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

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17.1 Applicability

The Smoke and Flash Test Procedures[1] will be conducted on ammunition submitted for either NATO Qualification Approval or NATO Production Testing, if it is deemed that the ammunition produces excessive smoke or flash from any part of the weapon during Function and Casualty Testing or Barrel Erosion Testing.

Note 1: It is only necessary to conduct both investigative test procedures if there is deemed to be a problem with smoke and flash.

17.2 NATO Requirements

Ammunition shall not produce excessive smoke or flash in comparison with the NATO Reference Ammunition.

17.3 Ammunition Quantity

Up to a maximum quantity of one hundred (100) cartridges of ammunition[2] will be required to demonstrate and capture the excessive smoke or flash on video.

Note 2: This is the individual test quantity, obviously it would be 200 cartridges if both smoke and flash tests are required.

17.4 Equipment

The required equipment is listed below:

Equipment List
Relevant calibre NATO Nominated Weapon as detailed in Volume 10 or Barrel Erosion Weapon as defined in Volume 16[3]
Sufficient quantity of Magazines/Links appropriate for the weapon
NATO 1980 Mark 2 Weapon Mount, Drawing No. 14-(MC)-1[4]
Suitable Rigid Base for the NATO 1980 Mark 2 Weapon Mount
For Pistols Only: Ransome Rest or Apparatus, Mounting, Pistol (Sketch) Drawing No. 14-(MC)-2[4]
For 12.7mm only: Fixture, Test, Function and Casualty, Figure No. 6-B-7[4]
For Smoke Test only: a chequer board target at least 2 metres x 2 metres with black and white squares, 300 mm x 300 mm
Suitable video camera(s)
Bore Sight
Compressed air system for barrel cooling (optional)

Note 3: The test only needs to be conducted in one weapon, using the weapon that was judged to exhibit the worst problem. Therefore, it may be necessary to use two different weapons if both Smoke and Flash are being examined.
Note 4: Drawings and figures are contained in Volume 6.

17.5 Preparation for Testing

17.5.1 Test Weapons

The test is to be performed with the NATO Nominated Weapon or Barrel Erosion Weapon of the type where the worst problem was encountered.

17.5.2 Weapon Preparation, Checks and Adjustments

Weapons to be used for the Smoke and Flash Test shall be prepared and thoroughly checked by a competent armourer. Headspace, firing pin protrusion and barrel gauging shall conform to the dimensions given in the relevant weapon characteristics Annex of Volume 10 or 16, as applicable. On weapons with multiple gas settings, the normal gas setting shall be used. "Adverse" or "Excess" gas settings shall not be used. The barrel and chamber shall be clean and dry.

17.5.3 Ammunition Conditioning

The test and NATO Reference Ammunition are to be conditioned to the temperature of the test where the original concern was noted[5]. The conditioning procedures in the Function & Casualty Test (AEP-97 – Volume 14) are to be used.

Note 5: The exception is that conditioning will not be necessary if the original incident occurred during Barrel Erosion test at ambient.

17.6 Method of Conducting the Smoke Test

17.6.1 Preparation for Firing

The firing range shall be as clean as possible so that dust will not be raised by the muzzle blast of the weapon.

The target screen shall be placed at a distance of 25 metres from the muzzle, perpendicular to the line of fire. The camera shall be positioned slightly above the weapon so that its line of sight takes in both the muzzle and the chequer board target. The camera shall be focused on the chequer board.

The weapon shall be assembled on the mount and sighted into position.

17.6.2 Firing Procedure – Smoke Test

The test shall be conducted in the following manner:

Firing will be conducted under minimal wind conditions to ensure the smoke remains in front of the chequer board screen sufficiently long to obtain video evidence. When firing

in indoor ranges it will be necessary to disable air ventilation equipment for the duration of the video capture.

The test cartridges shall be fired in the equivalent manner as when the problem was identified.

After firing the test cartridges, the weapon shall be cooled to ambient temperature and thoroughly cleaned prior to firing the NATO Reference Cartridges. The above procedures shall be repeated until the required number of NATO Reference Cartridges have been fired.

17.6.3 Recording of Smoke Test Results

The video results of smoke produced by the test cartridges shall be compared to those of the NATO Reference Cartridges and visual observations of the target screen for both shall also be compared. The results shall be recorded on Form No. 17 (Annex 17-A) and the video evidence retained.

17.6.4 Sentencing of the Smoke Test

If smoke produced by the test cartridges is considerably more than that produced by the NATO Reference Cartridges, the ammunition will be considered unacceptable.

17.7 Method of Conducting the Flash Test

17.7.1 Preparation for Firing

For optimum observation and video recording of results, the firing position should be in darkness when the test is being conducted.

The weapon shall be assembled on the mount and sighted into position.

17.7.2 Firing Procedure – Flash Test

The test shall be conducted in the following manner:

The test cartridges shall be fired in the equivalent manner as when the problem was identified.

After firing the test cartridges, the weapon shall be cooled to ambient temperature and thoroughly cleaned prior to firing the NATO Reference Cartridges. The above procedures shall be repeated until the required number of NATO Reference Cartridges has been fired.

17.7.3 Recording of Flash Test Results

The video results of flash produced by the test cartridges shall be compared to those of the NATO Reference Cartridges and visual observations shall also be compared. The results shall be recorded on Form No.17 (Annex 17-A) and the video evidence retained.

17.7.4 Sentencing of the Flash Test

If the flash produced by the test cartridges is considerably more than that produced by the NATO Reference Cartridges, the ammunition will be considered unacceptable.

17.8 Other Defects and Incidents - Sentencing

If any defects occur that are not related to this particular test, either during firing, or visually after firing, during any test or re-test they shall be categorised in accordance with Volume 11 and sentenced in accordance with the cumulative sentencing requirements of Volume 7.

ANNEX 17-A
FORM NUMBER 17 – SMOKE AND FLASH TESTS

Per the applicable Recording of Results paragraphs in Volume 17, the following forms for recording Smoke And Flash Test results are presented on page 17-A-2 of this Annex.

17.A.1 FORM 17 – SMOKE AND FLASH

Form Number 17	Page 1of 1			**SMOKE and FLASH**
Test Centre			Test Reference	
Submitting Nation			Lot Number	
Manufacturer			Cartridge Type	
Date Fired			NATO Design No.	

Weapon Type	Weapon Serial Number	Weapon Life	Barrel Serial Number	Barrel Start Life	Head Space (mm)	Pin Protrusion (mm)

Smoke Test		**NATO Reference Ammunition**	**Test Ammunition Comparison to NATO Reference Ammunition**		
Serial	Firing Mode		Appreciably Less	Appreciably More	Comparable

Flash Test		**NATO Reference Ammunition**	**Test Ammunition Comparison to NATO Reference Ammunition**		
Serial	Firing Mode		Appreciably Less	Appreciably More	Comparable

Supply Video and or Photographs as supporting evidence

Remarks

NATO STANDARD

AEP-97

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PRECISION TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

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18.1 Applicability

4.6 mm, 5.56 mm, 5.7 mm, 7.62 mm, 9 mm and 12.7 mm ammunition submitted for NATO Qualification Approval, NATO Production Testing or NATO Surveillance Testing shall be subjected to the Precision Test Procedure defined in this volume.

18.2 NATO Requirements

18.2.1 NATO Qualification Approval and NATO Production Tests

The pooled mean of the vertical standard deviations and the pooled mean of the horizontal standard deviations of ninety (90) cartridges (thirty (30) cartridges from each of three (3) different barrels) shall be equal to or less than:

Calibre – Ammunition Nature	Horizontal Standard Deviation	Vertical Standard Deviation	Target Distance
4.6 mm – All Metal Bullets	35 mm	35 mm	100 m
5.56 mm – All Metal Bullets	200 mm	200 mm	550 m
5.56 mm – Tracer or Pyrotechnic Bullets	300 mm	300 mm	550 m
5.7 mm – All Metal Bullets	40 mm	40 mm	100 m
5.7 mm – Tracer Bullets	50 mm	50 mm	100 m
7.62 mm – All Metal Bullets	200 mm	200 mm	550 m
7.62 mm – Tracer or Pyrotechnic Bullets	300 mm	300 mm	550 m
9 mm – All Metal Bullets	50 mm	50 mm	46 m
12.7 mm – All Bullets except Tracer	300 mm	300 mm	550 m
12.7 mm – Containing Tracer Components	400 mm	400 mm	550 m

18.2.2 NATO Surveillance Test

The Horizontal and Vertical standard deviation sentencing requirements for NATO Surveillance Testing are contained in AEP-97, Volume 4.

18.3 Ammunition Quantity

a. Test Ammunition: 99 cartridges

1. Nine (9) cartridges for warmers
2. Ninety (90) cartridges for the test (additional warmer cartridges may be required)

b. NATO Reference Ammunition: As required by paragraph 18.7

Note: The warmer cartridges to be used are to be from the same lot as the test ammunition.

18.4 Equipment

The required equipment is listed below:

Equipment	Drawing/Figure Number [3]					
	4.6 mm	**5.56 mm**	**5.7 mm**	**7.62 mm**	**9 mm**	**12.7 mm**
Precision Barrel (Quantity 3)	18-(4.6mm)-1	18-(5.56mm)-1	18-(5.7mm)-1	18-(7.62mm)-1	18-(9mm)-1	18-(12.7mm)-1
Fixture, Test, Precision	Figure 6-B-10	Figure 6-B-8	Figure 6-B-10	Figure 6-B-9	Figure 6-B-10	Figure 6-B-11
Firing Mechanism [1]	NA	Mauser or Remington 700	Mauser or Remington 700	Springfield 1903	Enfield 303	18-(12.7mm)-2
Target Size [2]	600 mm x 600 mm	2 m x 2 m	600 mm x 600 mm	2 m x 2 m	600 mm x 600 mm	2 m x 2 m @ 550m 3 m x 3 m @ 900m
Wind Measurement	Instruments for measuring wind velocity and direction at both firing point and target and any necessary intermediate point. (see para. 18.6.1)					
Ammunition Conditioning Equipment	Constant temperature controlled container capable of maintaining temperature at + 21 ± 3°C.					

Note 1: NATO National Test Centres are permitted to use an alternative Firing Mechanism/Action but must ensure the headspace and internal barrel configuration are as defined in AEP-97.

Note 2: An automatic target system may be used providing it is capable of measuring the strike position with an average error over thirty (30) cartridges of less than 5 mm.

Note 3: Drawings and figures are contained in AEP-97, Volume 6.

18.5 Equipment and Range Set Up

The equipment and range set up shall be as follows:

18.5.1 Precision Barrel and Action Assembly

The precision barrel assembly shall be in accordance with the applicable drawings and the measurements listed below shall be made before a test weapon is placed in service, after misfires, pierced primers, blowbacks or whenever a part replacement has been made in the assembly.

Calibre	Firing Pin Protrusion (mm)	Firing Pin Indent (mm)	Headspace (mm)
4.6 mm	0.76 to 0.99	0.45 to 0.65	32.35 to 32.5
5.56 mm	0.76 to 0.99	0.51 to 0.64	38.024 to 38.1 @ 7.663 mm dia.
5.7 mm	0.76 to 0.99	0.51 to 0.64	23.75 to 23.826 @ 7.00 mm dia.
7.62 mm	1.27 to 1.91	0.46 to 0.61	41.35 to 41.43 @ 10.16 mm dia.
9 mm	0.89 to 0.94	0.46 to 0.64	19.15 to 19.23
12.7 mm	1.88 to 2.08	0.51 to 0.64	79.58 to 79.83 @ 16.15 mm dia.

18.5.2 Precision Barrel Set Up

The precision barrel shall be set up in the Fixture, Test, Precision defined in paragraph 18.4 ensuring it is securely clamped. For 5.56 mm, 7.62 mm and 12.7 mm, it is important to ensure that the barrel is clamped to both “V” blocks. For 4.6 mm, 5.7 mm and 9 mm, it is important to ensure that the appropriate collars are used at the correct locations. It is of prime importance that the barrel assembly maintains its original position from shot to shot.

18.5.3 Wind Measurement

Instruments for measuring wind velocity and direction are to be set up to meet the requirements of paragraph 18.6.1.

18.5.4 Target Size and Position

For 5.56 mm, 7.62 mm and 12.7 mm, a target of minimum 2 m x 2 m is to be set up at 550 metres from the muzzle of the precision barrel. For 9 mm, a target of minimum 600 mm x 600 mm is to be set up at 46 metres from the muzzle of the precision barrel. For 4.6 mm and 5.7 mm, a target of minimum 600 mm x 600 mm is to be set up at 100 metres from the muzzle of the precision barrel. When a hard target system is used, it must be replaced after every 30-round (cartridge) series for 5.56 mm, 7.62 mm and 12.7 mm. When a hard target system is used for 4.6 mm, 5.7 mm and 9 mm, it must be replaced after each 10-round series. This is to ensure that it is possible to identify each shot hole. It is important that each replacement target is fixed against a set vertical and horizontal reference axis from the same datum, to ensure that accumulative measurement of shot dispersion is accurate.

18.5.5 Ammunition Conditioning

The required number of test cartridges shall be placed in a vertical position, primer-end down, in separate recessed holding blocks. The ammunition shall be conditioned to a temperature of + 21 °C ± 3 °C for at least two (2) hours immediately preceding the test. The conditioning cabinet shall be reasonably close to the firing point to avoid the ammunition being out of conditioning for more than sixty (60) seconds prior to firing. Ideally, the cartridges shall be removed singly from the conditioning cabinet. However, if the firing location is not at approximately + 21 °C, no more than five (5) cartridges may be placed in an insulated box which has been conditioned at + 21 °C ± 3 °C, and the box placed at a point convenient to the technician; the cartridges shall then be removed singly from the insulated box immediately before firing.

18.6 Method of Conducting the Test

18.6.1 Wind Restrictions

The flight of the bullet is affected to a degree by the direction and velocity of the wind over an outdoor firing range. Therefore, the trajectory match test should not be fired when the velocity of the transverse wind is greater than 14 km per hour or varies more than 7 km per hour. Wind measurements must be taken and recorded at regular intervals during the test at both the firing point and at the target. Where the projectile leaves the sheltered part of the range to an unsheltered part of the range, then wind direction and velocity must additionally be measured at this point.

18.6.2 Sighting the Barrel onto the Target

The barrel shall be boresighted onto an aiming mark on the target and elevated sufficiently to achieve impact of the test ammunition in the centre of the target. This is usually achieved by using tracer ammunition of similar trajectory performance to the test ammunition. Confirmation of the correct sighting shall be verified by firing two (2) cartridges of the test ammunition lot. If hard targets are used, the impact holes are to be marked and identified after target sighting has been completed, before firing the test.

18.6.3 Maintenance of Point of Aim

Once the test has commenced at each target distance, it is **NOT** permitted to change the point of aim of the barrel until the firing sequence, Serial No. 1 through Serial No. 4 of paragraph 18.6.6, has been completed. (Point of aim may be changed when the barrel is changed or when moving from one target distance to another).

18.6.4 Continuity of Firing

Firing of the complete test on any one target is to be completed in a continuous manner with delays only permitted to allow for marking and identification of shot holes between warmer cartridges and test ammunition. The time interval between shots is to be approximately twenty (20) seconds.

18.6.5 Ammunition Handling and Loading

The ammunition handling and loading is to be conducted in a uniform manner throughout the test. Consideration is not given to the position of the propellant in the cartridge case, except that the manner of handling and loading the ammunition from cartridge to cartridge is to be reasonably uniform. If a delay occurs during the firing of the test and the delay exceeds sixty (60) seconds, the ammunition is to be placed back into the conditioning chamber until testing resumes.

18.6.6 Firing Sequence

Firing shall be conducted in the following order:

Serial	Firing Sequence
1	Five (5) to ten (10) warmer cartridges (the last three (3) to be test ammunition) are to be fired at the target.
2	Shot Holes are to be marked and identified if using a hard target. [1]
3	Thirty (30) test cartridges are to be fired at the target. (3 x 10-cartridge groups for 4.6 mm, 5.7 mm, and 9 mm at the same aim point).
4	Shot Holes are to be marked and identified if using a hard target. [1]
5	**Test is to be repeated with a two (2) additional barrels at this same distance.**

Note 1: This will not be required if an automatic target system is used.

18.7 Test Validity

If dispersion outside the requirements is obtained from any one or more of the test barrels, the equipment shall be checked by firing three (3) NATO Reference Cartridges as warmers followed by thirty (30) NATO Reference Cartridges in the suspect barrel. Precision shall be measured at the distance specified in the table below and velocity shall also be recorded, for information only, at the distance specified. Any barrel which fails to meet the requirements listed in the table below will be withdrawn and another barrel used for a repeat test. Results from the disqualified barrel will be noted but not used for sentencing. A re-test is not permitted if the barrels have been successfully validated.

NATO Reference Calibre	Maximum Permitted Horizontal and Vertical Standard Deviation	Target Distance	Distance from Muzzle for Velocity Test [1]
4.6 mm	28 mm	100 m	24 m
5.56 mm	160 mm	550 m	24 m
5.7 mm	32 mm	100 m	24 m
7.62 mm	140 mm	550 m	24 m
9 mm	40 mm	46 m	16 m
12.7 mm	200 mm	550 m	24 m

Note 1: The measurement method or base length between sensors (if used) is optional providing the equipment is capable of maintaining measurement errors of less than ± 1 m/s.

18.8 Recording of Results

For each group of thirty (30) cartridges fired the following are to be recorded and calculated on Form No. 18 (Annex 18-A):

a. Individual cartridge X and Y co-ordinates for each barrel

b. Horizontal and Vertical standard deviations for each barrel

c. Pooled horizontal and pooled vertical standard deviations for all three (3) barrels

18.8.1 Target Misses

The following procedures are to be used when one (1), or more than one (1), shot misses the target:

18.8.1.1 For 5.56 mm, 7.62 mm and 12.7 mm Ammunition:

a. If one (1) shot of a 30-round series misses the target at 550 metres, the series shall be considered valid only if the centre of impact of the 29 recorded shots is 900 mm or more from the edge of the target. If this condition is met, then the following procedure will be used in evaluating the shots on the target. The mean point of impact of the group will be determined in the usual manner for the 29 recorded shots. The entry on the report is to be marked with an asterisk and annotated to indicate that the figures pertain only to the 29 recorded shots of a 30-round series. The vertical and horizontal standard deviations will be recalculated including, for the missing shot, distances from the reference axes equal to the distances to the mean point of impact plus an arbitrary figure of one (1) metre. The standard deviations so obtained are to be marked and annotated in accordance with this paragraph.

b. If more than one (1) shot of a 30-round series misses the target, the alignment of the weapon shall be verified by firing a 10-round series of NATO Reference Cartridges. If the centre of impact of this series is less than 900 mm from the nearest edge of the target, the alignment of the weapon shall be corrected and the 30-round series re-fired. If the correct alignment of the weapon is verified, i.e. the centre of impact using NATO Reference Ammunition is at least 900 mm from the nearest edge of the target and two (2) or more shots of any 30-round series miss the target, then the entire Precision Test shall be re-fired using a larger target. The results of the first firing and the re-firing shall be reported to SG/1 by the Superintendent of the RTC for an appropriate decision as to the necessity for further investigation.

18.8.1.2 For 4.6 mm, 5.7 mm and 9 mm Ammunition:

a. If one (1) shot of a 10-round series misses the target at 46 m, the series shall be considered valid only if the centre of impact of the 9 recorded shots is 200 mm or more from the edge of the target. If this condition is met, then the following procedure will be used in evaluating the shots on the target. The mean point of impact of the group will be determined in the usual manner for the 9 recorded shots. The entry on the report is to be marked with an asterisk and annotated to indicate that the figures pertain only to the 9 recorded shots of a 10-round series. The vertical and horizontal standard deviations will be recalculated including, for the missing shot, distances from the reference axes equal to the distances to the mean point of impact plus an arbitrary figure of 300 mm. The standard deviations so obtained are to be marked and annotated in accordance with this paragraph.

b. If more than one (1) shot of a 10-round series misses the target, the alignment of the weapon shall be verified by firing a 10-round series of NATO Reference Cartridges. If the centre of impact of this series is less than 200 mm from the nearest edge of the target, the alignment of the weapon shall be corrected and the 10-round test series re-fired. If the correct alignment of the weapon is verified, i.e. the Centre of Impact using NATO Reference Cartridges is at least 200 mm from the nearest edge of the target and two (2) or more shots of any 10-round series miss the target, then the entire Precision Test shall be re-fired using a larger target. The results of the first firing and the re-firing shall be reported to SG/1 by the Superintendent of the RTC for an appropriate decision as to the necessity for further investigation.

18.8.2 Recording of Additional Information

In addition the following will be recorded:

a. Number and type of case casualties

b. Misfires

c. Any other relevant technical incidents

d. All details required by Precision Test Form No. 18 (Annex 18-A).

18.9 Sentencing – NATO Qualification Approval and NATO Production Tests

The ammunition shall be considered to have met the NATO requirements if the pooled mean of the vertical standard deviations and the pooled mean of the horizontal standard deviations of 90-rounds (thirty (30) cartridges from each of three (3) different barrels) shall be equal or less than:

Calibre – Ammunition Nature	Horizontal Standard Deviation	Vertical Standard Deviation	Target Distance
4.6 mm – All Metal Bullets	35 mm	35 mm	100 m
5.56 mm – All Metal Bullets	200 mm	200 mm	550 m
5.56 mm – Tracer or Pyrotechnic Bullets	300 mm	300 mm	550 m
5.7 mm – All Metal Bullets	40 mm	40 mm	100 m
5.7 mm – Tracer Bullets	50 mm	50 mm	100 m
7.62 mm – All Metal Bullets	200 mm	200 mm	550 m
7.62 mm – Tracer or Pyrotechnic Bullets	300 mm	300 mm	550 m
9 mm – All Metal Bullets	50 mm	50 mm	46 m
12.7 mm – All Bullets except Tracer	300 mm	300 mm	550 m
12.7 mm – Containing Tracer Components	400 mm	400 mm	550 m

18.10 Re-Test in the Event of Failure

If the ammunition fails the Precision Test a re-test is not permitted if the barrels have been successfully validated in accordance with paragraph 18.7.

18.11 Sentencing – NATO Surveillance Test

The acceptance parameters for the Surveillance Test are contained in AEP-97, Volume 4.

18.12 Other Defects and Incidents - Sentencing

During the test, if any defects occur that are not related to this particular test, either during firing or visually after firing, they shall be categorized in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

ANNEX 18-A

FORM NUMBER 18 – PRECISION TEST

Per the applicable Recording of Results paragraph in Volume 18, the following forms for recording the Precision Test results on Form No. 18 (pages 1-3) are presented on pages 21-A-2 through 21-A-4 of this Annex.

18.A.1 FORM 18: PRECISION (BARREL 1) (PAGE 1 OF 3)

Form Number 18	Page 1of 3		**PRECISION (Barrel 1)**
Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

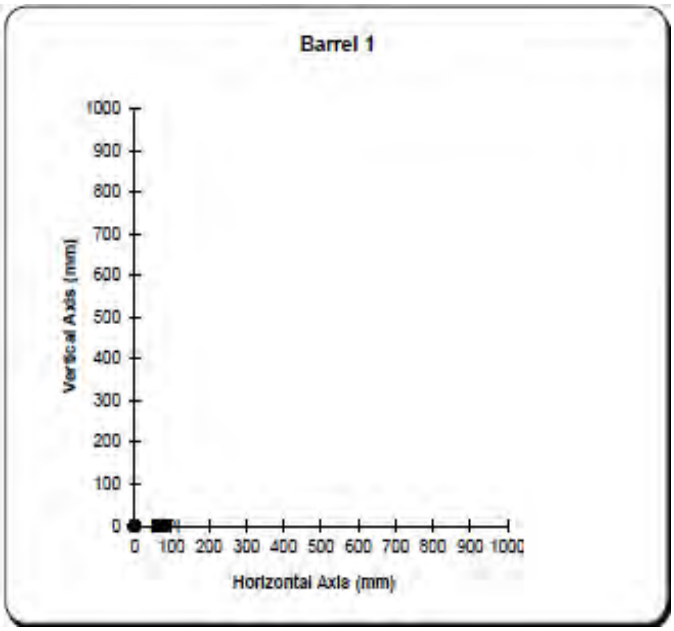
Individual Shot Data For:			**Barrel 1**
Cartridge No.	Horizontal (mm)	Vertical (mm)	Velocity (m/s)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
Expected NATO Reference Lot Values:			
	Lot #:		
	Velocity @	m	
	Horizontal SD		
	Vertical SD		
Test Statistics Of All Barrels Fired			
Pooled Mean of Horizontal SD			
Pooled Mean of Vertical SD			

Target Distance @ 550m

Weapon Details			
Barrel Number		Life	
Head Space		mm	
Pin Protrusion		mm	
Firing Pin Indent		mm	

Meterological Data			
	F / Point	Target	Mean
Wind Direction (o'clock)			
Velocity (Km/h)			
Humidity (%)			
Ambient Temp (^{o}C)			

Test Statistics Barrel 1			
	Horizontal		Vertical
MPI			
SD			
Group Rectangle			
Mean Velocity		SD	



Remarks

18.A.2 FORM 18: PRECISION (BARREL 2) (PAGE 2 OF 3)

Form Number 18	Page 2 of 3		**PRECISION (Barrel 2)**
Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Individual Shot Data For:			**Barrel 2**
Cartridge No.	Horizontal (mm)	Vertical (mm)	Velocity (m/s)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

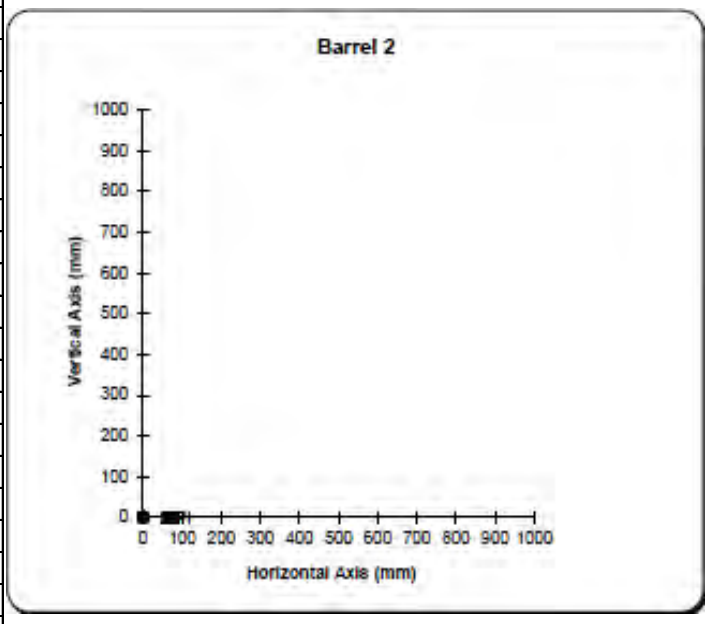
Expected NATO Reference Lot Values:			
	Lot #:		
	Velocity @	m	
	Horizontal SD		
	Vertical SD		
Test Statistics Of All Barrels Fired			
Pooled Mean of Horizontal SD			
Pooled Mean of Vertical SD			

Weapon Details			
Barrel Number		Life	
Head Space		mm	
Pin Protrusion		mm	
Firing Pin Indent		mm	

Meterological Data			
	F / Point	Target	Mean
Wind Direction (o'clock)			
Velocity (Km/h)			
Humidity (%)			
Ambient Temp (^{o}C)			

Test Statistics Barrel 2			
	Horizontal		Vertical
MPI			
SD			
Group Rectangle			
Mean Velocity		SD	

Target Distance @ 550m



Remarks

18.A.3 FORM 18: PRECISION (BARREL 3) (PAGE 3 OF 3)

Form Number 18	Page 3 of 3		**PRECISION (Barrel 3)**
Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Individual Shot Data For:			**Barrel 3**
Cartridge No.	Horizontal (mm)	Vertical (mm)	Velocity (m/s)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

Expected NATO Reference Lot Values:			
	Lot #:		
	Velocity @	m	
	Horizontal SD		
	Vertical SD		

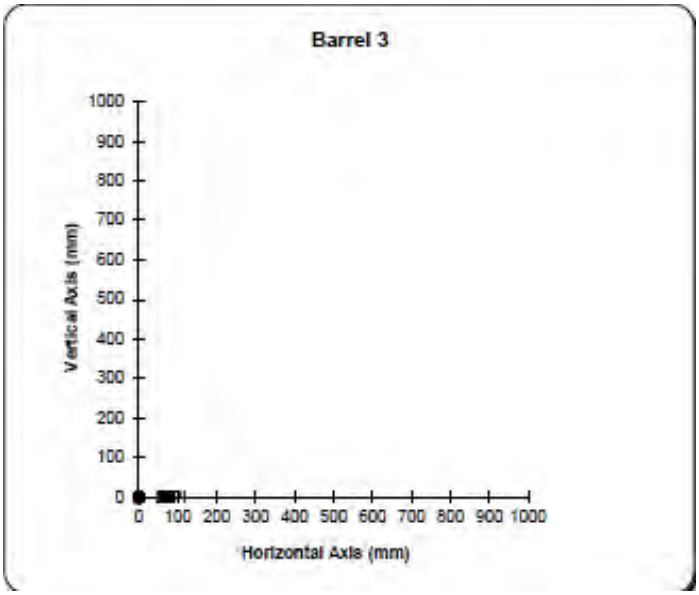
Test Statistics Of All Barrels Fired	
Pooled Mean of Horizontal SD	
Pooled Mean of Vertical SD	

Weapon Details			
Barrel Number		Life	
Head Space		mm	
Pin Protrusion		mm	
Firing Pin Indent		mm	

Meterological Data			
	F / Point	Target	Mean
Wind Direction (o'clock)			
Velocity (Km/h)			
Humidity (%)			
Ambient Temp (^{o}C)			

Test Statistics Barrel 3			
	Horizontal		Vertical
MPI			
SD			
Group Rectangle			
Mean Velocity		SD	

Target Distance @ 550m



Remarks

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 19

TERMINAL EFFECTS TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

19.1 Applicability

4.6 mm, 5.56 mm, 5.7 mm, 7.62 mm, and 12.7 mm ammunition submitted for NATO Qualification Approval and NATO Production Testing shall be subjected to the Terminal Effects Procedure defined in this volume. 9 mm ammunition which satisfies the 9 mm requirement for Muzzle Energy (AEP-97, Volume 12) shall be considered to have met the 9 mm requirement for terminal effects.

12.7 mm cartridges containing an Incendiary and/or Explosive Effects capability shall be subjected to the tests as defined in Annex 19-B and Annex 19-C as appropriate.

NATO Surveillance tests only be conducted for 12.7 mm cartridges containing an Incendiary and/or Explosive Effects capability shall be subjected to the tests as defined in Annex 19-B and Annex 19-C as appropriate.

19.2 NATO Requirements

19.2.1 Terminal Effects Requirement – NATO Qualification Approval and NATO Production Tests (NATO Surveillance Tests for 12.7 mm only)

19.2.2 Perforation (Annex 19-A)

a. **4.6 mm:** A projectile containing inert materials shall completely perforate six (6) mild steel plates of 1 mm nominal thickness defined in DIN EN 10130 (short name DC01 and material number 1.0330) with a size of 250 mm x 250 mm and a distance of 20 mm between each plate when fired at 100 metres from the muzzle at zero degree (0^o) obliquity (normal to the line of fire). At least six (6) steel plates (ten (10) are recommended to check for differences in terminal performance) are fixed with the necessary mount of 20 mm distance bushes on four (4) threaded bars. The required four (4) holes with a diameter of 9 mm in the steel plates are located 10 mm from each edge (AEP-97, Volume 6, Figure 6-B-12).

b. **5.56 mm:** A projectile containing inert materials shall completely perforate a mild steel plate of 3.5 mm nominal (10 gauge) thickness, defined in SAE 1010, SAE 1020, or S235JR, with a Rockwell hardness of minimum B 55 and maximum B 70, placed at 570 metres from the muzzle at zero (0^o) degree obliquity (normal to the line of fire). At least one (1) splinter shall perforate a 0.5 mm aluminum witness plate set at zero degree obliquity positioned 300 mm behind the mild steel plate.

c. **5.7 mm:** A projectile containing inert materials shall completely perforate six (6) mild steel plates of 1 mm nominal thickness defined in DIN EN 10130 (short name DC01 and material number 1.0330) with a size of 250 mm x 250 mm and a distance of 20 mm between each plate when fired at 100 metres from the muzzle at zero degree (0^o) obliquity (normal to the line of fire). At least six (6) steel plates (ten (10) are recommended to check for differences in terminal performance) are fixed with the necessary mount of 20 mm distance bushes on four (4) threaded bars. The required four (4) holes with a diameter of 9 mm in the steel plates are located 10 mm from each edge (AEP-97, Volume 6, Figure 6-B-12).

d. 7.62 mm: A projectile containing inert materials shall completely perforate a mild steel plate of 3.5 mm nominal (10 gauge) thickness, defined in SAE 1010, SAE 1020, or S235JR, with a Rockwell hardness of minimum B 55 and maximum B 70, placed at 550 metres from the muzzle at zero (0^o) degree obliquity (normal to the line of fire). At least one (1) splinter shall perforate a 0.5 mm aluminum witness plate set at zero (0^o) degree obliquity positioned 300 mm behind the mild steel plate.

e. 12.7 mm: A projectile with armour piercing capabilities shall completely perforate a Rolled Homogeneous Armour plate 22 mm thick, with a Brinell hardness range of 321 - 375 (3000 kg load - 10 mm ball) at zero (0^o) degree obliquity (normal to the line of fire), placed at 100 metres from the muzzle of the weapon. At least one (1) splinter shall perforate a 1.5 mm mild steel witness plate set at zero (0^o) degree obliquity positioned 500 mm behind the armour plate.

Calibre – Ammunition Nature	**Target Distance from Muzzle[1]** (0 degrees of obliquity - normal to the line of fire)	**Target Thickness** (Type as specified below or national equivalent)	**Target Hardness**		**Witness Plate**	
			Rockwell	**Brinell**	**Distance Behind Target Plate[2]**	**Thickness** (Type as specified below or national equivalent)
4.6 mm – Projectiles containing inert material	100 m	6 x 1 mm Mild Steel (DIN EN 10130, DC01)	B 52 min B 66 max	90 min 120 max	Not Applicable based on Target Array	Not Applicable based on Target Array
5.56 mm – Projectiles containing inert material	570 m	3.5 mm Mild Steel ,10 Gauge (SAE 1010, SAE 1020, or S235JR)	B 55 min B 70 max	99 min 124 max	300 mm	0.5 mm Aluminium (ANSI 2024 T3)
5.7 mm – Projectiles containing inert material	100 m	6 x 1 mm Mild Steel (DIN EN 10130,DC01)	B 52 min B 66 max	90 min 120 max	Not Applicable based on Target Array	Not Applicable based on Target Array
7.62 mm – Projectiles containing inert material	550 m	3.5 mm Mild Steel, 10 Gauge (SAE 1010, SAE 1020, or S235JR)	B 55 min B 70 max	99 min 124 max	300 mm	0.5 mm Aluminium (ANSI 2024 T3)
12.7 mm – With Armour Piercing Capabilities	100 m	22 mm RHA (321 – 375)	C 34 min C 40 max	321 min 375 max	500 mm	1.5 mm Mild Steel (S235, JRG2, or HE280M)

Note 1: Tolerance on distance of target plate is ± 1 m.
Note 2: Tolerance on distance of witness plate is ± 10 mm.

19.2.3 Incendiary Effects (Annex 19-B)

12.7 mm incendiary projectiles shall ignite and produce an incendiary flash in less than 600 mm behind an aluminium target plate (2024 T3) of 2 mm nominal thickness placed at 150 metres from the muzzle at zero (0º) degrees of obliquity (normal to the line of fire).

Calibre – Ammunition Nature	**Target Distance from Muzzle**[1] (0 degrees of obliquity - normal to the line of fire)	**Target Thickness** (Type as specified below or national equivalent)	**Witness Plate**	
			Distance Behind Target Plate	**Thickness** (Type as specified below or national equivalent)
12.7 mm – With Incendiary Effects	150 m	2 mm Aluminum (ANSI 2024 T3)	NA	NA

Note 1: Tolerance on distance of target plate is ± 1 m.

19.2.4 Explosive Effects (Annex 19-C)

12.7 mm explosive projectiles shall function and produce at least eight (8) perforations in the 0.5 mm aluminium witness plate (1050 A) located 1200 mm behind an aluminium target plate (2024 T3) of 2 mm nominal thickness placed not less than 150 metres from the muzzle at zero (0º) degrees of obliquity (normal to the line of fire).

Calibre – Ammunition Nature	**Target Distance from Muzzle**[1] (0 degrees of obliquity - normal to the line of fire)	**Target Thickness** (Type as specified below or national equivalent)	**Witness Plate**	
			Distance Behind Target Plate	**Thickness** (Type as specified below or national equivalent)
12.7 mm – With Explosive Effects	150 m	2 mm Aluminum (ANSI 2024 T3)	1200 mm	0.5 mm Aluminium (ANSI 1050 A)

Note 1: Tolerance on distance of target plate is ± 1 m.
Note 2: Tolerance on distance of witness plate is ± 10 mm.

19.3 Ammunition Quantity

The following table for calibres; 4.6 mm, 5.56 mm, 5.7 mm, and 7.62 mm, provides the quantities of test ammunition and NATO Reference Ammunition for the Perforation Test.

4.6 mm 5.56 mm 5.7 mm 7.62 mm	NATO Qualification Approval		NATO Production Test		NATO Surveillance Test	
	Test Quantity	Re-Test Quantity	Test Quantity	Re-Test Quantity	Test Quantity	Re-Test Quantity
Perforation						
Untreated	20	20	20	20	NA	
NATO Reference	10	10 [1]	10	10 [1]	NA	

Note 1: This is only required if the re-test is not fired on the same day or if the barrel is changed.

The following table for calibre 12.7 mm provides the quantities of test ammunition samples, untreated and those from the Climatic Storage conditions (AEP-97, Volume 13) and the NATO Reference Ammunition for the Perforation Test, Incendiary Effects, and Explosive Effects.

12.7 mm	NATO Qualification Approval		NATO Production Test		NATO Surveillance Test	
	Test Quantity	Re-Test Quantity	Test Quantity	Re-Test Quantity	Test Quantity	Re-Test Quantity
Perforation						
Untreated	20	20	20	20	NA	
NATO Reference	10	10 [1]	10	10 [1]	NA	
Incendiary Effects						
Untreated	20	20	20	20	20	20
Exposed Desert	20	20	NA		NA	
Continuous Heating	20	20	NA		NA	
Continuous Arctic	20	20	NA		NA	
Explosive Effects						
Untreated	20	20	20	20	20	20
Exposed Desert	20	20	NA		NA	
Continuous Heating	20	20	NA		NA	
Continuous Artic	20	20	NA		NA	

Note 1: This is only required if the re-test is not fired on the same day or if the barrel is changed.

ANNEX 19-A
TERMINAL EFFECTS (PERFORATION)

19.A.1 Equipment

The required equipment is listed below:

Equipment	Drawing/Figure Number [4]				
	4.6 mm	**5.56 mm**	**5.7 mm**	**7.62 mm**	**12.7 mm**
Precision Barrel	18-(4.6mm)-1	18-(5.56mm)-1	18-(5.7mm)-1	18-(7.62mm)-1	18-(12.7mm)-1
Fixture, Test, Precision	Figure 6-B-10	Figure 6-B-8	Figure 6-B-10	Figure 6-B-9	Figure 6-B-11
Firing Mechanism [1]	NA	Mauser or Remington 700	Mauser or Remington 700	Springfield 1903	18-(12.7mm)-2
Target Plate	6 x 1 mm Mild Steel (DIN EN 10130, DC01)	3.5 mm [2] Mild Steel ,10 Gauge (SAE 1010, SAE 1020, or S235JR)	6 x 1 mm Mild Steel (DIN EN 10130, DC01	3.5 mm [2] Mild Steel ,10 Gauge (SAE 1010, SAE 1020, or S235JR)	22 mm RHA (321 – 375)
Witness Plate	Not Applicable based on Target Array	0.5 mm Aluminum (ANSI 2024T3)	Not Applicable based on Target Array	0.5 mm Aluminum (ANSI 2024T3)	1.5 mm Mild Steel (S235, JRG2, or HE280M)
Plate Holder	A suitable frame to rigidly hold target/witness plates.				
Meteorological Data Measurement	Instruments for measuring air temperature, pressure and humidity.				
Ammunition Conditioning Equipment	Constant temperature controlled container capable of maintaining temperature at + 21 ± 3°C.				
Instrumental Velocity Measuring Equipment[3] to measure velocity at:	24 m	24 m	24 m	24 m	24 m

Note 1: NATO National Test Centres are permitted to use an alternative Firing Mechanism/Action but must ensure the headspace and internal barrel configuration are as defined in AEP-97.

Note 2: The mild steel target plate described must have a 1 metre unsupported span in both directions.

Note 3: The measurement method or base length between sensors (if used) is optional providing the equipment is capable of maintaining measurement errors of less than ± 1 m/s.

Note 4: Drawings and figures are contained in AEP-97, Volume 6.

19.A.2 Preparation for Firing

The equipment and range set up shall be as follows:

19.A.2.1 Precision Barrel and Action Assembly

The precision barrel assembly shall be in accordance with the applicable drawings and the measurements listed below shall be made before a test weapon is placed in service, after misfires, pierced primers, blowbacks or whenever a part replacement has been made in the assembly.

Calibre	Firing Pin Protrusion (mm)	Firing Pin Indent (mm)	Headspace (mm)
4.6 mm	0.76 to 0.99	0.45 to 0.65	32.35 to 32.5
5.56 mm	0.76 to 0.99	0.51 to 0.64	38.024 to 38.1 @ 7.663 mm dia.
5.7 mm	0.76 to 0.99	0.51 to 0.64	23.75 to 23.826 @ 7.00 mm dia.
7.62 mm	1.27 to 1.91	0.46 to 0.61	41.35 to 41.43 @ 10.16 mm dia.
12.7 mm	1.88 to 2.08	0.51 to 0.64	79.58 to 79.83 @ 16.15 mm dia.

19.A.2.2 Precision Barrel Set Up

The precision barrel shall be set up in the Fixture, Test, Precision defined in paragraph 19.A.1 ensuring it is securely clamped. For 5.56 mm, 7.62 mm and 12.7 mm, it is important to ensure that the barrel is clamped to both “V” blocks. For 4.6 mm and 5.7 mm, it is important to ensure that the appropriate collars are used at the correct locations. It is of prime importance that the barrel assembly maintains its original position from shot to shot.

19.A.2.2 Ammunition Conditioning

The required number of test cartridges and NATO Reference Cartridges shall be placed in a vertical position, primer-end down, in separate recessed holding blocks. The ammunition shall be conditioned to a temperature of + 21 °C ± 3 °C for at least two (2) hours immediately preceding the test. The conditioning cabinet shall be reasonably close to the firing point to avoid the ammunition being out of conditioning for more than sixty (60) seconds prior to firing. Ideally, the cartridges shall be removed singly from the conditioning cabinet. However, if the firing location is not at approximately + 21 °C, no more than five (5) cartridges may be placed in an insulated box which has been conditioned at + 21 °C ± 3 °C, and the box placed at a point convenient to the technician; the cartridges shall then be removed singly from the insulated box immediately before firing.

19.A.3 Method of Conducting the Test

4.6 mm, 5.7 mm, 7.62 mm and 12.7 mm ammunition tests will be conducted only in an ambient range temperature between 0 °C and + 35 °C.

5.56 mm ammunition testing is only permitted when the air density is less than 1.270 kg/m3 as defined in paragraph 19.A.13.

19.A.3.1 The chamber and bore of the barrel shall be wiped dry and the test weapon properly aligned on the target position.

Velocity recording equipment is to be set up to record velocity at 24 metres from the muzzle. The velocity measuring equipment must be capable of maintaining measurement errors of less than ± 1 m/s.

Under normal circumstances three (3) warming cartridges shall be fired. However, if the cartridges to be fired contain primers or propellant different from that previously fired in the test weapon, five (5) warming cartridges shall be fired. Velocity readings shall be recorded to assure that the equipment is in functioning properly.

In order that the propellant shall be uniformly positioned from shot to shot, attention to detail is necessary in handling and chambering the cartridge. The cartridge shall first be held vertically, bullet upward. It shall then be rotated slowly in a vertical plane, stopping the rotation momentarily after 180° of rotation when the bullet is downward, and then continuing through the remainder of 360°, stopping with the cartridge again bullet end upward. The bullet end of the cartridge shall now be lowered to a position slightly above the primer end of the case. The cartridge shall remain in this attitude, as far as is practical, as it is inserted into the chamber. The object is to have the propellant seated in the primer end of the case, and any airspace present at the bullet end of the case[1].

Note 1: Improper handling of ammunition immediately prior to and during the chambering operation (i.e. propellant is at the bullet end of the case when the cartridge is fired) will result in lower velocities being obtained than if the propellant is at the primer end of the case in a loose condition, provided air space is present. This condition is more likely to occur as the size of the calibre/case increases.

At no time shall the exposed metal surface of the test barrel become too hot to grasp with bare hands (approximately + 60 ºC).

19.A.4 Use of NATO Reference Cartridges

The following procedure shall be used for NATO Reference Cartridges prior to installation of the target plates:

Ten (10) NATO Reference Cartridges at + 21 °C ± 3 °C shall be fired for velocity only to qualify the barrel assembly.

The precision barrel assembly will be qualified for use if the mean velocity value obtained with NATO Reference Cartridges is within ± 12 m/s of the official assessed velocity value of the NATO Reference Cartridges[2].

Note 2: The assessed velocity value used for the qualification of the precision barrel assembly is the velocity assessment value associated with the Precision Barrel and <u>not</u> the velocity assessment obtained from the EPVAT Barrel.

If the actual mean velocity obtained with the NATO Reference Cartridges deviates by more than ± 12 m/s from the official assessed value, the cause shall be corrected and a new series of NATO Reference Cartridges shall be fired.

19.A.5 Firing the Test

Definitions:

A valid shot occurs in the case of no marginal or double hit. The distance of a valid shot from the margin of another hit must be a calibre diameter between the damaged areas. The damaged areas are formed by descaling, heat treatment (colour change of plate material), ruptures, etc. **For each non-valid shot that occurs an additional cartridge will be fired. The results from the non-valid shots will be disregarded.**

Perforation occurs in those cases where at least one splinter goes through the witness screen for all calibres. The definitions to be used for reporting information are given in paragraph 19.A.12.

19.A.6 Firing Test Cartridges

The same preparation to the weapon and firing as described in paragraph 19.A.3.1 shall be applied. The target and witness plate assembly are to be mounted rigidly at the specified distance from the muzzle:

Calibre	Distance of Target/Witness Plate Assembly From Muzzle
4.6 mm	100 m
5.56 mm	570 m
5.7 mm	100 m
7.62 mm	550 m
12.7 mm	100 m

The target plate and witness plates shall be inspected after each shot. The recorded velocity shall be identified with the penetration (perforation) result. The penetration (perforation) result shall be identified by the definitions given in paragraph 19.A.12.

In the event that a sample of test cartridges fails to meet the penetration requirement, the velocity level of the test weapon shall be re-checked immediately after cooling, by firing ten (10) NATO Reference Cartridges in accordance with paragraph 19.A.3.1. If the mean velocity obtained with the NATO Reference Cartridges exceeds the ± 12 m/s qualification limit, penetration results of the test lot shall be disregarded and another test weapon shall be selected and qualified before the official test is recommenced.

19.A.7 Recording of Results

The results of firing the NATO Reference and test cartridges shall be recorded using the Terminal Effects Form No. 19-1 (Annex 19-D), along with the additional information below if relevant:

a. Number and type of case casualties.

b. Misfires.

c. Any other relevant technical incidents.

d. All details required by Terminal Effects Test Form No. 19-1 (Annex 19-D).

19.A.8 Sentencing

The ammunition shall be considered to have met the NATO requirement if no less than ninety percent (90%) of the projectiles meet the conditions of penetration given in paragraph 19.2.2. The test ammunition samples from each of the climatic conditions shall be sentenced in accordance with AEP-97, Volume 13.

19.A.9 Re-Test Procedures

If any of the original test samples fails to meet the specified requirements, a re-test is to be conducted for that particular climatic test sample (Untreated, Exposed Desert, Continuous Heating or Continuous Arctic). The re-test sample size shall be the same as the original test sample for the particular condition(s) being re-tested.

19.A.10 Re-Test Sentencing

The results from the original test and the re-test shall be combined. The ammunition shall be considered to have met the NATO requirement if no less than ninety percent (90%) of the projectiles meet the conditions of penetration given in paragraph 19.2.2. The test ammunition samples from each of the climatic conditions shall be sentenced in accordance with AEP-97, Volume 13.

19.A.11 Other Defects and Incidents - Sentencing

If any defects occur that are not related to this particular test, either during firing, or visually after firing, during any test or re-test they shall be categorised in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

19.A.12 Penetration (Perforation) Code Definitions

Letter Code	Description

Hole Normal **(HN)**	A complete hole through the plate of approximately the diameter of the projectile.
Hole Small **(HS)**	A hole through the plate, of smaller diameter than the projectile, through which light can be seen.
Point Through Rear **(PTR)**	This description relates to one type of complete penetration in which the armour piercing core remains in the target plate, unbroken, with its tip or a portion of its body protruding through the back face of the plate (core intact in the plate).
Partial Penetration **(PP)**	This term describes the occurrence when the armour piercing indents the plate through some fraction of the plate thickness and then bounces out of the indent.
Cracked Bulge **(CB)**	A bulge on the back of the plate with at least one distinct crack in it.
Smooth Bulge **(SB)**	A bulge on the back of the plate without cracks.
Disc Off **(DO)**	A complete disc off the back of the plate considerably larger in size than the normal "collar" effect around the hole exit, or a disc off the back of the plate without a perforation. It may be used with HN or HS.
Disc Started **(DS)**	A circular cracking effect and lifting of metal on the back of the plate indicating that a disc is starting to detach itself. The extent of the circumferential crack can be indicated, e.g. 1/2, 3/4 or clock-code (3-8 o'clock) etc.
Scoop **(SC)**	An indentation produced on the front of the plate which does not result in a complete hole through the plate. It would often accompany an SB, CB or DS.
Core Lodged **(CL)**	An indication that the projectile core is lodged in the scoop, cavity or hole. Used with SC, HN or HS.
Plug Out **(PO)**	A lump of metal of approximately the diameter of the projectile punched from the plate in one piece.
Nose Lodge **(NL)**	Nose, only, of shot or core lodge.
Middle Lodge **(ML)**	Middle, portion only, of shot or core lodge.
Base Lodge **(BL)**	Base, only, of shot or core lodge.
Middle Base Lodge **(MBL)**	Rear part of shot or core lodge (i.e. whole of shot or core less nose).

Where applicable, one or more codes may be used.

19.A.13 Air Density Calculation (For 5.56 mm testing only)

An Excel file for the calculation of air density is available upon request from the RTC Superintendents.

Calculation of Air Density

Input Data		
Air Temperature	**0.0**	**[°C]**
Air Pressure	**997**	**[hPa]**
Air Humidity	**50**	**[%]**
Air Density	**1.270**	**[kg/m³]**

Exterior Ballistic Differential Equation:

(1) Air resistance $dv/dt = - c_d \times \rho/2 \times v^2 \times 1/q$ [m/s^2]

cd = drag coefficient [-]
ρ = air density [kg/m^3]
v = velocity [m/s]
q = cross sectional density [g/mm^2]

Air Density ρ

(2) $\rho = 0{,}34838 \times p_L / T_K$

Equation doesn't consider the air humidity

Equation for correction - considering the air humidity
(3) $\Delta \rho = - 0{,}1315 \times r \times E / T_K$

Equation for air density - considering the air humidity

(4) $\rho = 0{,}34838 \times p_L / T_K - 0{,}1315 \times r \times E / T_K$

Equation for calculation of Saturation Vapour Pressure

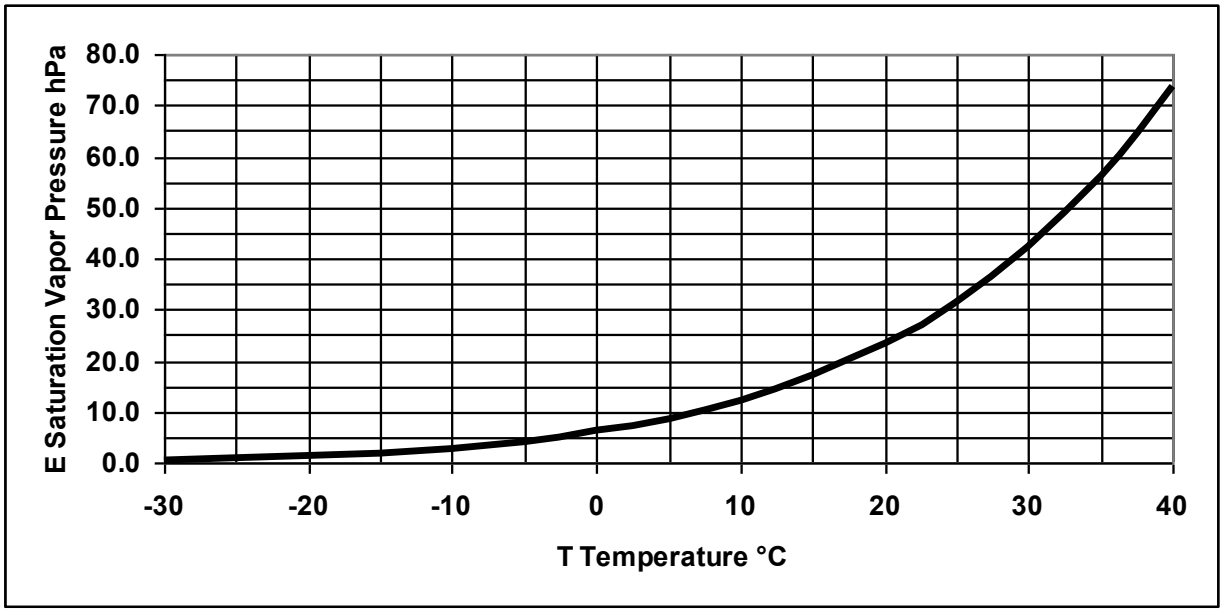
(5) $E = 611.2138 \times EXP (17.5043 \times T_C/(241.2+ T_C))/100$

ρ = air density [kg/m^3]
p_L = air pressure [hPa]
r = relative air humidity [**decimal equivalent**, = r %/100]
E = saturation vapour pressure [hPa]
T_C = air temperature [°C]
T_K = air temperature [°K] (=°C+273,15)

Saturation Vapour Pressure and Air Temperature:

T[°C]	E[hPa]
-30	0.51
-25	0.81
-20	1.26
-15	1.91
-10	2.87
-5	4.22
0	6.11
5	8.72
10	12.27
15	17.03
20	23.35
25	31.63
30	42.38
35	56.17
40	73.72

Ratio of Saturation Vapour Pressure E and Air Temperature T



Saturation Vapour Pressure f (Temperature)

ANNEX 19-B
TERMINAL EFFECTS (INCENDIARY EFFECTS)

19.B.1 Equipment

The required equipment is listed below:

Equipment	Drawing/Figure Number [2]
	12.7 mm
Precision Barrel	18-(12.7mm)-1
Fixture, Test, Precision	Figure 6-B-11
Firing Mechanism [1]	18-(12.7mm)-2
Target Plate	2 mm Duralumin (2024 T3)
Plate Holder	A suitable frame to rigidly hold target/witness plates.
Ammunition Conditioning Equipment	Constant temperature controlled container capable of maintaining temperature at + 21 ± 3°C.
Digital Video Equipment	If digital video is to be used it should be capable of a sample rate of at least 500 pictures per second (pps).

Note 1: NATO National Test Centres are permitted to use an alternative Firing Mechanism/Action but must ensure the headspace and internal barrel configuration are as defined in AEP-97.

Note 2: Drawings and figures are contained in AEP-97, Volume 6.

19.B.2 Preparation for Firing

The equipment and range set up shall be as follows:

19.B.2.1 Precision Barrel and Action Assembly

The precision barrel assembly shall be in accordance with the applicable drawings and the measurements listed below shall be made before a test weapon is placed in service, after misfires, pierced primers, blowbacks or whenever a part replacement has been made in the assembly.

Calibre	Firing Pin Protrusion (mm)	Firing Pin Indent (mm)	Headspace (mm)
12.7 mm	1.88 to 2.08	0.51 to 0.64	79.58 to 79.83 @ 16.15 mm dia.

19.B.2.2 Precision Barrel Set Up

The precision barrel shall be set up in the Fixture, Test, Precision defined in paragraph 19.B.1 ensuring it is securely clamped. It is important to ensure that the barrel is clamped to both "V" blocks.

19.B.2.3 Ammunition Conditioning

The required number of test cartridges and NATO Reference Cartridges shall be placed in a vertical position, primer-end down, in separate recessed holding blocks. The ammunition shall be conditioned to a temperature of + 21 °C ± 3 °C for at least two (2) hours immediately preceding the test. The conditioning cabinet shall be reasonably close to the firing point to avoid the ammunition being out of conditioning for more than sixty (60) seconds prior to firing. Ideally, the cartridges shall be removed singly from the conditioning cabinet. However, if the firing location is not at approximately + 21 °C, no more than five (5) cartridges may be placed in an insulated box which has been conditioned at + 21 °C ± 3 °C, and the box placed at a point convenient to the technician; the cartridges shall then be removed singly from the insulated box immediately before firing.

19.B.3 Method of Conducting the Test

12.7 mm ammunition tests will be conducted only in an ambient range temperature between 0 °C and + 35 °C.

19.B.3.1 The chamber and bore of the barrel shall be wiped dry and the test weapon properly aligned on the target position.

Under normal circumstances three (3) warming cartridges shall be fired. However, if the cartridges to be fired contain primers or propellant different from that previously fired in the test weapon, five (5) warming cartridges shall be fired to assure that the equipment is in functioning properly. At no time shall the exposed metal surface of the test barrel become too hot to grasp with bare hands (approximately + 60 ºC).

19.B.4 Firing the Test

Definitions:

A valid shot occurs in the case of no marginal or double hit. The distance of a valid shot from the margin of another hit must be a calibre diameter between the damaged areas. **If a non-valid shot occurs then that cartridge will be replaced.**

The projectiles must produce an incendiary flash at a distance of less than 600 mm behind the target plate, below is an example of acceptable flash. This photograph was taken using the recommended digital video equipment image capturing speed of (500 pps).

19.B.5 Firing Test Cartridges

The same preparation to the weapon and firing as described in paragraph 19.B.3.1 shall be applied. The target and witness plate assembly are to be mounted rigidly at the specified distance from the muzzle:

Calibre	Distance of Target Plate Assembly From Muzzle
12.7 mm	150 m

The target plate shall be inspected after each shot along with the image recorded.

19.B.6 Recording of Results

The results of firing the test cartridges shall be recorded using the Terminal Effects Form No. 19-2 (Annex 19-D), along with the additional information below if relevant:

a. Number and type of case casualties.

b. Misfires.

c. Any other relevant technical incidents.

d. All details required by Terminal Effects Test Form No. 19-2 (Annex 19-D).

19.B.7 Sentencing

The ammunition shall be considered to have met the NATO requirement if no less than ninety percent (90%) of the projectiles meet the conditions of penetration given in paragraph 19.2.3. The test ammunition samples from each of the climatic conditions shall be sentenced in accordance with AEP-97, Volume 13.

19.B.8 Re-Test Procedures

If any of the original test samples fails to meet the specified requirements, a re-test is to be conducted for that particular climatic test sample (Untreated, Exposed Desert, Continuous Heating or Continuous Arctic). The re-test sample size shall be the same as the original test sample for the particular condition(s) being re-tested.

19.B.9 Re-Test Sentencing

The results from the original test and the re-test shall be combined. The ammunition shall be considered to have met the NATO requirement if no less than ninety percent (90%) of the projectiles meet the conditions of penetration given in paragraph 19.2.3. The test ammunition samples from each of the climatic conditions shall be sentenced in accordance with AEP-97, Volume 13.

19.B.10 Other Defects and Incidents – Sentencing

If any defects occur that are not related to this particular test, either during firing, or visually after firing, during any test or re-test they shall be categorised in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

19.B.11 Sentencing – NATO Surveillance Test

The acceptance parameters for the NATO Surveillance Test are contained in AEP-97, Volume 4.

ANNEX 19-C
TERMINAL EFFECTS (EXPLOSIVE EFFECTS)

19.C.1 Equipment

The required equipment is listed below:

Equipment	Drawing/Figure Number [2]
	12.7 mm
Precision Barrel	18-(12.7mm)-1
Fixture, Test, Precision	Figure 6-B-11
Firing Mechanism [1]	18-(12.7mm)-2
Target Plate	2 mm Duralumin (2024 T3)
Witness Plate	0.5 mm Aluminium (1050A)
Plate Holder	A suitable frame to rigidly hold target/witness plates.
Ammunition Conditioning Equipment	Constant temperature controlled container capable of maintaining temperature at + 21 ± 3°C.

Note 1: NATO National Test Centres are permitted to use an alternative Firing Mechanism/Action but must ensure the headspace and internal barrel configuration are as defined in AEP-97.

Note 2: Drawings and figures are contained in AEP-97, Volume 6.

19.C.2 Preparation for Firing

The equipment and range set up shall be as follows:

19.C.2.1 Precision Barrel and Action Assembly

The precision barrel assembly shall be in accordance with the applicable drawings and the measurements listed below shall be made before a test weapon is placed in service, after misfires, pierced primers, blowbacks or whenever a part replacement has been made in the assembly.

Calibre	Firing Pin Protrusion (mm)	Firing Pin Indent (mm)	Headspace (mm)
12.7 mm	1.88 to 2.08	0.51 to 0.64	79.58 to 79.83 @ 16.15 mm dia.

19.C.2.2 Precision Barrel Set Up

The precision barrel shall be set up in the Fixture, Test, Precision defined in paragraph 19.C.1 ensuring it is securely clamped. It is important to ensure that the barrel is clamped to both "V" blocks.

19.C.2.3 Ammunition Conditioning

The required number of test cartridges and NATO Reference Cartridges shall be placed in a vertical position, primer-end down, in separate recessed holding blocks. The ammunition shall be conditioned to a temperature of + 21 °C ± 3 °C for at least two (2) hours immediately preceding the test. The conditioning cabinet shall be reasonably close to the firing point to avoid the ammunition being out of conditioning for more than sixty (60) seconds prior to firing. Ideally, the cartridges shall be removed singly from the conditioning cabinet. However, if the firing location is not at approximately + 21 °C, no more than five (5) cartridges may be placed in an insulated box which has been conditioned at + 21 °C ± 3 °C, and the box placed at a point convenient to the technician; the cartridges shall then be removed singly from the insulated box immediately before firing.

19.C.3 Method of Conducting the Test

12.7 mm ammunition tests will be conducted only in an ambient range temperature between 0 °C and + 35 °C.

19.C.3.1 The chamber and bore of the barrel shall be wiped dry and the test weapon properly aligned on the target position.

Under normal circumstances three (3) warming cartridges shall be fired. However, if the cartridges to be fired contain primers or propellant different from that previously fired in the test weapon, five (5) warming cartridges shall be fired to assure that the equipment is in functioning properly. At no time shall the exposed metal surface of the test barrel become too hot to grasp with bare hands (approximately + 60 ºC).

19.C.4 Firing the Test

Definitions:

A valid shot occurs in the case of no marginal or double hit. The distance of a valid shot from the margin of another hit must be a calibre diameter between the damaged areas. **If a non-valid shot occurs then that cartridge will be replaced.**

The projectile must function on the plate and produce at least eight (8) perforations in the witness plate.

19.C.5 Firing Test Cartridges

The same preparation to the weapon and firing as described in paragraph 19.C.3.1 shall be applied. The target and witness plate assembly are to be mounted rigidly at the specified distance from the muzzle:

Calibre	Distance of Target Plate Assembly From Muzzle
12.7 mm	150 m

The target and witness plates shall be inspected and marked after each shot.

19.C.6 Recording of Results

The results of firing the test cartridges shall be recorded using the Terminal Effects Form No. 19-3 (Annex 19-D), along with the additional information below if relevant:

a. Number and type of case casualties.

b. Misfires.

c. Any other relevant technical incidents.

d. All details required by Terminal Effects Test Form No. 19-3 (Annex 19-D).

19.C.7 Sentencing

The ammunition shall be considered to have met the NATO requirement if no less than ninety percent (90%) of the projectiles meet the conditions of penetration given in paragraph 19.2.4. The test ammunition samples from each of the climatic conditions shall be sentenced in accordance with AEP-97, Volume 13.

19.C.8 Re-Test Procedures

If any of the original test samples fails to meet the specified requirements, a re-test is to be conducted for that particular climatic test sample (Untreated, Exposed Desert, Continuous Heating or Continuous Arctic). The re-test sample size shall be the same as the original test sample for the particular condition(s) being re-tested.

19.C.9 Re-Test Sentencing

The results from the original test and the re-test shall be combined. The ammunition shall be considered to have met the NATO requirement if no less than ninety percent (90%) of the projectiles meet the conditions of penetration given in paragraph 19.2.4. The test ammunition samples from each of the climatic conditions shall be sentenced in accordance with AEP-97, Volume 13.

19.C.10 Other Defects and Incidents – Sentencing

If any defects occur that are not related to this particular test, either during firing, or visually after firing, during any test or re-test they shall be categorised in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

19.C.11 Sentencing – NATO Surveillance Test

The acceptance parameters for the NATO Surveillance Test are contained in AEP-97, Volume 4.

ANNEX 19-D

FORM NUMBER 19 – TERMINAL EFFECTS

Per the applicable Recording of Results paragraphs in Volume 19, the following forms for recording the Terminal Effects (Perforation) Test results on Form 19-1 is presented on page 19-D-2, the Terminal Effects (Incendiary Effects) Test results on Form 19-2 is presented on page 19-D-3, and the Terminal Effects (Explosive Effects) Test results on Form 19-3 is presented on page 19-D-4 of this Annex.

19.D.1 FORM 19-1 – TERMINAL EFFECTS - PERFORATION

Form Number 19-1	Page 1 of 1		**TERMINAL EFFECTS - PERFORATION**
Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Observed Velocity @		metres
NATO Reference Lot		

NATO Reference Individual Shot Data

Cartridge No.	Observed Velocity
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Mean	

Weapon Details			
Barrel Number			Life
Head Space		mm	
Pin Protrusion		mm	
Firing Pin Indent		mm	

Plate Details*	**Penetration Plate**	**Witness Screen**
Type/Material		
Thickness (mm)		
Set @ (m)		

**Plates in accordance with AEP-97, Volume 19, Annex A*

Test Sample Individual Shot Data

Cartridge No.	Observed Velocity	Penetration Plate Code	Witness Screen (≥ 1 splinter)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
Mean			

Meterological Data		
Air Pressure		hPa
Velocity		Km/h
Humidity		%
Ambient Temp		^{o}C
Air Density		kg/m

Units: Velocities - m/s

For Penetration and Definition Codes, see AEP-97, Volume 19, Annex A

Remarks

19.D.2 FORM 19-2 – TERMINAL EFFECTS - INCENDIARY EFFECTS

Form Number 19-2	Page 1 of 1	**TERMINAL EFFECTS - INCENDIARY EFFECTS**

Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Test Sample Individual Shot Data

Cartridge No.	Acceptable Incendiary Flash (≤ 600m)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

Weapon Details				
Barrel Number			Life	
Head Space		mm		
Pin Protrusion		mm		
Firing Pin Indent		mm		

Plate Details*	**Penetration Plate**	**Witness Screen**
Type/Material		
Thickness (mm)		
Set @ (m)		

**Plates in accordance with AEP-97, Volume 19, Annex A*

Test Sample Individual Shot Data (Re-Test)

Cartridge No.	Acceptable Incendiary Flash (≤ 600m)
1	
2	
3	
4	
5	
6	
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Remarks

19.D.3 FORM 19-3 – TERMINAL EFFECTS - EXPLOSIVE EFFECTS

Form Number 19-3	Page 1 of 1	**TERMINAL EFFECTS - EXPLOSIVE EFFECTS**

Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Test Sample Individual Shot Data	
Cartridge No.	Perforations in Witness Plate (≥ 8)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

Weapon Details				
Barrel Number			Life	
Head Space		mm		
Pin Protrusion		mm		
Firing Pin Indent		mm		

Plate Details*	**Penetration Plate**	**Witness Screen**
Type/Material		
Thickness (mm)		
Set @ (m)		

**Plates in accordance with AEP-97, Volume 19, Annex A*

Test Sample Individual Shot Data (Re-Test)	
Cartridge No.	Perforations in Witness Plate (≥ 8)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
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Remarks

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 20

TRAJECTORY MATCH TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

20.1 Applicability

4.6 mm, 5.56 mm, 5.7 mm, 7.62 mm, and 12.7 mm ammunition submitted for NATO Qualification Approval and NATO Production Testing shall be subjected to the Trajectory Match Test Procedure defined in this volume.

20.2 NATO Requirements

20.2.1 Need for Consistency of Trajectory Match

It is a fundamental requirement for interchangeability and interoperability that all NATO qualified ammunition of a particular calibre have sufficiently close trajectory performance to enable NATO armed forces to switch between ammunition sources on the battlefield with minimum sight adjustment. The NATO Reference Ammunition is the baseline for this requirement.

20.2.2 Matching Requirement

To ensure that the trajectory of the ammunition being submitted for testing is of a similar trajectory to the NATO Reference Ammunition, the requirement is that the test ammunition Mean Point of Impact (MPI) must match the NATO Reference Ammunition MPI within a certain requirement as listed in the table below:

Calibre	**Vertical Match Difference between Test Ammunition MPI and NATO Reference MPI**			
	Match at Distance		**Match at Distance**	
4.6 mm	≤ 25 mm	50 m	≤ 50 mm	100 m
5.56 mm	≤ 125 mm	300 m	≤ 275 mm	550 m
5.7 mm	≤ 30 mm	50 m	≤ 70 mm	100 m
7.62 mm	≤ 125 mm	300 m	≤ 275 mm	550 m
12.7 mm	≤ 385 mm	550 m	≤ 630 mm	900 m
Calibre	**Horizontal Match Difference between Test Ammunition MPI and NATO Reference MPI**			
	Match at Distance		**Match at Distance**	
4.6 mm	≤ 25 mm	50 m	≤ 50 mm	100 m
5.56 mm	≤ 175 mm	300 m	≤ 385 mm	550 m
5.7 mm	≤ 25 mm	50 m	≤ 50 mm	100 m
7.62 mm	≤ 175 mm	300 m	≤ 385 mm	550 m
12.7 mm	≤ 550 mm	550 m	≤ 900 mm	900 m

20.3 Ammunition Quantity

Ammunition Type for Firing	Barrel No. #	Distance (m)			NATO Reference Ammunition Quantity	Test Ammunition Quantity
		4.6 & 5.7 mm	5.56 & 7.62 mm	12.7 mm		
NATO Ref Warmers	**1**	50	300	550	3	--
NATO Reference	**1**	50	300	550	15	--
Test Ammo Warmers	**1**	50	300	550	--	3
Test Ammunition	**1**	50	300	550	--	30
NATO Ref Warmers	**1**	50	300	550	3	--
NATO Reference	**1**	50	300	550	15	--
NATO Ref Warmers	2	50	300	550	3	--
NATO Reference	2	50	300	550	15	--
Test Ammo Warmers	2	50	300	550	--	3
Test Ammunition	2	50	300	550		30
NATO Ref Warmers	2	50	300	550	3	--
NATO Reference	2	50	300	550	15	--
NATO Ref Warmers	**1**	100	550	900	3	--
NATO Reference	**1**	100	550	900	15	--
Test Ammo Warmers	**1**	100	550	900	--	3
Test Ammunition	**1**	100	550	900		30
NATO Ref Warmers	**1**	100	550	900	3	--
NATO Reference	**1**	100	550	900	15	--
NATO Ref Warmers	2	100	550	900	3	--
NATO Reference	2	100	550	900	15	--
Test Ammo Warmers	2	100	550	900	--	3
Test Ammunition	2	100	550	900		30
NATO Ref Warmers	2	100	550	900	3	--
NATO Reference	2	100	550	900	15	--
				Totals[1]	144	132

Note 1: A small quantity of test ammunition warmers is also required to ensure barrel warming is adequate. If an automatic target is used at either the near position or both positions the amount of ammunition required can be halved.

20.4 Equipment

The required equipment is listed below:

Equipment	Drawing/Figure Number [4]				
	4.6 mm	**5.56 mm**	**5.7 mm**	**7.62 mm**	**12.7 mm**
Precision Barrel (Quantity 2)	18-(4.6mm)-1	18-(5.56mm)-1	18-(5.7mm)-1	18-(7.62mm)-1	18-(12.7mm)-1
Fixture, Test, Precision	Figure 6-B-10	Figure 6-B-1	Figure 6-B-10	Figure 6-B-2	Figure 6-B-4
Firing Mechanism [1]	NA	Mauser or Remington 700	Mauser or Remington 700	Springfield 1903	18-(12.7mm)-2
Target Size [2]	600 mm x 600 mm	2 m x 2 m	600 mm x 600 mm	2 m x 2 m	2 m x 2 m @ 550m 3 m x 3 m @ 900m
Wind Measurement	Instruments for measuring wind velocity and direction at both firing point and target and any necessary intermediate point. (see para. 20.6.1)				
Ammunition Conditioning Equipment	Constant temperature controlled container capable of maintaining temperature at + 21 ± 3°C.				
Instrumental Velocity Measuring Equipment to measure velocity at: [3]	24 m	24 m	24 m	24 m	24 m

Note 1: NATO National Test Centres are permitted to use an alternative Firing Mechanism/Action but must ensure the headspace and internal barrel configuration are as defined in AEP-97.

Note 2: An automatic target system may be used providing it is capable of measuring the strike position with an average error over thirty (30) cartridges of less than 5 mm.

Note 3: The measurement method or base length between sensors (if used) is optional providing the equipment is capable of maintaining measurement errors of less than ± 1 m/s.

Note 4: Drawings and figures are contained in AEP-97, Volume 6.

20.5 Equipment and Range Set Up

The equipment and range set up shall be as follows:

20.5.1 Precision Barrel and Action Assembly

A precision barrel shall be used which produces an average instrumental velocity with the NATO Reference Ammunition within 12 m/s of the official NATO assessed velocity value from the precision assessment. The precision barrel assembly shall be in accordance with the applicable drawings and the measurements listed below shall be made before a test weapon is placed in service, after misfires, pierced primers, blowbacks or whenever a part replacement has been made in the assembly.

Calibre	Firing Pin Protrusion (mm)	Firing Pin Indent (mm)	Headspace (mm)
4.6 mm	0.76 to 0.99	0.45 to 0.65	32.35 to 32.5
5.56 mm	0.76 to 0.99	0.51 to 0.64	38.024 to 38.1 @ 7.663 mm dia.
5.7 mm	0.76 to 0.99	0.51 to 0.64	23.75 to 23.826 @ 7.00 mm dia.
7.62 mm	1.27 to 1.91	0.46 to 0.61	41.35 to 41.43 @ 10.16 mm dia.
12.7 mm	1.88 to 2.08	0.51 to 0.64	79.58 to 79.83 @ 16.15 mm dia.

20.5.2 Precision Barrel Set Up

The precision barrel shall be set up in the Fixture, Test, Precision defined in paragraph 20.4 ensuring it is securely clamped. For 5.56 mm, 7.62 mm and 12.7 mm, it is important to ensure that the barrel is clamped to both "V" blocks. For 4.6 mm, 5.7 mm and 9 mm, it is important to ensure that the appropriate collars are used at the correct locations. It is of prime importance that the barrel assembly maintains its original position from shot to shot.

20.5.3 Velocity Recording Equipment Set Up

Velocity recording equipment is to be set up to record velocity at twenty-four metres (24 m) from the muzzle. The velocity measuring equipment must be capable of maintaining measurement errors of less than $\pm$ 1 m/s.

20.5.4 Wind Measurement

Instruments for measuring wind velocity and direction are to be set up to meet the requirements of paragraph 20.6.1.

20.5.5 Target Size and Position

A target of minimum, 2 m x 2 m, is to be set up at the appropriate distance with the exception of 12.7 mm tests, where the target at the 900 m distance shall be a minimum of 3 m x 3 m. A target of 600 mm x 600 mm is to be set up at the appropriate distances for 4.6 mm and 5.7 mm. The vertical and horizontal target position is to be adjusted to ensure that the NATO Reference Ammunition hits approximately around the centre. The target position is to be maintained for the firing of both the NATO Reference Ammunition and the test ammunition throughout the firing sequence, Serial No. 1 through No. 12 of paragraph 20.6.6.

20.5.6 Ammunition Conditioning

The required number of test cartridges shall be placed in a vertical position, primer-end down, in separate recessed holding blocks. The ammunition shall be conditioned to a temperature of + 21 °C $\pm$ 3 °C for at least two (2) hours immediately preceding the test.

The conditioning cabinet shall be reasonably close to the firing point to avoid the ammunition being out of conditioning for more than sixty (60) seconds prior to firing. Ideally, the cartridges shall be removed singly from the conditioning cabinet. However, if the firing location is not at approximately + 21 °C, no more than five (5) cartridges may be placed in an insulated box which has been conditioned at + 21 °C ± 3 °C, and the box placed at a point convenient to the technician; the cartridges shall then be removed singly from the insulated box immediately before firing.

20.6 Method of Conducting the Test

20.6.1 Wind Restrictions

The flight of the bullet is affected to a degree by the direction and velocity of the wind over an outdoor firing range. Therefore, the trajectory match test should not be fired when the velocity of the transverse wind is greater than 14 km per hour or varies more than 7 km per hour. Wind measurements must be taken and recorded at regular intervals during the test at both the firing point and at the target. Where the projectile leaves the sheltered part of the range to an unsheltered part of the range, then wind direction and velocity must additionally be measured at this point.

20.6.2 Sighting the Barrel onto the Target

The barrel shall be boresighted onto an aiming mark on the target and elevated sufficiently to achieve impact of the test ammunition in the centre of the target. This is usually achieved by using tracer ammunition of similar trajectory performance to the test ammunition. Confirmation of the correct sighting shall be verified by firing two (2) cartridges of the test ammunition lot. If hard targets are used, the impact holes are to be marked and identified after target sighting has been completed, before firing the test.

20.6.3 Maintenance of Point of Aim

Once the test has commenced at each target distance, it is **NOT** permitted to change the point of aim of the barrel until the firing sequence, Serial No. 1 through Serial No. 12 of paragraph 20.6.6, has been completed. (Point of aim may be changed when the barrel is changed or when moving from one target distance to another).

20.6.4 Continuity of Firing

Firing of the complete test (test ammunition and NATO Reference Ammunition) on any one (1) target is to be completed in a continuous manner with delays only permitted to allow for marking and identification of shot holes between NATO Reference Ammunition and test ammunition. The time interval between shots is to be approximately twenty (20) seconds. (It is recommended that firing of the test ammunition is to be commenced using the furthest target if hard targets are used. If an automatic target system is being used then the matching test at both distances may be conducted simultaneously).

20.6.5 Ammunition Handling and Loading

The ammunition handling and loading is to be conducted in a uniform manner throughout the test. Consideration is not given to the position of the propellant in the cartridge case, except that the manner of handling and loading the ammunition from cartridge to cartridge is to be reasonably uniform. If any delay in excess of sixty (60) seconds occurs after the cartridge is placed in the chamber, the cartridge shall be extracted, reconditioned and another inserted in its place.

20.6.6 Firing Sequence

Firing shall be conducted in the following order:

Serial	Firing Sequence
1	Five (5) warmer cartridges (the last three (3) to be NATO Reference Ammunition) are to be fired at the target.
2	Shot Holes are to be marked and identified if using a hard target. [1]
3	Fifteen (15) NATO Reference Cartridges are to be fired and the velocities recorded. If the average velocity is within 12 m/s of the assessed value the test is to continue. If not, the barrel is to be changed and test procedure re-started.
4	Shot Holes are to be marked and identified if using a hard target. [1]
5	Three (3) warmer cartridges from the test ammunition sample are to be fired.
6	Shot Holes are to be marked and identified if using a hard target. [1]
7	Thirty (30) test cartridges are to be fired and the velocities recorded.
8	Shot Holes are to be marked and identified if using a hard target. [1]
9	Three (3) warmer cartridges from the NATO Reference Ammunition Lot are to be fired.
10	Shot Holes are to be marked and identified if using a hard target. [1]
11	Fifteen (15) NATO Reference Cartridges are to be fired and the velocities recorded. The results are to be averaged with the results from Serial No. 3. Providing the average is within 12 m/s of the official assessed value, the barrel is considered qualified for the test. [2]
12	Shot Holes are to be marked and identified if using a hard target. [1]
13	**Test is to be repeated with a second barrel at this same distance.**
14	**Complete Test (serial 1 through 13) to be repeated at the second matching distance.** [1]

Note 1: This will not be required if an automatic target system is used. Simultaneous firing of both near and far targets is permitted if an automatic target system is used at either the near or both positions. It is not permitted to use data collected at the far target if the ammunition has been fired through a hard target at the near distance.

Note 2: The assessed velocity value used for the qualification of the precision barrel assembly is the velocity assessment value associated with the Precision Barrel and not the velocity assessment value obtained from the EPVAT Barrel.

20.7 Recording of Results

The following are to be recorded on Form No. 20 (Annex 20-A) and calculated:

a. For NATO Reference Ammunition at both near and far targets:

1. Individual cartridge X and Y co-ordinates for each barrel

2. Individual cartridge Velocities (V24 m) for each barrel

3. Average Velocity (V24 m) for each barrel

4. Mean Point of Impact for each barrel at each distance

5. Average Mean Point of Impact for both barrels at near distance

6. Average Mean Point of Impact for both barrels at far distance

b. For Test Ammunition at both near and far targets:

1. Individual cartridge X and Y co-ordinates for each barrel.

2. Individual cartridge Velocities (V24 m) for each barrel.

3. Average Velocity (V24 m) for each barrel.

4. Mean Point of Impact for each barrel at each distance.

5. Average Mean Point of Impact for both barrels at near distance.

6. Average Mean Point of Impact for both barrels at far distance.

7. Vertical difference between the MPI of test and NATO Reference Ammunition for each barrel at each distance.

8. Horizontal difference between the MPI of test and NATO Reference Ammunition for each barrel at each distance.

9. Average Vertical difference of both barrels between the MPI of test and NATO Reference Ammunition at near distance.

10. Average Horizontal difference of both barrels between the MPI of test and NATO Reference Ammunition at near distance.

11. Average Vertical difference of both barrels between the MPI of test and NATO Reference Ammunition at far distance.

12. Average Horizontal difference of both barrels between the MPI of test and NATO Reference Ammunition at far distance.

13. Number and type of case casualties.

14. Misfires.

15. Any other relevant technical incidents.

16. All details required by Trajectory Match Form No. 20 (Annex 20-A).

20.8 Sentencing

The ammunition shall be considered to have met the NATO requirements if the difference between the MPI Average of both barrels for the NATO Reference Ammunition and the test ammunition, at both distances does not exceed the parameters listed below.

Calibre	**Vertical Match Difference between Test Ammunition MPI and NATO Reference MPI**			
	Match at Distance		**Match at Distance**	
4.6 mm	≤ 25 mm	50 m	≤ 50 mm	100 m
5.56 mm	≤ 125 mm	300 m	≤ 275 mm	550 m
5.7 mm	≤ 30 mm	50 m	≤ 70 mm	100 m
7.62 mm	≤ 125 mm	300 m	≤ 275 mm	550 m
12.7 mm	≤ 385 mm	550 m	≤ 630 mm	900 m
Calibre	**Horizontal Match Difference between Test Ammunition MPI and NATO Reference MPI**			
	Match at Distance		**Match at Distance**	
4.6 mm	≤ 25 mm	50 m	≤ 50 mm	100 m
5.56 mm	≤ 175 mm	300 m	≤ 385 mm	550 m
5.7 mm	≤ 25 mm	50 m	≤ 50 mm	100 m
7.62 mm	≤ 175 mm	300 m	≤ 385 mm	550 m
12.7 mm	≤ 550 mm	550 m	≤ 900 mm	900 m

20.9 Re-Test Procedures

If the ammunition fails the matching test, a re-test shall be conducted using two (2) different barrels.

20.10 Re-Test Sentencing

The results from these two (2) different barrels shall be averaged for sentencing. If the ammunition still fails the test then no further testing is permitted.

20.11 Other Defects and Incidents - Sentencing

During any test or retest, if any defects occur that are not related to this particular test, either during firing or visually after firing, they shall be categorized in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

ANNEX 20-A

FORM NUMBER 20 – TRAJECTORY MATCH TEST

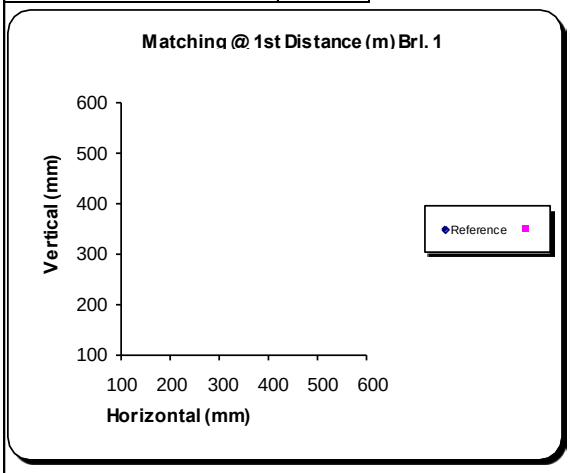
Per the applicable Recording of Results paragraphs in Volume 20, the following forms for recording the Trajectory Test results on Form No. 20 (5 pages) are presented on pages 20-A-2 through 20-A-6 of this Annex.

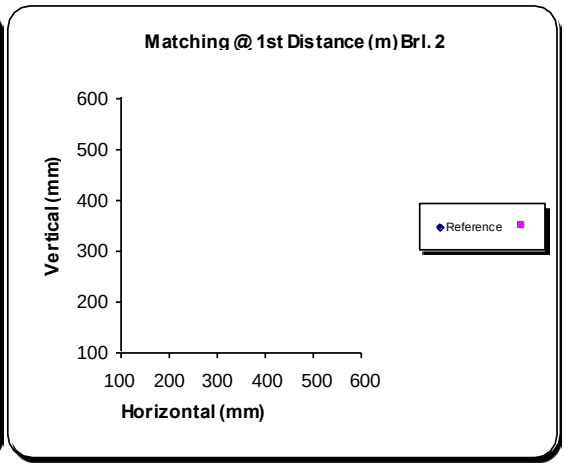
20.A.1 FORM 20 (PAGE 1 OF 5) – TRAJECTORY MATCH TEST RESULTS

Form Number 20	Page 1 of 5		TRAJECTORY MATCH
Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design	

1st Matching Distance		m

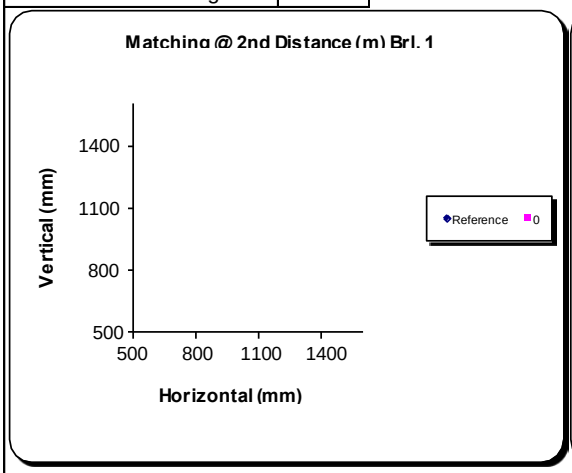
	Weapon 1		Weapon 2	
	NATO Reference	Test Sample	NATO Reference	Test Sample
Horizontal MPI				
Vertical MPI				
Horizontal Difference from NATO Reference				
Vertical Difference from NATO Reference				
Mean Horizontal of				
Mean Vertical of Targets				

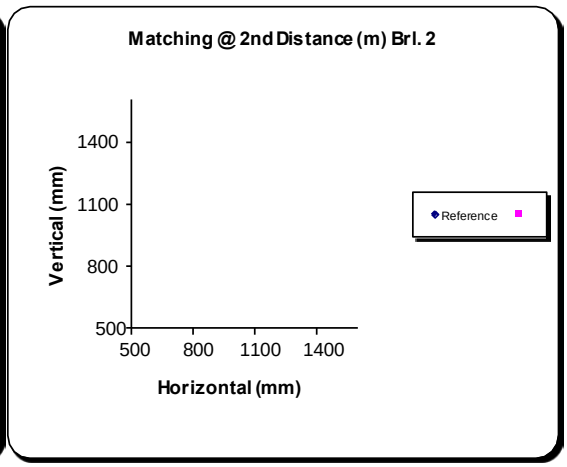




2nd Matching Distance		m

	Weapon 1		Weapon 2	
	NATO Reference	Test Sample	NATO Reference	Test Sample
Horizontal MPI				
Vertical MPI				
Horizontal Difference from NATO Reference				
Vertical Difference from NATO Reference				
Mean Horizontal of				
Mean Vertical of Targets				





20.A.2 FORM 20 (PAGE 2 OF 5) – TRAJECTORY MATCH TEST RESULTS

Form Number 20	Page 2 of 5						**TRAJECTORY MATCH (1st Match Distance)**		
Test Centre					Test Reference				
Submitting Nation					Lot Number				
Manufacturer					Cartridge Type				
Date Fired					NATO Design No.				

Weapon Number	Barrel Number	Times Fired	Head Space	Pin Protrusion	1st Range Distance	m	Wind		o'clock
1					NATO Reference Lot		Velocity		Km/h
2							Humidity		%
							Ambient Temp.		ºC

Cartridge No.	Weapon 1 (NATO Reference)			Cartridge No.	Weapon 1 (Test Sample)		
	Velocity*	Horizontal	Vertical		Velocity*	Horizontal	Vertical
1				1			
2				2			
3				3			
4				4			
5				5			
6				6			
7				7			
8				8			
9				9			
10				10			
11				11			
12				12			
13				13			
14				14			
15				15			
16				16			
17				17			
18				18			
19				19			
20				20			
21				21			
22				22			
23				23			
24				24			
25				25			
26				26			
27				27			
28				28			
29				29			
30				30			
Mean/MP				Mean/M			
Min				Min			
Max				Max			
Ext				Ext			
SD				SD			

UNITS: (Velocities - m/s) (Horizontal & Vertical - mm)

**The velocity may not be associated with its own horizontal and vertical co-ordinate.*

Vertical Difference from MPI of NATO Reference	
Horizontal Difference from MPI of NATO Reference	

Remarks

20.A.3 FORM 20 (PAGE 3 OF 5) – TRAJECTORY MATCH TEST RESULTS

Form Number 20	Page 3 of 5					**TRAJECTORY MATCH (1st Match Distance)**			
Test Centre						Test Reference			
Submitting Nation						Lot Number			
Manufacturer						Cartridge Type			
Date Fired						NATO Design No.			

Weapon Number	Barrel Number	Times Fired	Head Space	Pin Protrusion	1st Range Distance		Wind		
						m	Direction		o'clock
1					NATO Reference Lot		Velocity		Km/h
2							Humidity		%
							Ambient Temp.		ºC

Cartridge No.	Weapon 2 (NATO Reference)			Cartridge No.	Weapon 2 (Test Sample)		
	Velocity*	Horizontal	Vertical		Velocity*	Horizontal	Vertical
1				1			
2				2			
3				3			
4				4			
5				5			
6				6			
7				7			
8				8			
9				9			
10				10			
11				11			
12				12			
13				13			
14				14			
15				15			
16				16			
17				17			
18				18			
19				19			
20				20			
21				21			
22				22			
23				23			
24				24			
25				25			
26				26			
27				27			
28				28			
29				29			
30				30			
Mean/MP				Mean/M			
Min				Min			
Max				Max			
Ext				Ext			
SD				SD			

UNITS: (Velocities - m/s) (Horizontal & Vertical - mm)

**The velocity may not be associated with its own horizontal and vertical co-ordinate.*

Vertical Difference from MPI of NATO Reference	
Horizontal Difference from MPI of NATO Reference	

Remarks

20.A.4 FORM 20 (PAGE 4 OF 5) – TRAJECTORY MATCH TEST RESULTS

Form Number 20	Page 4 of 5	**TRAJECTORY MATCH (2nd Match Distance)**

Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Weapon Number	Barrel Number	Times Fired	Head Space	Pin Protrusion
1				
2				

2nd Range Distance		Wind		
	m	Direction		o'clock
NATO Reference Lot		Velocity		Km/h
		Humidity		%
		Ambient Temp.		ºC

Cartridge No.	Weapon 1 (NATO Reference)			Cartridge No.	Weapon 1 (Test Sample)		
	Velocity*	Horizontal	Vertical		Velocity*	Horizontal	Vertical
1				1			
2				2			
3				3			
4				4			
5				5			
6				6			
7				7			
8				8			
9				9			
10				10			
11				11			
12				12			
13				13			
14				14			
15				15			
16				16			
17				17			
18				18			
19				19			
20				20			
21				21			
22				22			
23				23			
24				24			
25				25			
26				26			
27				27			
28				28			
29				29			
30				30			
Mean/MP				Mean/M			
Min				Min			
Max				Max			
Ext				Ext			
SD				SD			

UNITS: (Velocities - m/s) (Horizontal & Vertical - mm)

**The velocity may not be associated with its own horizontal and vertical co-ordinate.*

Vertical Difference from MPI of NATO Reference	
Horizontal Difference from MPI of NATO Reference	

Remarks

20.A.5 FORM 20 (PAGE 5 OF 5) – TRAJECTORY MATCH TEST RESULTS

Form Number 20	Page 5 of 5					**TRAJECTORY MATCH (2nd Match Distance)**				
Test Centre						Test Reference				
Submitting Nation						Lot Number				
Manufacturer						Cartridge Type				
Date Fired						NATO Design No.				

Weapon Number	Barrel Number	Times Fired	Head Space	Pin Protrusion	2nd Range Distance	m	Wind		
1					NATO Reference Lot		Direction		o'clock
2							Velocity		Km/h
							Humidity		%
							Ambient Temp.		ºC

Cartridge No.	Weapon 2 (NATO Reference)			Cartridge No.	Weapon 2 (Test Sample)		
	Velocity*	Horizontal	Vertical		Velocity*	Horizontal	Vertical
1				1			
2				2			
3				3			
4				4			
5				5			
6				6			
7				7			
8				8			
9				9			
10				10			
11				11			
12				12			
13				13			
14				14			
15				15			
16				16			
17				17			
18				18			
19				19			
20				20			
21				21			
22				22			
23				23			
24				24			
25				25			
26				26			
27				27			
28				28			
29				29			
30				30			
Mean/MP				Mean/M			
Min				Min			
Max				Max			
Ext				Ext			
SD				SD			

UNITS: (Velocities - m/s) (Horizontal & Vertical - mm)

**The velocity may not be associated with its own horizontal and vertical co-ordinate.*

Vertical Difference from MPI of NATO Reference	
Horizontal Difference from MPI of NATO Reference	

Remarks

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 21

TRACER PERFORMANCE TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

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NATO STANDARDIZATION OFFICE (NSO)

21.1 Applicability

5.56 mm, 5.7 mm, 7.62 mm, and 12.7 mm ammunition submitted for NATO Qualification Approval, NATO Production Testing or NATO Surveillance Testing shall be subjected to the Trace Test Procedure defined in this volume. The procedure in this volume is to be used for the evaluation of cartridges that are designed as tracers as noted in the relevant STANAGs. The procedure is not to be used for the evaluation of the Dim Tracer Cartridges which are designed for use with night vision equipment.

21.2 NATO Requirements

21.2.1 Trace Distance

The tracer ammunition tested shall meet the following requirements:

Calibre	Dim or Invisible from the Muzzle for at least	Visible by	Continuous Visibility between
5.56 mm	13 m	140 m	140 m and 600 m
5.7 mm	No Requirement	20 m	20 m and 150 m
7.62 mm	13 m	140 m	140 m and 775 m
12.7 mm	No Requirement	200 m	200 m and 1500 m for tracer bullets
			200 m and 1000 m for combined function bullets

21.2.2 Trace Quality

The tracer ammunition tested shall exhibit a continuous trace of satisfactory quality throughout its visible range. The requirement applies to daylight visibility conditions in which it is reasonable to expect satisfactory observation of trace.

21.2.3 Definition of Terms

Visible

The trace of the bullet is visible to the observer during the Trace Distance portion and Trace Quality portion of the Trace Test.

Invisible

The trace of the bullet is not visible to the observer during the Trace Distance portion and the Trace Quality portion of the Trace Test.

Dim

The trace of the bullet is barely visible to the observer. This definition refers only to the portion of the trace from the muzzle to at least thirteen (13) metres from the muzzle where the trace must be dim or invisible. The definition does not represent the Dim Tracer Cartridge which is designed for use with night vision equipment.

Note. A change in trace colour may be observed due to the transition from the ignitor to the tracer composition. This is acceptable providing luminosity is uninterrupted during the visible portion of the trace.

21.3 Ammunition Quantity

Calibre	Trace Distance	Trace Quality	Total
5.56 mm	50	50	100
5.7 mm	50	50	100
7.62 mm	50	50	100
12.7 mm	50	50	100

21.4 Equipment

21.4.1 Trace Observation

21.4.1.1 All trace testing shall utilize human observers. If electronic trace detection systems are proposed for use instead of human observers, the equipment must be proven, by testing, to be the equivalent of human observers. The approval of an electronic trace detection system will be based on testing reviewed and accepted by SG/1.

21.4.1.2 Marker lights shall be utilized to mark the points being monitored from the observation locations.

21.4.2 Weapons

It is desirable that the barrels used for the Trace test should only be used for Trace testing.

Calibre	Trace Distance	Trace Quality
5.56 mm[1]	Rifle, M16A2/A4	Gun, Machine, Minimi, Mk1
5.7 mm[1]	Gun, Sub-Machine, P90	Gun, Sub-Machine, P90
7.62 mm[1]	Gun, Machine, T65E1 (w/ chrome plated barrel) or Gun, Machine, M240B	Gun, Machine, T65E1 (w/ chrome plated barrel) or Gun, Machine, M240B
12.7 mm[1]	Gun, Machine, M2HB (w/ Stellite Lined barrel)	Gun, Machine, M2HB (w/ Stellite Lined barrel)

Note 1: The barrels shall have fired at least 200 but not more than 5,000 cartridges.

21.4.3 Test Fixtures

Appropriate test fixtures for mounting weapons to ensure accurate firing to the required distances. A typical firing position set-up for the 7.62 mm Trace Test with the T65E1 Machine Gun is shown in Figure 6-B-13 of AEP-97, Volume 6.

21.4.4 Ammunition Conditioning

Constant temperature-controlled container capable of maintaining temperature limits at a tolerance of ± 3 °C.

21.5 Method of Conducting the Test

21.5.1 Preparation for Firing

21.5.1.1 Weapon Preparation

The following measurements shall be made before a test weapon is placed in service, after misfires, pierced primers or blowbacks, or whenever a part replacement has been made to the weapon.

Calibre >	5.56 mm		5.7 mm	7.62 mm		12.7 mm
Weapon >	**M16A2/A4**	**Minimi, Mk1**	**P90**	**T65E1**	**M240B**	**M2HB**
Headspace	37.125 - 37.353	37.95 - 38.05	NA	41.38 - 41.66	41.284 - 41.494	5.131 - 5.232*
To Datum	8.382	7.663	--	10.16	10.16	--
Firing Pin Protrusion	0.711 - 0.914	0.76 - 1.12	1.17 - 1.53	1.52 - 1.73	0.59 - 0.87	1.83 - 2.01

Note: All dimensions are in millimetres (mm).
Note*: Measured from rear face of barrel to bolt face.

21.5.1.2 Ammunition Conditioning

The required number of test cartridges shall be placed in a conditioning cabinet and shall be conditioned to a temperature of + 21 °C ± 3 °C for at least two (2) hours immediately preceding the test. The conditioning cabinet shall be reasonably close to the firing point to avoid the ammunition being out of conditioning for more than sixty (60) seconds prior to firing commences. If the firing location is not at approximately + 21 °C, no more than twenty-five (25) cartridges may be placed in an insulated box which has been conditioned at + 21 °C ± 3 °C, and the box placed at a point convenient to the technician.

21.5.2 Firing the Test - Trace Distance Monitoring

21.5.2.1 Positioning of Observers / Trace Detection Equipment

The firer and another observer shall observe from the firing stand. Observers shall be stationed at the relevant distances shown in paragraph 21.2.1. The observers must be located at a perpendicular distance of approximately 50 m to 70 m from the trajectory. If an electronic trace detection system, approved by SG/1, is used, the location and alignment of the sensors will be determined by the nature of the system and the recommendation of the manufacturer.

21.5.2.2 Placement of Marker Lights

Marker lights shall be placed at the appropriate distances for each calibre along the trajectory to mark the points being monitored from the observation locations.

21.5.2.3 Firing the Trace Distance Test

Firing shall be carried out under conditions that make it possible to observe the performance of the tracer at each observation position. When the weapon is put into service, at least three (3) warmer cartridges from the test ammunition sample shall be fired. These cartridges shall be used to aim the weapon, to verify that the equipment is working satisfactorily and to acclimatize the observers but the results shall be disregarded. The test cartridges shall be fired one by one with sufficient time between each cartridge so that the trace may be observed and the results may be recorded. When approximately fifty (50) cartridges have been fired, the weapon barrel shall be cooled to approximately ambient temperature or capable of being held by a bare hand. When firing resumes, at least three (3) tracer cartridges from the test ammunition sample shall be fired to acclimatize the observers but the results shall be disregarded.

21.5.3 Firing the Test - Trace Quality Monitoring

21.5.3.1 Positioning of Observers

The firer and at least one observer shall observe from the firing point.

21.5.3.2 Firing the Trace Quality Test

Firing shall be carried out by day in light and visibility conditions in which it is reasonable to expect satisfactory observation of trace quality. When the weapon is put into service, at least three (3) warmer cartridges from the test ammunition sample shall be fired. These cartridges shall be used to aim the weapon, to verify that the equipment is working satisfactorily and to acclimatize the observers but the results shall be disregarded. The test cartridges shall be fired one by one with sufficient time between each cartridge so that the trace may be observed and the results may be recorded. When approximately fifty (50) cartridges have been fired, the weapon barrel shall be cooled to approximately ambient temperature or capable of being held by a bare hand. When firing resumes, at least three (3) tracer cartridges from the test ammunition sample shall be fired to acclimatize the observers but the results shall be disregarded.

21.6 Recording of Results

21.6.1 All details on the Trace Distance Test Form No. 21a and Trace Quality Test Form No. 21b (Annex 21-A) shall be completed.

21.6.2 Any defects observed shall be counted and classified according to the following definitions:

Classification and Definition of Defects	Trace Distance Monitoring	Trace Quality Monitoring
B: Blind Trace. No trace during any part of the trajectory.	X	X
S: Short Trace. Trace did not reach required distance, no other defect.	X	
SI: Short Ignitor. Same as short, but only the ignitor burned.	X	
E: Early Trace. The visible trace begins too soon and ends before reaching the required distance. This is not a defect for 12.7 mm ammunition.	X	
D: Delayed Trace. The visible trace begins too late but traces the required distance.	X	
L: Long Trace. The visible trace begins too soon but traces the required distance. This is not a defect for 12.7 mm ammunition.	X	
P: Partial Trace. The visible trace begins too late and does not trace the required distance.	X	
BB: Bursting Bullet. The bullet explodes with a loud report and disintegrates, producing a bright flash and does not continue in normal flight.	X	X

Classification and Definition of Defects	Trace Distance Monitoring	Trace Quality Monitoring
IMF: Ignitor Muzzle Flash. Particles of burning ignitor and tracer composition are blown from the bullet on exit from the muzzle, producing serious bright sparks which may compromise the soldier's position or affect night vision capability.	X	X
TMF: Trace Muzzle Flash. Tracer composition is blown from the bullet and ignites, producing a large pink or red flash at the muzzle, while the bullet continues flight. It does not trace more than 25 m.	X	X
GF: Gun Flash. Re-ignition of gas at muzzle; this is not a trace defect but can occur simultaneously with one of the above defects.	X	X
TFO: Tracer Falls Out. Visible burning particles of tracer and/or ignitor composition are observed separately from the projectile during the trajectory.	X	X
IMT: Intermittent Trace. The projectile does not appear to trace continuously.	X	X
EF: Erratic Flight. Abnormal, unpredictable, trajectory of projectile.	X	X

21.7 Sentencing

A cartridge containing more than one defect in either the Trace Distance portion or the Trace Quality portion of the test shall only be counted as one (1) defective cartridge for sentencing. However, all defects relating to every cartridge tested shall be recorded for information.

21.7.1 NATO Qualification Approval and NATO Production Tests

21.7.1.1 Trace Distance

Eighty percent (80%) of the test sample shall meet the requirements contained in paragraph 21.2.1. For the NATO Qualification Approval Test, the Trace Distance requirement for ammunition evaluated as part of the Climatic Storage Test Procedure is specified in AEP-97, Volume 13, paragraphs 13.2 and 13.9.

21.7.1.2 Trace Quality

Eighty percent (80%) of the test sample shall meet the requirements contained in paragraph 21.2.2. For the NATO Qualification Approval Test, the Trace Quality requirement for ammunition evaluated as part of the Climatic Storage Test procedure is specified in AEP-97, Volume 13, paragraphs 13.2 and 13.9.

21.7.2 NATO Surveillance Test

The acceptance parameters for the NATO Surveillance Test are contained in AEP-97, Volume 4.

21.8 Re-Test Procedures

Ammunition that exhibits less than sixty percent (60%) satisfactory performance in either of the tracer tests shall be rejected outright. Ammunition with satisfactory performance between 60 % and 79 % shall be subjected to a retest of the test that failed. The test sample shall be the same size as the original sample.

21.9 Re-Test Sentencing

The results of the retest shall be combined with results from the original test. If at least eighty percent (80%) of the combined result meets the test requirements, then the ammunition shall have passed the test.

21.10 Other Defects and Incidents - Sentencing

During any test or retest, if any defects occur that are not related to this particular test, either during firing or visually after firing, they shall be categorized in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

ANNEX 21-A

FORM NUMBER 21 – TRACE TEST

Per the applicable Recording of Results paragraphs in Volume 21, the following forms for recording the Trace Distance Test results on Form No. 21a is presented on page 21-A-2 and 21-A-3 and the Trace Quality Test results on Form No. 21b is presented on page 21-A-4 and 21-A-5 of this Annex.

21.A.1 FORM 21a (PAGE 1 OF 2) – TRACE DISTANCE TEST RESULTS

Form Number 21a	Page 1of 2			**TRACE DISTANCE**
Test Centre			Test Reference	
Submitting Nation			Lot Number	
Manufacturer			Cartridge Type	
Date Fired			NATO Design No.	

	Trace Distances					
Cartridge No.	Muzzle*	Dim or Invisible from Muzzle	Tracer Visible By	Continuous Visibility Between	Comments	Defect Code(s)
		(m)	(m)	(m)		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35+						

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*
+Cartridge No. 36-50 on Page 2 of 2

Remarks

21.A.2 FORM 21a (PAGE 2 OF 2) – TRACE DISTANCE TEST RESULTS

Form Number 21a	Page 2 of 2			**TRACE DISTANCE**
Test Centre			Test Reference	
Submitting Nation			Lot Number	
Manufacturer			Cartridge Type	
Date Fired			NATO Design No.	

	Trace Distances					
Cartridge No.	Muzzle*	Dim or Invisible from Muzzle	Tracer Visible By	Continuous Visibility Between	Comments	Defect Code(s)
		(m)	(m)	(m)		
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*

Test Summary	Total Observed Defects
Defect Codes	
B-Blind	
S-Short	
SI-Short Igniter	
E-Early	
D-Delayed	
L-Long	
P-Partial	
BB-Bursting Bullet	
IMF-Igniter Muzzle Flash	
TMF-Tracer Muzzle Flash	
TFO-Tracer Falls Out	
IMT-Intermittent Trace	
EF-Erratic Flight	
Observation Codes	
GF-Gun Flash	

Weapon Details		
Weapon Type		
Weapon Number		
Weapon Life		
Head Space		mm
Pin Protrusion		mm
Firing Pin Indent		mm
Barrel Number		
Barrel Life		

Number Of Cartridges Meeting The Trace Distance Requirement

No. Cartridges Passed		Percentage (%)	

Remarks

21.A.3 FORM 21b (PAGE 1 OF 2) – TRACE QUALITY TEST RESULTS

Form Number 21b	Page 1of 2		**TRACE QUALITY**
Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Fired		NATO Design No.	

Cartridge No.	Trace Quality Observations		Defect Code(s)
	Muzzle*	Comments	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35+			

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*
+Cartridge No. 36-50 on Page 2 of 2

Remarks

21.A.4 FORM 21b (PAGE 2 OF 2) – TRACE QUALITY TEST RESULTS

Form Number 21b	Page 2 of 2			**TRACE QUALITY**
Test Centre			Test Reference	
Submitting Nation			Lot Number	
Manufacturer			Cartridge Type	
Date Fired			NATO Design No.	

Cartridge No.	Trace Quality Observations		Defect Code(s)
	Muzzle*	Comments	
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			

**Observations - Place a check mark (✓) in the Muzzle Column to annotate that the trace was observed in flight.*

Test Summary	Total Observed Defects
Defect Codes	
B-Blind	
S-Short	
SI-Short Igniter	
E-Early	
D-Delayed	
L-Long	
P-Partial	
BB-Bursting Bullet	
IMF-Igniter Muzzle Flash	
TMF-Tracer Muzzle Flash	
TFO-Tracer Falls Out	
IMT-Intermittent Trace	
EF-Erratic Flight	
Observation Codes	
GF-Gun Flash	

Weapon Details		
Weapon Type		
Weapon Number		
Weapon Life		
Head Space		mm
Pin Protrusion		mm
Firing Pin Indent		mm
Barrel Number		
Barrel Life		

Number Of Cartridges Meeting The Trace Distance Requirement

No. Cartridges Passed		Percentage (%)	

Remarks

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 22

RESIDUAL STRESS TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

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22.1 Applicability

4.6 mm, 5.56 mm, 5.7 mm, 7.62 mm, 9 mm and 12.7 mm ammunition submitted for NATO Qualification Approval or NATO Production Testing shall be subjected to the Residual Stress Test Procedure defined in this volume. Annex 22-A contains the Mercurous Nitrate Test Procedure, this test procedure shall be performed on ammunition manufactured with brass cartridge cases only.

22.2 NATO Requirements

No brass cartridge case shall display either splits or cracks when subjected to the Residual Stress Test, except as permitted in "I" area of the case as specified in paragraph 22.8. A split is defined as a separation of the metal entirely through the wall of the case. A crack is a surface condition and represents a separation of the metal not entirely through the case wall.

22.3 Ammunition Quantity

Fifty (50) complete test cartridges.

22.4 Equipment

Equipment as specified in Annex 22-A.

22.5 Equipment Set-Up

Equipment set-up as specified in Annex 22-A.

22.6 Method of Conducting the Test

The method of conducting the test as specified in Annex 22-A.

22.7 Recording of Results

The following information is to be recorded on Form No. 22 (Annex 22-C).

a. Number of splits/cracks.

b. Location on the cartridge case.

22.8 Sentencing

The ammunition shall be considered to have met the NATO requirements if no cartridge case shows either splits or cracks, except in the "I" area (case locations are shown on the drawing in Annex 22-B and in AEP-97, Volume 11, Annex 11-A, Appendix 1). A total of two (2) cracks or splits are permitted in the "I" area on the fifty (50) cartridge sample. If three (3) cracks or splits are found in the "I" area on the fifty (50) cartridge sample, a retest on double quantity (100 cartridges) is permissible with no cracks or splits allowed on the

re-test sample. If four (4) or more cracks or splits occur in the “I” area, the sample fails and no re-test is permitted.

22.9 Re-Test Procedures

The retest (as permitted by paragraph 22.8) sample size shall be one hundred (100) cartridges.

22.10 Re-Test Sentencing

The ammunition shall be considered to have met NATO requirements if no cartridge case in the retest sample shows splits or cracks in any location.

ANNEX 22-A
MERCUROUS NITRATE TEST PROCEDURE

22.A.1 Equipment

Suggested equipment:

a. Acid resistant sink with running water.

b. Cartridge holding rack.

c. Hood with exhaust fan.

d. Microscope, 10 power to 15 power.

e. Timer/Clock.

f. Rubber gloves.

g. Acid resistant pan.

h. Acid resistant tongs, straight lip, 40 cm length.

i. Acid resistant beaker.

22.A.2 Solution Preparation

Nitric Acid Solution:

400 cm3 of nitric acid (of specific gravity 1.42) are dissolved in 500 cm3 of distilled water at room temperature. To this solution, distilled water is added to bring the volume of the resulting solution to one litre. The temperature of the solution, at the beginning of the test, must be + 21 °C ± 2 °C.

Mercurous Nitrate (MN) Solution:

The solution shall be an aqueous mercurous nitrate solution containing 10 g of mercurous nitrate, $Hg_2(NO_3)_2$ (sometimes expressed as $HgNO_3$)[1] and 10 ml of nitric acid, HNO_3 (specific gravity 1.42). The solution may be prepared using mercurous nitrate crystals or liquid mercury.

Preparation Using Mercurous Nitrate Crystals:

When using mercurous nitrate crystals, the waters of hydration need to be taken into account to ensure that the final concentration be 10 g of mercurous nitrate in the solution. For example, 10.7 g of $Hg_2(NO_3)2 \cdot 2H2O$ (formal weight 561.22 g) need to be added to obtain the required 10 g of mercurous nitrate:

$$10\ \text{g}\ Hg_2(NO_3)_2 \ \frac{1\ \text{mol}\ Hg_2(NO_3)_2}{525.2\ \text{g}\ 1\ \text{mol}\ Hg_2(NO_3)_2} \ \frac{1\ \text{mol}\ Hg_2(NO_3)_2 \cdot 2H_2O}{1\ \text{mol}\ Hg_2(NO_3)_2} \ \frac{561.22\ \text{g}\ Hg_2(NO_3)_2 \cdot 2H_2O}{1\ \text{mol}\ Hg_2(NO_3)_2 \cdot 2H_2O}$$

$$= \ 10.7\ \text{g}\ Hg_2(NO_3)_2 \cdot 2H_2O$$

Dissolve the required mass of mercurous nitrate and 10 ml nitric acid (specific gravity 1.42) into approximately 400 ml distilled water. After the crystals are completely dissolved, distilled water is added to this solution, bringing the total volume to 1 litre. The temperature of the solution, at the beginning of the test, must be + 21 °C ± 2 °C.

Preparation Using Mercury:

Dissolve 76 g of mercury in 114 ml of diluted HNO_3 (1 part water to 1 part 1.42 specific gravity HNO_3). Carefully dilute with distilled water to 1 litre. This provides a concentration of 100 g mercurous nitrate after a slight loss due to heating. Add the water in small portions while stirring to prevent local over dilution. This gradual dilution, together with the excess acid, will prevent the precipitation of basic salts of mercury. Dilute 100 mL of this solution (10% mercurous nitrate) with 7 ml of HNO_3 (specific gravity 1.42) and 893 ml of water. The temperature of the solution, at the beginning of the test, must be + 21 °C ± 2 °C.

Note 1: Mercurous nitrate is known only to exist as $Hg_2(NO_3)^2$, however it is sometimes represented as $HgNO_3$. This, along with ambiguity regarding the waters of hydration (monohydrate and dihydrate are sometimes used interchangeably to describe the same chemical), can lead to confusion.

22.A.3 Method of Conducting the Test

Inspection of Cases before Test

All cartridges are to be carefully examined, using 10 power to 15 power magnification, prior to the test. Any cartridges containing defects are to be noted on the report form and replaced with another cartridge. Only cartridges that have no visual defects are to be used for the test.

Test Equipment

The cartridges are to be placed in the holding rack which is to be used for all stages of washing and immersing in chemicals to avoid direct handling of the cartridges. This is to prevent the introduction of mechanical stresses and ensure even distribution of solutions.

Continuity of Process

Each successive step in the following process is to be conducted immediately following the completion of the previous step.

Pre-Treatment

Submerge the cartridges in Acetone for approximately one (1) minute to clean the surfaces.

Rinsing in Water

Rinse the cartridges under water for approximately one (1) minute.

Rinsing in Deionised Water

Rinse and agitate the cartridges in deionised water for approximately fifteen (15) seconds.

Submersion in Nitric Acid Solution

Ensure that the solution is at + 21 °C ± 2° C. Submerge the cartridges in the nitric acid solution for a period of thirty (30) seconds ± three (3) seconds.

Rinsing in Water

Rinse the cartridges under running water for approximately two (2) minutes.

Rinsing in Deionised Water

Rinse and agitate the cartridges in deionised water for approximately fifteen (15) seconds.

Submersion in Mercurous Nitrate Solution

Ensure that the solution is at + 21° ± 2 °C. Ensure that there is a sufficient quantity of solution to test the required number of cartridges (see table below). Submerge the cartridges for fifteen (15) minutes ± five (5) seconds in the mercurous nitrate solution. Lightly agitate the cartridges only once approximately halfway through the emersion time (± twenty (20) seconds), being careful to avoid the introduction of mechanical stresses. Carefully remove the cartridges from the solution at the end of the prescribed period to avoid any mechanical stresses.

MN Solution Volume per Cartridge

Caliber	Volume, ml
4.6 mm	25
5.56 mm	25
5.7 mm	25
7.62 mm	40
9 mm	25
12.7 mm	120

Rinsing in Deionised Water

Immediately after removal from the mercurous nitrate solution, rinse and agitate the cartridges in deionised water for approximately one (1) minute.

Rinsing in Water

Rinse the cartridges under running water for approximately three (3) minutes.

Rinsing in Deionised Water

Rinse and agitate the cartridges in deionised water for approximately fifteen (15) seconds.

Rinsing in Acetone

Rinse the cartridges in Acetone for approximately one (1) minute. This is the drying process. Physical drying by cloth or paper towel is not permitted.

Examination

Immediately after drying, examine the cartridge cases for the presence of splits or cracks by using 10 power to 15 power magnification. Cartridges must be handled gently and not subjected to mechanical stresses. The examination of the cartridges must be completed within forty-five (45) minutes after removal from the mercurous nitrate solution.

22.A.4 Recording of Results

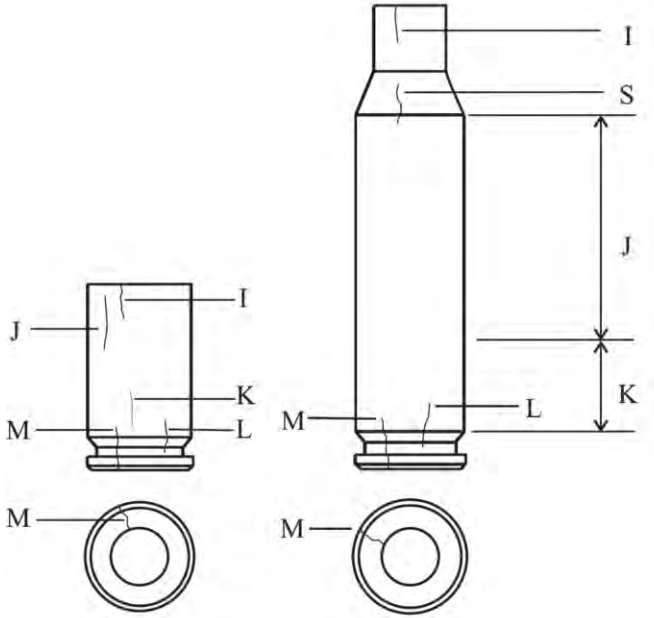
Results shall be recorded as specified in paragraph 22.7 (Form No. 22 (Annex 22-C)).

ANNEX 22-B

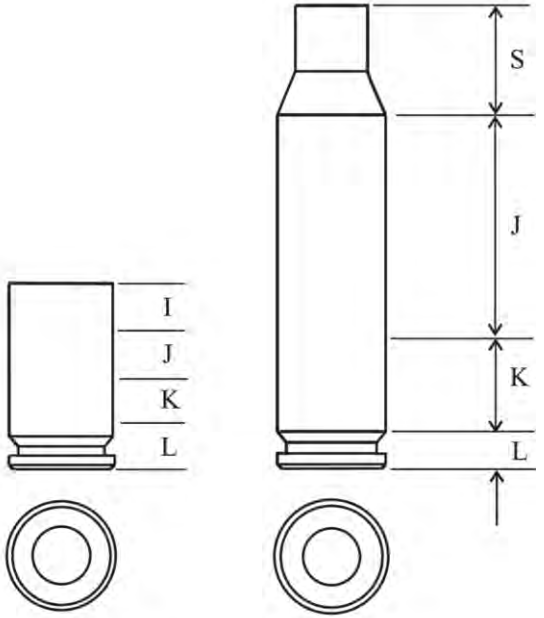
DRAWING OF THE LOCATION ON THE CARTRIDGE CASE FOR SPLITS AND RUPTURES/SEPARATIONS

The following page (page 22-B-2) provides a graphical representation of the location on the cartridge case for splits and ruptures/separations. This same drawing is also located in AEP-97, Volume 11, Annex 11-A, Appendix 1.

SPLITS



RUPTURES / SEPARATIONS



I - Mouth or neck
J - In upper 2/3 body section
K - In lower 1/3 body section above extractor groove
L - In sidewall extending into extractor groove
M - In sidewall extending into primer pocket
S - In sidewall of shoulder

S - Neck and shoulder
J - In upper 2/3 body section
K - In lower 1/3 body section above extractor groove
L - In head and in extractor groove

Note: If a split extends through the upper 2/3 body section at it shall be classified J provided the split does not extend through the mouth. If the mouth of the case is split and the split is within the upper 1/3 of the body, it shall be classified I; However, if the mouth is split and the split is longer than 1/3 of the body length it, it shall be classified IJ. If defects occur in multiple areas on a cartridge case, the defect shall be categorised against the most severe category.

ANNEX 22-C

FORM NUMBER 22 – RESIDUAL STRESS TEST

Per the applicable Recording of Results paragraph in Volume 22, the following form for recording the Residual Stress Test results is presented on page 22-C-2 of this Annex.

22.C.1 FORM 22 – RESIDUAL STRESS TEST RESULTS

Form Number 22	Page 1of 1			**RESIDUAL STRESS**
Test Centre			Test Reference	
Submitting Nation			Lot Number	
Manufacturer			Cartridge Type	
Date Fired			NATO Design No.	
Complete Cartridges				
Cartridges Tested	**Cracks/Splits**		**Location on Case**	
Remarks				

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23.1 Applicability

4.6 mm, 5.56 mm, 5.7 mm, 7.62 mm, 9 mm and 12.7 mm ammunition submitted for NATO Qualification Approval or NATO Production Testing shall be subjected to the Primer Sensitivity Test Procedure defined in this volume.

23.2 NATO Requirements

Primer sensitivity shall be evaluated by conducting a critical height method (run-down) test using the test and sentencing parameters defined in the table below:

Calibre	**Ball Mass** (g)	$\overline{H}$ **+ 5 Standard Deviations** (mm)	$\overline{H}$ **- 2 Standard Deviations** (mm)	**Initial Drop Height** (mm)
4.6 mm	55 ± 0.57	≤ 405	≥ 75	180
5.56 mm	111.7 ± 0.57	≤ 450	≥ 75	180
5.7 mm	55 ± 0.57	≤ 355	≥ 75	180
7.62 mm	111.7 ± 0.57	≤ 500	≥ 75	180
9 mm	55 ± 0.57	≤ 350	≥ 75	180
12.7 mm	225.1 ± 0.57	≤ 380	≥ 63	180

23.3 Primed Case Quantity

Twenty-five (25) primed cases per drop height (average total quantity is approximately 175). Fifty (50) primed cases per drop height will be required if it is necessary to conduct a re-test.

23.4 Equipment

The case holder assembly, firing pin and ball details shall conform to the requirements of NATO Document AC/225 (Panel III-SP1) D/237 - Drawings of Primer Sensitivity Test Equipment For Primers Used In NATO Small Arms Ammunition (Annex 23-B). The support stand, column and electro-magnetic ball holder may vary providing they are of a professional standard with the necessary rigidity and fine adjustment capability. The electro-magnetic ball holder is to be fitted with a non-ferrous metal ring to ensure consistent re-location of the ball and central release. They must not be of a lower standard than the equipment defined in D/237. AEP-97, Volume 6, Figure 6-B-14, shows two photographs of the Primer Sensitivity Test Fixture.

23.4.1 Equipment Set-Up

23.4.1.1 Firing Pin Protrusion

The equipment shall have a firing pin protrusion of

Calibre	Firing Pin Protrusion (mm)
4.6 mm	0.76 to 0.99
5.56 mm	0.76 to 0.99
5.7 mm	1.17 to 1.35
7.62 mm	1.47 to 1.73
9 mm	0.89 to 0.94
12.7 mm	1.47 to 1.73

This shall be measured by seating the firing pin fully against the shoulder stop in the firing pin retainer and measuring the resulting protrusion of the point of the firing pin from the face of the firing pin retainer. A micrometre, dial indicator or other suitable measuring instrument shall be used for this purpose. If the firing pin protrusion is found not to be within the specified dimensions, then the firing pin or the firing pin retainer shall be replaced as necessary to achieve the required firing pin protrusion.

23.4.1.2 Cartridge Case Support Setting

The adjustment gauge shall be inserted in the case holder device. If necessary, the case support shall be lowered until the support head locks easily without interference by the gauge. Using the alignment slot at the base of the case support, the support shall be screwed in until the base of the gauge and the firing pin retainer make contact. After a further half turn of the screw, the lock nut of the case support shall be secured tightly. The gauge shall be removed. The calibrated spring will hold the firing pin guide against the base of the case, accommodating normal variations of case length.

23.4.1.3 Levelling and Ensuring Central Impact of Ball on Base of Firing Pin and Drop Height Adjustment

The equipment shall be set up as prescribed below:

a. The firing pin profile and ball mass should be checked for conformance and condition before use.

b. The sensitivity device shall be installed on the drop equipment and the coincidence of the axes (axis of equipment and axis of ball drop) checked by means of a plumb bob. The plumb bob shall be attached to the magnet, in the manner provided by the equipment, and the equipment shall be adjusted so that the point of the plumb bob is above the centre of the firing pin. This adjustment shall be accomplished by turning the adjusting screws on the base of the frame or the magnetic ball holder. The plumb bob shall be removed when this adjustment has been completed. Final adjustment shall be on a trial and error basis achieved by marking the top of the firing pin with black felt tip pen and releasing the ball from the electromagnetic holder. The position of strike should be visible as a small mark. Minor adjustments are to be made to the position of the ball holder as necessary to ensure that the strike is in the centre of the firing pin. This check should be made at the start of each drop height and at any time during the test if the operator notes that the ball strike is not in the centre of the firing pin.

23.4.1.4 Drop Height Adjustment

a. A primed case shall be inserted in the case holder and the screw-cap shall be screwed down to lock.

b. The ball shall be attached to the energized electromagnet.

c. The adjusting rod corresponding to the initial drop height from the table below shall be inserted between the firing pin and the ball.

Calibre	Initial Drop Height (mm)
4.6 mm	180
5.56 mm	180
5.7 mm	180
7.62 mm	180
9 mm	180
12.7 mm	180

The position of the magnet and ball shall be adjusted so that the rod touches the bottom of the ball and the top of the firing pin simultaneously. The electromagnetic support shall be locked into position. The rod and ball shall be removed from the equipment when this adjustment has been completed and the case used for the adjustment shall be removed. The electromagnetic support height shall be adjusted in this manner for each of the different drop heights using the appropriate length adjusting rod.

23.5.1 Preparation of Ammunition

The test shall be conducted on empty primed cases. The empty primed cases shall be obtained by removal of the bullet and propellant from the ammunition submitted for testing. This disassembly of cartridges shall be accomplished with equipment that does not subject the primed cartridge case to any shock loading force which may result in movement of the primer or primer components in the cartridge case. Cartridges disassembled for the primer sensitivity test shall be stored at a temperature of 21 °C ± 5 °C, relative humidity of 50 % ± 10 % environment and tested within 48 hours after disassembly as the absence of the bullet, and therefore an adequate seal, is likely to lead to the primer composition absorbing moisture from the atmosphere thereby influencing the result of the test.

23.5.2 Method of Conducting the Test

23.5.2.1 A series of twenty-five (25) drops shall be carried out at the initial drop height in accordance with the following procedure:

a. With a primed case from the test lot in the case holder the screw-cap shall be screwed down to the locked position. The ball shall be attached to the energised electromagnet.

b. The ball shall be released to drop on the firing pin, by pressing the switch provided for that purpose. Observation shall be made as to whether or not the primer fired. The result shall be recorded.

c. The screw-cap shall be unscrewed, the test case removed from the case holder, and another test case inserted.

d. After completion of the twenty-five (25) drops at the initial drop height, the height shall then be decreased by increments of 25 mm. This procedure will be repeated until none of the twenty-five (25) primers function. The drop height shall then be adjusted back to the initial height and increased in increments of 25 mm, and a series of drops carried out at each incremental increase. The height shall be increased and the procedure repeated until all of the twenty-five (25) primers function.

23.5.3 Recording of Results

The values indicated on the "Computation Sheet for Sensitivity Test" shall be filled in as the test progresses. The values obtained for $\overline{H}$ + 5 standard deviations and $\overline{H}$ - 2 standard deviations shall be calculated and recorded on Form No. 23 (Annex 23-A).

23.6 Sentencing

The ammunition shall be considered to have met the NATO requirements if $\overline{H}$ + 5 standard deviations and $\overline{H}$ - 2 standard deviations complies with the requirements of the relevant calibre listed below:

Calibre	$\overline{H}$ **+ 5 Standard Deviations** (mm)	$\overline{H}$ **- 2 Standard Deviations** (mm)
4.6 mm	≤ 405	≥ 75
5.56 mm	≤ 450	≥ 75
5.7 mm	≤ 355	≥ 75
7.62 mm	≤ 500	≥ 75
9 mm	≤ 350	≥ 75
12.7 mm	≤ 380	≥ 63

23.7 Re-Test Procedures

If the original test sample fails to meet the specified requirements the test equipment is to be thoroughly checked. If the test equipment is found to be satisfactory then a re-test is to be conducted. The re-test shall be conducted using fifty (50) primed cases at each drop height. If the equipment is found to be defective, the results from the first test shall be disregarded and the test shall be repeated using twenty-five (25) primed cases from each drop height.

23.8 Re-Test Sentencing

For re-test sentencing, the results of the re-test alone shall be used. The values obtained for $\overline{H}$ + 5 standard deviations and $\overline{H}$ - 2 standard deviations shall be calculated and recorded on Form No. 23 (Annex 23-A). The ammunition shall be considered to have met the NATO requirements if $\overline{H}$ + 5 standard deviations and $\overline{H}$ - 2 standard deviations complies with the requirements of the relevant calibre listed below:

Calibre	$\overline{H}$ **+ 5 Standard Deviations** (mm)	$\overline{H}$ **- 2 Standard Deviations** (mm)
4.6 mm	≤ 405	≥ 75
5.56 mm	≤ 450	≥ 75
5.7 mm	≤ 355	≥ 75
7.62 mm	≤ 500	≥ 75
9 mm	≤ 350	≥ 75
12.7 mm	≤ 380	≥ 63

ANNEX 23-A

FORM NUMBER 23 – PRIMER SENSITIVITY TEST

Per the applicable Recording of Results paragraph in Volume 23, the following form for recording the Primer Sensitivity Test results is presented on page 23-A-2 of this Annex.

23.A.1 FORM 23 – PRIMER SENSITIVITY TEST RESULTS

Form Number 23	Page 1 of 1			**PRIMER SENSITIVITY**
Test Centre			Test Reference	
Submitting Nation			Lot Number	
Manufacturer			Cartridge Type	
Date Tested			NATO Design No.	

Chosen height increment (*) =		mm	Number of cartridges tested	

Drop Height (H) in mm	Number of Caps "Fires"	Number of Caps "No Fires"		Proportion of Caps "No Fires" *(Column 3) 25/50		Multiples of "P" values	
H0 =							
			P1 =		1 * P1 =		
			P2 =		3 * P2 =		
			P3 =		5 * P3 =		
			P4 =		7 * P4 =		
			P5 =		9 *P5 =		
			P6 =		11 * P6 =		
			P7 =		13 * P7 =		
			P8 =		15 * P8 =		
			P9 =		17 * P9 =		
			Pn =		(2n-1)Pn =		

Disregard the "ALL FIRE" results in the final calculations

Σ_1 = (P1 + P2 + P3 + P4 + + Pn) =	
$(\Sigma_1)^2$ = (P1 + P2 + P3 + P4 + Pn)^2 =	
Σ_2 = (P1) + (3 x P2) + (5 x P3) + ... ([2n-1] * Pn)	
Mean H = H0 + $\frac{X}{2}$ + (X * Σ_1)	
Standard Deviations = $X\sqrt{\Sigma_2 - (\Sigma_1)^2}$	
H - 2 Standard Deviations =	
H + 5 Standard Deviations =	

Ball Mass (g)	
Pin Protrusion (mm)	

Remark

* NOTE: "No Fire" Caps Include "Fizzers"

ANNEX 23-B

NATO DOCUMENT AC/225 (Panel III-SP1) D/237
DRAWINGS OF PRIMER SENSITIVITY TEST EQUIPMENT FOR PRIMERS USED IN NATO SMALL ARMS AMMUNITION

The NATO Document AC/225 (Panel III-SP1) D/237 - Drawings of Primer Sensitivity Test Equipment For Primers Used In NATO Small Arms Ammunition can be found on the following pages of Annex 23-B.

AC/225 (C III – SC.1) D/237

TRACES DES APPAREILS D'ESSAI DE SENSIBILITE DES AMORCES POUR MUNITIONS OTAN DE PETIT CALIBRE

Novembre 1989

DRAWINGS OF PRIMER SENSIVITY TEST EQUIPMENTS FOR PRIMERS USED IN NATO SMALL ARMS AMMUNITION

November 1989

AC/225 (P III – SP.1) D/237

Edition A Version 1

AC 225_(CIII_SC1)D/237

Dossier de Définition

des appareillages pour

sensibilité des amorces

pour munitions OTAN

de petit calibre

DESIGNATION DES DOCUMENTS ET DES PAGES DU PRESENT DOSSIER	REFERENCE DES DOCUMENTS (OU DES PAGES)	DATE D'APPROBATION	NUMERO DE L'AVIS DE MODIFICATION 01	02	OBSERVATIONS
Page de garde	AC 225 (C III.SC1) D/237				
Sommaire général	Page 1		X	X	
Répertoire des avis de modification	Page 2		X	X	
Répertoire des tableaux de constitution	Page 3			X	
	Page 4				
	Page 5				
	Page 6			X	
	Page 7				
	Page 8			X	
	Page 9			X	
Dossier des tracés de définition			X	X	

PORTER L'INDICE CORRESPONDANT DES DOCUMENTS AU DROIT DU NUMERO DE L'AVIS

OBSERVATIONS

D.T.A.T.

SOMMAIRE GENERAL du DOSSIER de DEFINITION
Page : 1

NUMERO DE DOSSIER

AC 225 (C III . SC 1) D/ 237

DE L'AVIS	REFERENCE DU DOCUMENT MODIFIE OU DES PAGES MODIFIEES	MODIFICATION
01	28 A 238	bilia normalisée de 446 g.
02	28 A 238	– Nouveau plan : 28 A 238 – 1
	28 A 237	– Nouveau plan : 28 A 237 – 1
	28 A 240	– Nouveau plan : 28 A 240 – 1
	28 A 225	– Indice b
	28 A 239	– Annulé
	28 A 250	- Nouveau plan
	28 A 251	- Nouveau plan

D.T.A.T.

etbs cetam

INDICE

AVIS 02

REPERTOIRE DES AVIS DE MODIFICATION

Page: 2

NUMERO DE DOSSIER

AC 225 (C III.SC 1) D/237

N° DE TABLEAU	DESIGNATION	OBSERVATIONS
Page 4	- Appareil de chute	
Page 5	- Support de produit 5,56	
Page 6	- Support de produit 7,62	
Page 7	- Support de produit 9 mm	
Page 8	- Support de produit 12,7	
Page 9	- Support de produit grenade 40 mm	

D.T.A.T.

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INDICE

AVIS 02

REPERTOIRE DES TABLEAUX DE CONSTITUTION

Page : 3

NUMERO DE DOSSIER

AC 225 (C III . SC 1) D/ 237

DESIGNATION	NUMERO DE PLAN OU NOMENCLATURE (1)	OBSERVATIONS
	AT MF 28 A	
APPAREIL DE CHUTE	101 1/2 et 2/2	
Table	131	
Crapaudine	110	
Broche	102	
Support	103	
Colonne	104	
Protecteur	105	
Ceinture	106	
Vis de vérin	107	
Contre écrou	108	
Ecrou de vérin	109	

(1) Une nomenclature est précédée de la lettre N

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INDICE

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TABLEAU DE CONSTITUTION

Page: 4

NUMERO DE DOSSIER

AC/225 (C III . SC 1) D/ 237

Appareil de chute

DESIGNATION	NUMERO DE PLAN OU NOMENCLATURE (1)	OBSERVATIONS
X SUPPORT DE PRODUIT 5,56	28 A 200	
X Bille	201	
X Percuteur	202	
X Guide percuteur	203	
X Ressort	204	
X Chapeau	205	
X Tête	206	
X Support de l'étui	207	
X Bague	208	
X Corps	209	
X Ecrou	210	

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TABLEAU DE CONSTITUTION	Page: 5
NUMERO DE DOSSIER	
AC 225 (C III . SC 1) D/ 237	
Support de produit 5,56	

DESIGNATION	NUMERO DE PLAN OU NOMENCLATURE (1)	OBSERVATIONS
SUPPORT DE PRODUIT 7,62	28 À 224	
Bille	201	Voir 5,56
Percuteur	225 b	
Guide percuteur	216	
Ressort	204	Voir 5,56
Chapeau	205	Voir 5,56
Tête	206	Voir 5,56
Bague	227	
Corps	209	Voir 5,56
Support de l'étui	226	
Ecrou	210	Voir 5,56

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AVIS 02

TABLEAU DE CONSTITUTION

Page: 6

NUMERO DE DOSSIER

AC 225 (C III . SC 1) D/ 237

Support de produit 7,62

DESIGNATION	NUMERO DE PLAN OU NOMENCLATURE (1)	OBSERVATIONS
X SUPPORT DE PRODUIT 9 MM	28 A 229	
X Bille	230	
X Percuteur	231	
X Guide percuteur	216	Voir 7,62
X Ressort	204	Voir 5,56
X Chapeau	205	Voir 5,56
X Tête	206	Voir 5,56
X Support de l'étui	232	
X Support inférieur	213	
X Corps	209	Voir 5,56
X Ecrou	210	Voir 5,56

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TABLEAU DE CONSTITUTION	Page: 7
NUMERO DE DOSSIER	
AC 225 (C III . SC 1) D/237	
Support de produit 9 mm	

									DESIGNATION	NUMERO DE PLAN OU NOMENCLATURE (1)	OBSERVATIONS
				X					SUPPORT DE PRODUIT 12,7 MM	28 A 237-1	
					X				Bille	238-1	
					X				Percuteur	225 b	
					X				Guide percuteur	240-1	
					X				Ressort	241	
					X				Chapeau	242	
					X				Tête	243	
					X				Support de l'étui	244	
					X				Bague	245	
					X				Corps	246	
					X				Ecrou	247	

(1) Une nomenclature est précédée de la lettre N

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INDICE	
AVIS	02

TABLEAU DE CONSTITUTION

Page: 8

NUMERO DE DOSSIER

AC 225 (C III . SC 1) D/ 237

Support de produit 12,7

									DESIGNATION	NUMERO DE PLAN OU NOMENCLATURE (1)	OBSERVATIONS
								X	SUPPORT DE PRODUIT GRENADE 40 MM	28 A 250	
								X	Bille	238-1	
								X	Percuteur	225 b	
								X	Guide percuteur	240-1	
								X	Ressort	241	
								X	Chapeau	242	
								X	Tête	243	
								X	Support de l'étui	244	
								X	Bague	251	
								X	Corps	246	
								X	Ecrou	247	

(1) Une nomenclature est précédée de la lettre N

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TABLEAU DE CONSTITUTION

Page: 9

NUMERO DE DOSSIER

AC 225 (C III . SC 1) D/ 237

Support de produit Grenade 40 mm

- NOTES -

N.1 - Sécurité : nécessité d'adapter un écran protecteur et un aspirateur des gaz brûlés.

N.2 - Les ensembles supports de produits sont définis dans les Tables de Construction correspondantes à chaque munition.

N.3 - Marquage - Marquer : Appareil de chute pour sensibilité d'amorces (Type OTAN)

N.4 - Contrôle de l'appareil

a) Vérifier au moyen du fil à plomb (Plan 28 A 127) la position correcte de l'appareil. S'il y a lieu, rectifier cette position au moyen des vérins à vis existants sous le support. L'opération terminée, bien rebloquer les contre-écrous.

b) Vérifier s'il n'y a pas interposition de corps étrangers entre la pointe de chaque vérin et la crapaudine qui le reçoit.

N.5 - Contrôle de l'outillage employé -

a) Contrôler la masse de la bille (111,7 g. 55 g etc...) et la hauteur de chute de celle-ci.

b) Vérifier la forme de la pointe du percuteur

c) Contrôler éventuellement la forme de l'enclume et sa hauteur.

N.6 - Précaution à prendre en cours d'opération -

1) Vérifier le centrage de la percussion sur la première amorce tirée.

2) Contrôler après chaque détonation :

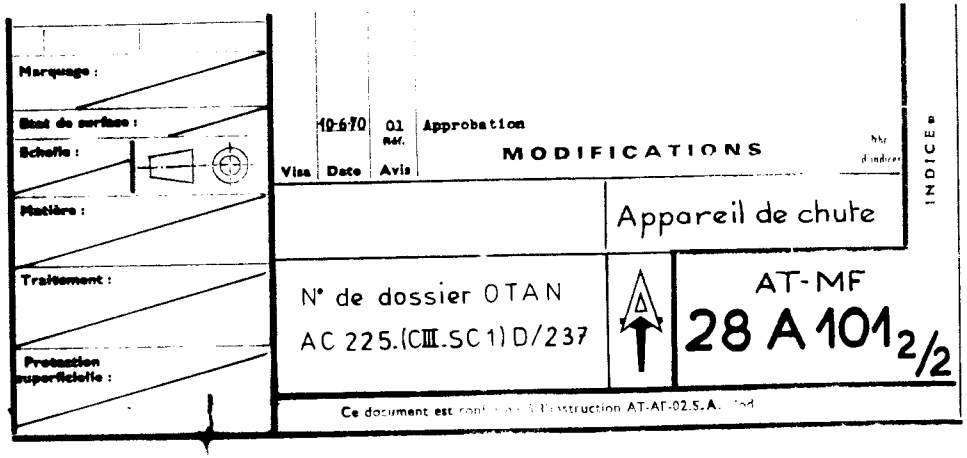
a) Si le percuteur glisse bien dans son guide et n'est pas coincé par des déchets provenant du fonctionnement de l'amorce essayée.

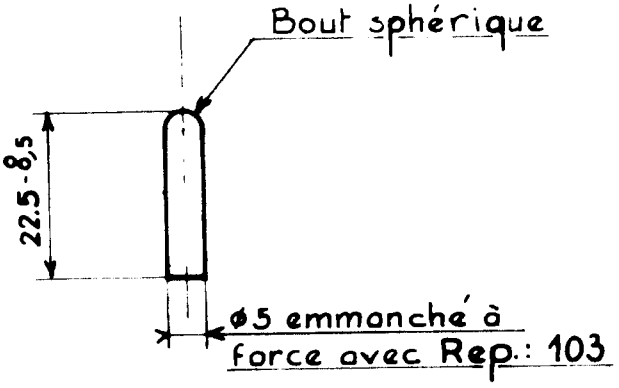
Nettoyer souvent le percuteur et son guide pour éviter des ratés.

b) Sortir le support d'étui ou d'amorce et éventuellement l'enclume après chaque fonctionnement d'amorce et les nettoyer soigneusement dans le but d'enlever les déchets de composition et de papier carbonisé.

REMARQUES - Les précautions indiquées ci-dessus sont importantes et leurs applications doivent être rigoureuses si l'on désire enregistrer des résultats d'essais toujours comparables à eux-mêmes.

Il y a lieu en outre de conserver, comme témoin, à l'abri de l'humidité (emballage étanche) une partie d'un lot d'amorces ayant donné à l'épreuve de chute des résultats peu dispersés et de vérifier périodiquement avec ce témoin la fidélité de l'appareil.





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Echelle : 1

Matière : XC 38

Traitement :

Protection superficielle : PHOSPHATATION

10-6-70 01 Approbation

Réf. Nbr

Visa Date Avis MODIFICATIONS

NOTES

Appareil de chute Broche

N° de dossier OTAN

AC 225.(CIII.SC1) D/237

AT-MF

28 A 102

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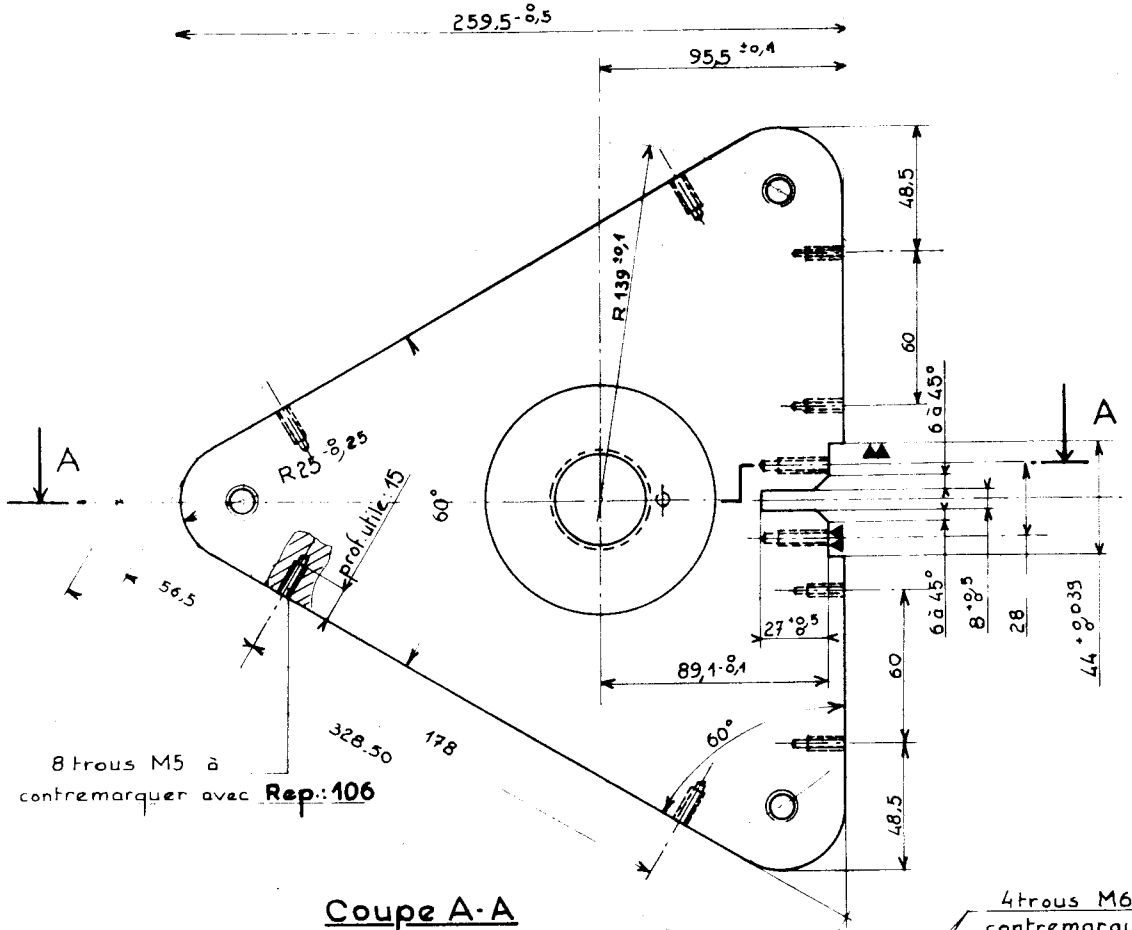
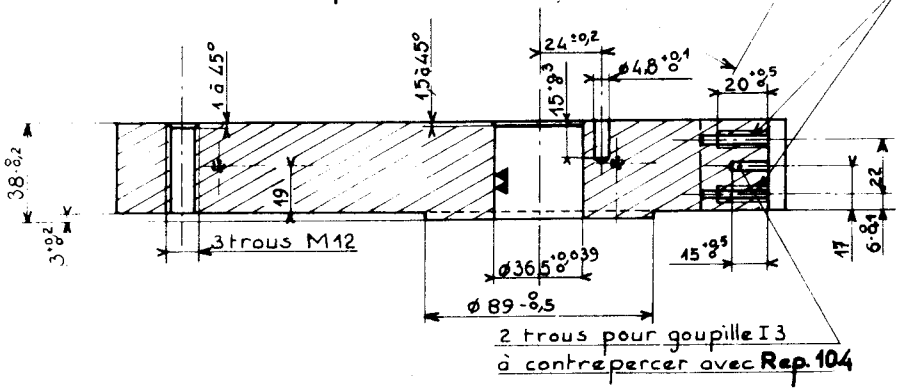
- NOTE -

N.1 - Les cotes non tolérancées sont [illegible] indicatif



Coupe A-A



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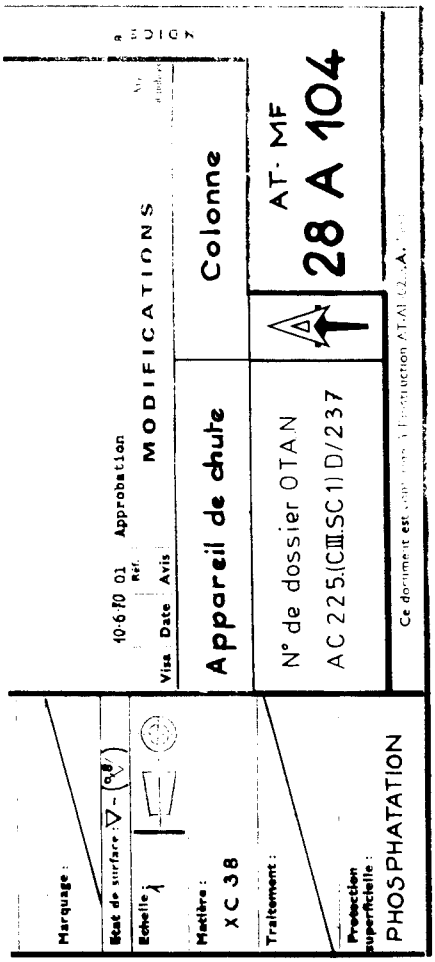
MODIFICATIONS
Visa Date Avis
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Réf.
Appareil de chute
Colonne
AT· MF
28 A 104
N° de dossier OTAN
AC 225.(CIII.SC1)D/237
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Etat de surface :
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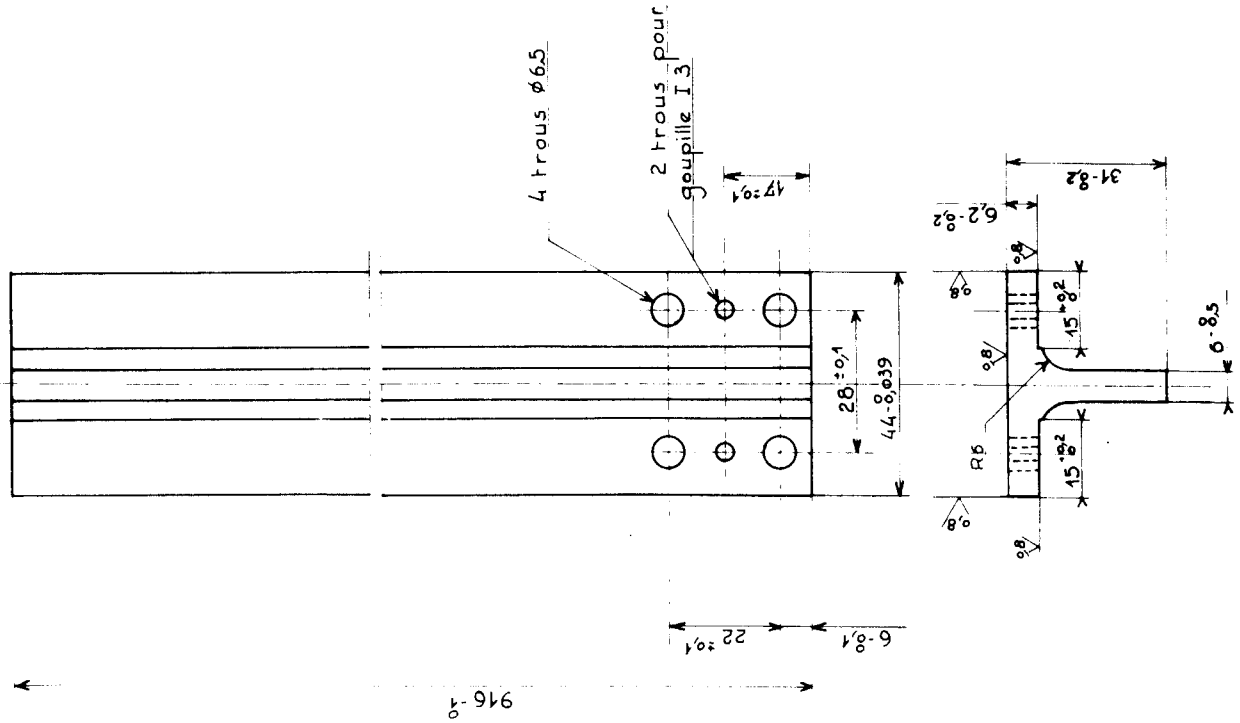
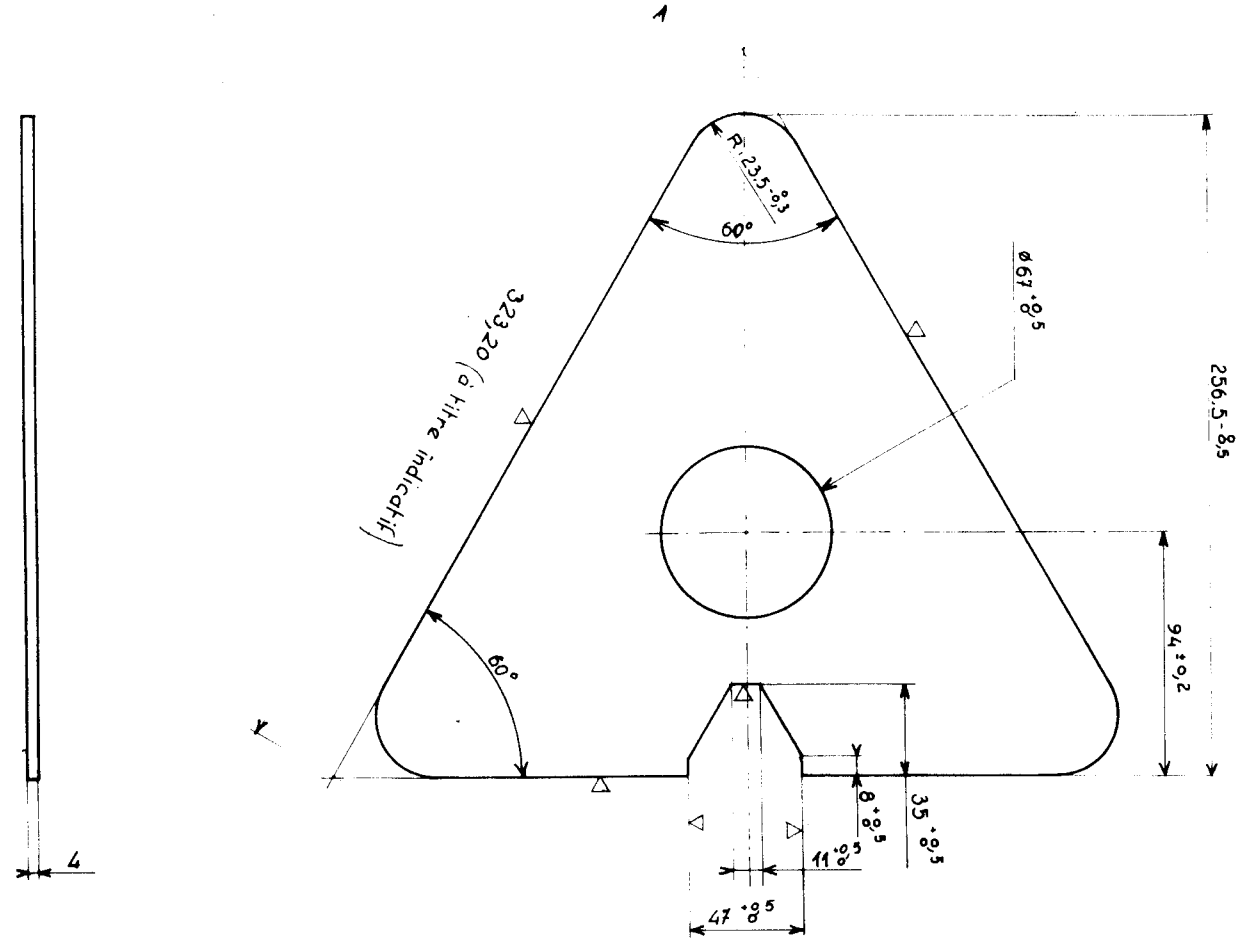
Matière :
XC 38
Traitement :
Protection superficielle :
PHOSPHATATION


4 trous ø6,5
2 trous pour goupille I 3
47 ±0,1
28 ±0,1
44 -0,039
22 ±0,1
6 -0,1
946 -4
31 -0,2
6,2 -0,2
15 +0,2
6 -0,5
R6
0,8
8°



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Appareil de chute	Protecteur			
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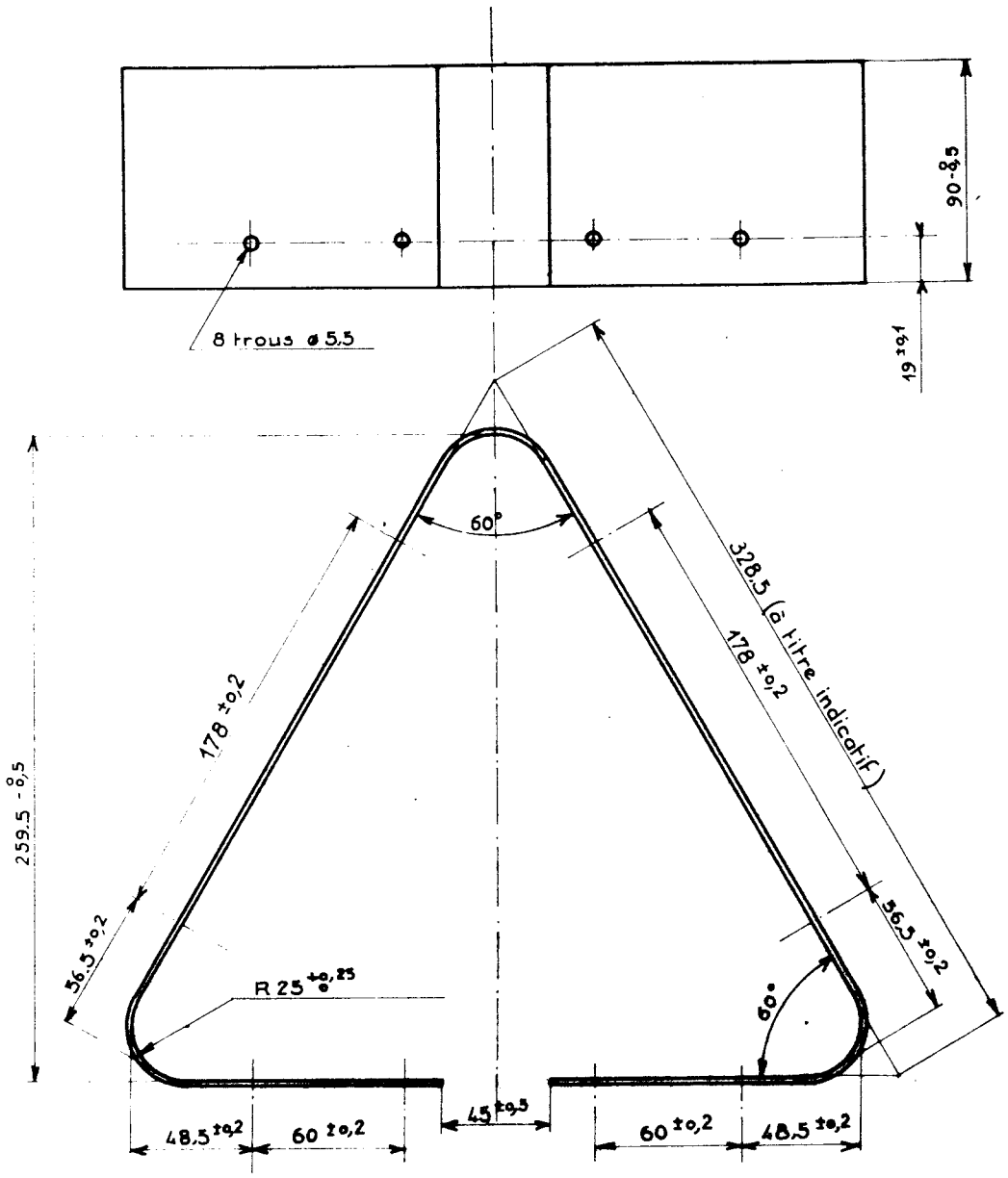

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Traitement :	Appareil de chute		Ceinture		INDICE P
Protection complémentaire : Phosphatation Peinture	N° de dossier OTAN AC 225.(CIII.SC 1) D/237		AT-MF 28 A 106		
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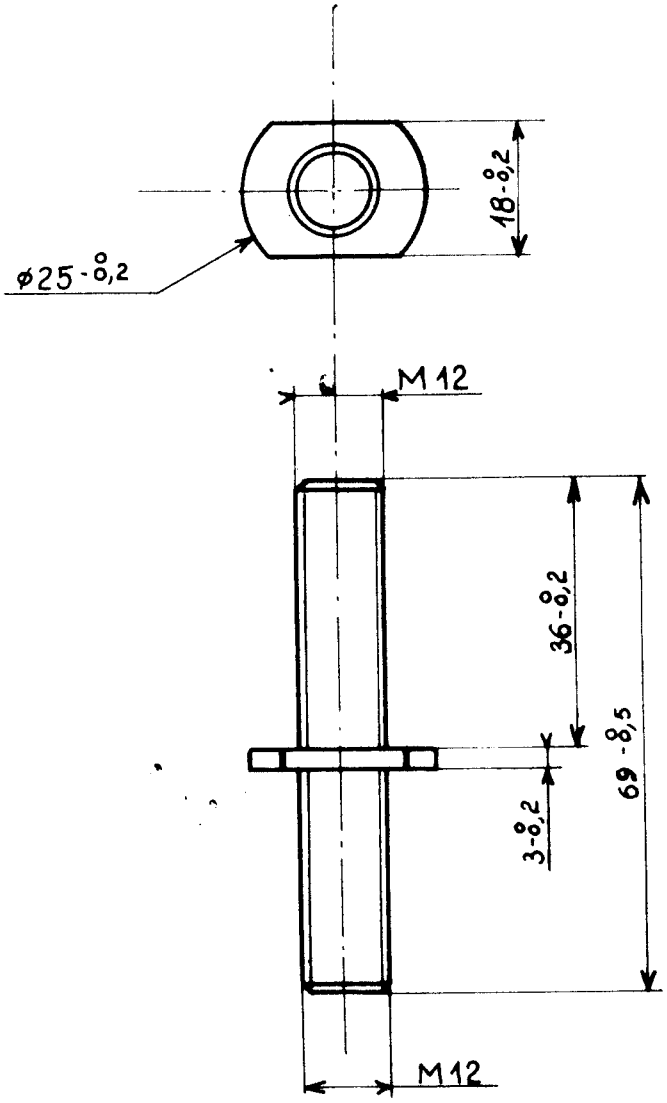

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Matière : XC 38

Traitement :

Protection superficielle : PHOSPHATATION

Visa	Date	Avis	MODIFICATIONS	Nbr. d'indices
	10-6-70	01 Réf.	Approbation	

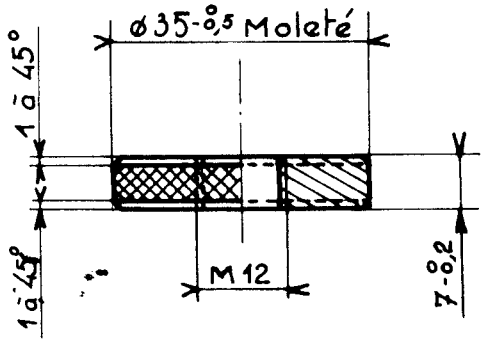
INDICE a

Appareil de chute — Vis de vérin

N° de dossier OTAN
AC 225.(CIII.SC1)D/237

AT-MF
28 A 107

Ce document est conforme à l'instruction AT-AF-02...A ...



Marquage :

Etat de surface : ▽

Echelle : 1

Matière : XC 38

Traitement :

Protection superficielle : PHOSPHATATION

Visa	Date	Avis	MODIFICATIONS	Nbr. d'indices
	10-6-70	01 Réf.	Approbation	

INDICE A

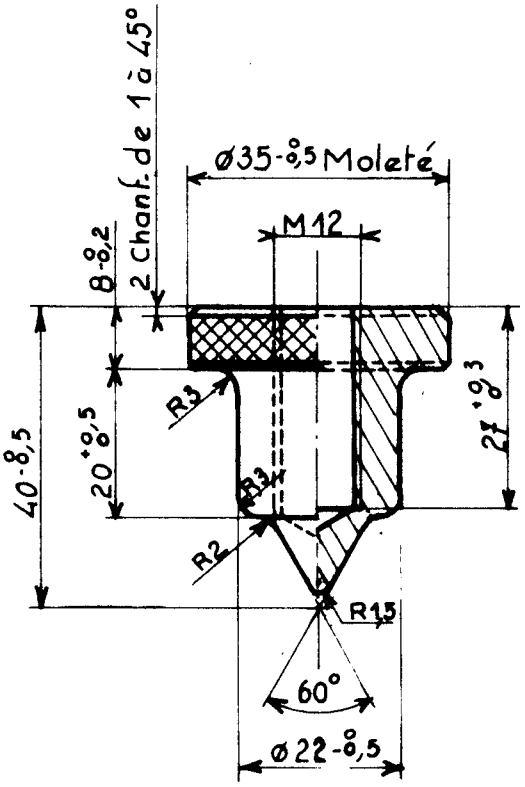
Appareil de chute

Contre-écrou

N° de dossier OTAN
AC 225(CIII.SC 1)D/237

AT-MF
28 A 108

Ce document est conforme à l'instruction AT-AF-02.C.A. Mod.



Marquage :

Etat de surface : ▽

Echelle : 1

Matière : XC 38

Traitement :

Protection superficielle : PHOSPHATATION

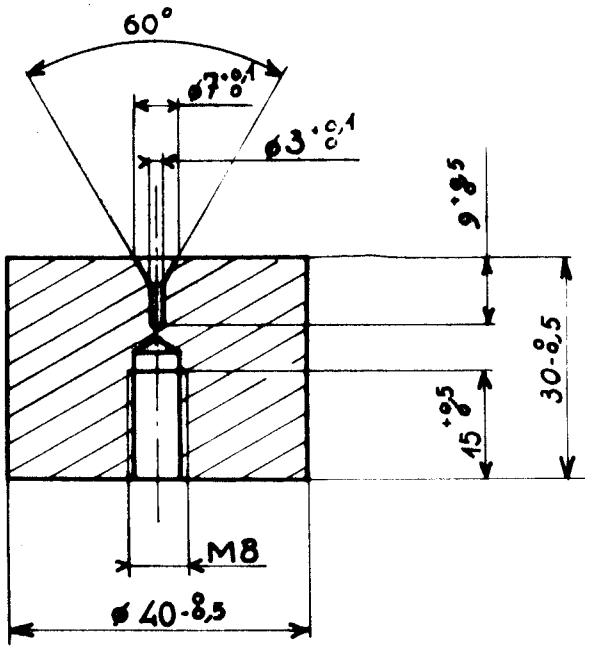
Visa	Date	Avis	MODIFICATIONS	Nbr. d'indices	INDICE
	10-6-70	01 Réf.	Approbation		a

Appareil de chute | Ecrou de vérin

N° de dossier OTAN
AC 225.(CIII.SC 1) D/237

AT- MF
28 A 109

Ce document est conforme à l'instruction AT... D... A. Mar...



Marquage :

Etat de surface : ▽

Echelle : 1

Matière : XC 38

Traitement :

Protection superficielle : PHOSPHATATION

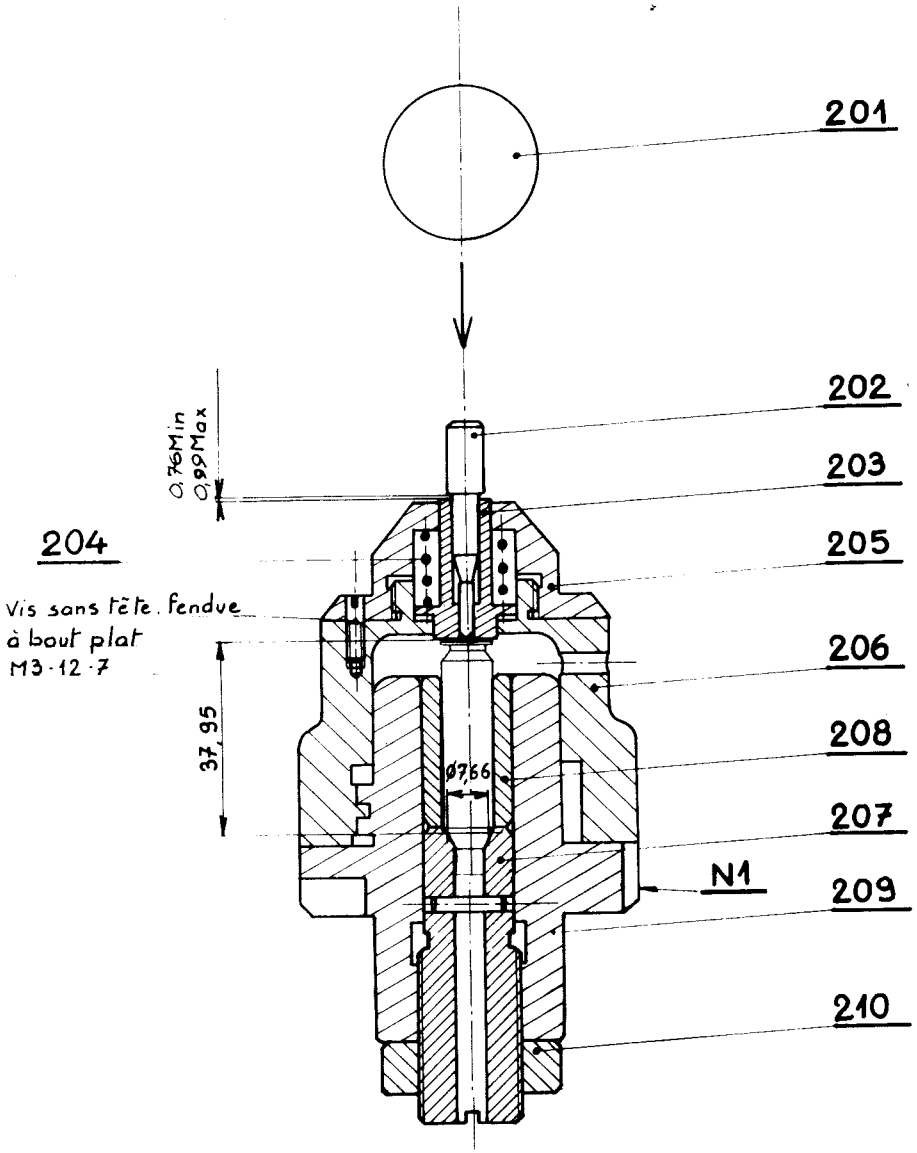
Visa	Date	Avis	MODIFICATIONS	Nbr. d'indices	INDICE
	10-6-70	01 Réf.	Approbation		

Appareil de chute — Crapaudine

N° de dossier OTAN
AC 225.(CIII-SC 1) D/237

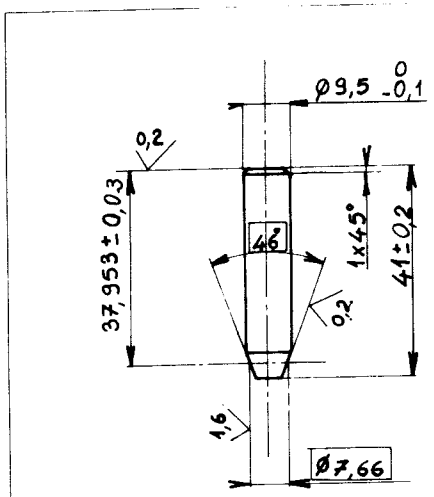
AT-MF
28 A 110

Ce document est conforme à l'instruction AT-AF-[illegible] Mod



N.T.F.

N.I. - MARQUER : CAT. 5,56 mm



RAPPORTEUR DE REGLAGE

Matière : 90 MCW5

Traitement : trempé

Marquage : N1				
Etat de surface :				
Echelle : 1				
Matière :				
Traitement :				
Protection superficielle :				
	2/3/86	06	la tolérance 37,953 ±0,003 devient 37,953 ± 0,03	
	24/7/81	05	0,80 min → 0,76 et 1,00 max → 0,99	
	17.3.80	02	Approbation	
	Visa	Date	Réf. Avis	MODIFICATIONS

INDICE : B

Calibre 5,56 amorces montées — SUPPORT DE PRODUIT

N° de dossier OTAN AC 225 (CIII.SC1) D/237

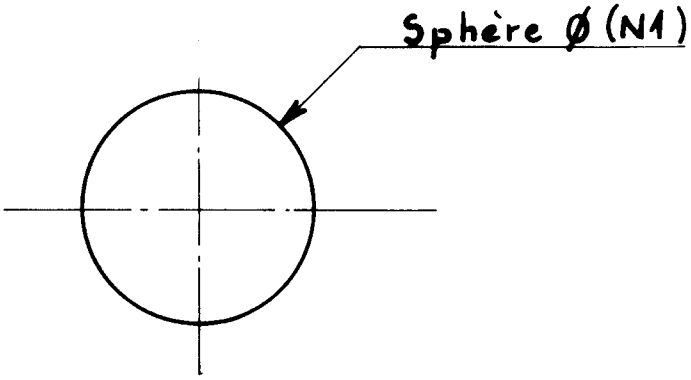
AT-MF 28A200

Ce document est conforme à l'instruction AT-AF 02.5.A. Mod.

- NOTES -

N.1 - Le diamètre de la bille est à déterminer en fonction de la masse.

N.2 - MASSE : 111,7 g ± 0,57 g

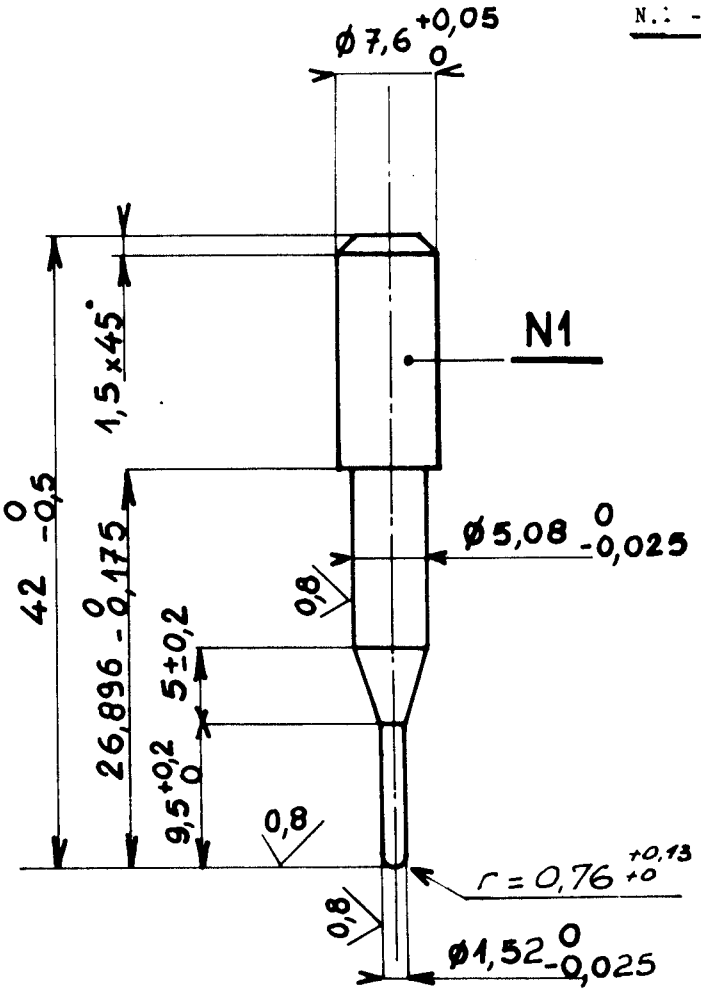


Marquage :					
Etat de surface : 0,8	24/7/[illegible]	05	111,7 ±0,56 → 111,7 ±0,57		b
	11.3.9.	C2	Approbation		a
Echelle : 1	Visa / Date	Réf. Avis	MODIFICATIONS	Nbre d'indices	INDICE
Matière : Z 100 CD 17	Support de produit		BILLE		
Traitement :	N° de dossier OTAN AC 225 (CIII.SC1) D/237		AT-MF 28 A 201		
Protection superficielle :	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.				

Echelle 1

- NOTE -

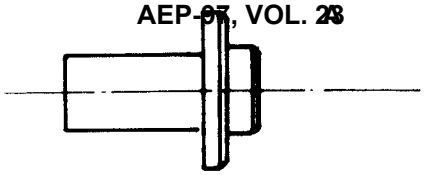
N.: - MARQUER : CAL 5,56



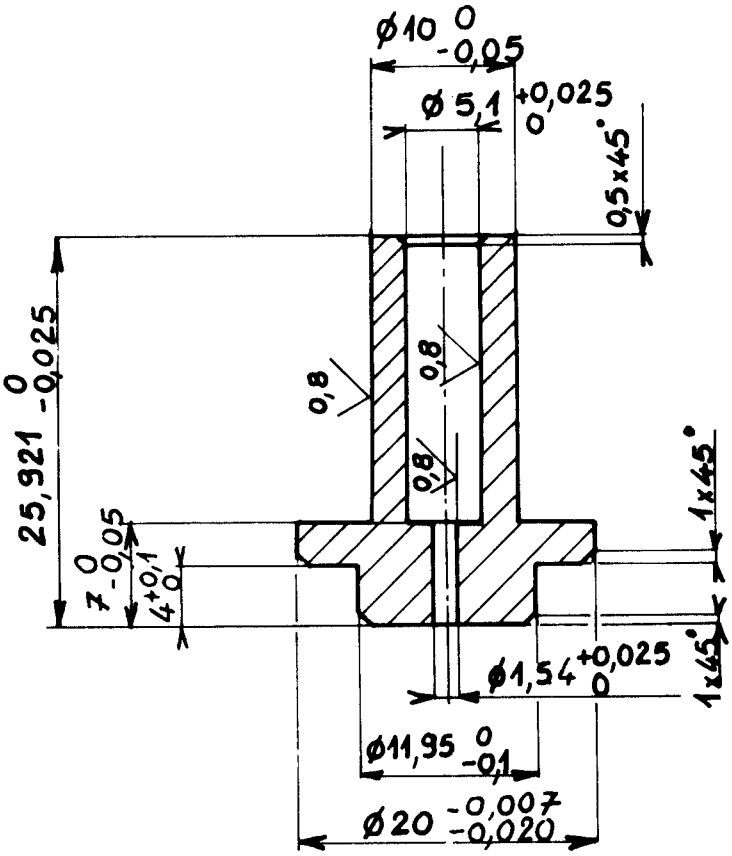
Marquage : N1				
Etat de surface : 3,2 0,8	-	24/7/81	05	Sphérique → r=0.76 +0.13 +0 et ⌀ 1,50 → 1.52 -0 -0,025
Echelle : 2 (1)		17.3.80	02	Approbation
Matière : 35 NCD 16	Visa	Date	Réf. Avis	MODIFICATIONS
Traitement : Traité pour 51 ± 1 HRc	Support de produit			PERCUTEUR
Protection superficielle :	N° de dossier OTAN AC 225.(CIII.SC1)D/237			AT-MF 28 A 202

Ce document est conforme à l'instruction AT-AF-02.S.A. Mod. _____

INDICE b a



Echelle 1



Marquage :					
Etat de surface : 3,2 0,8	24/7/81	05	1,52 +0,025 +0 → 1,54 +0,025 +0		b
	17.3.82	02	Approbation		a
Echelle : 2 (1)	Visa	Date	Réf. Avis	MODIFICATIONS	Mlle d'indices
Matière : 35 NCD16	Support de produit			GUIDE PERCUTEUR	INDICE
Traitement : traité pour 51 ±1HRc	N° de dossier OTAN AC 225.(CIII.SC1) D/237			AT-MF 28A 203	
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.				

Ø du fil : 2 mm

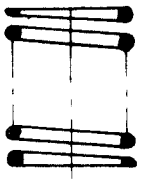
Ø extérieur : 17 mm

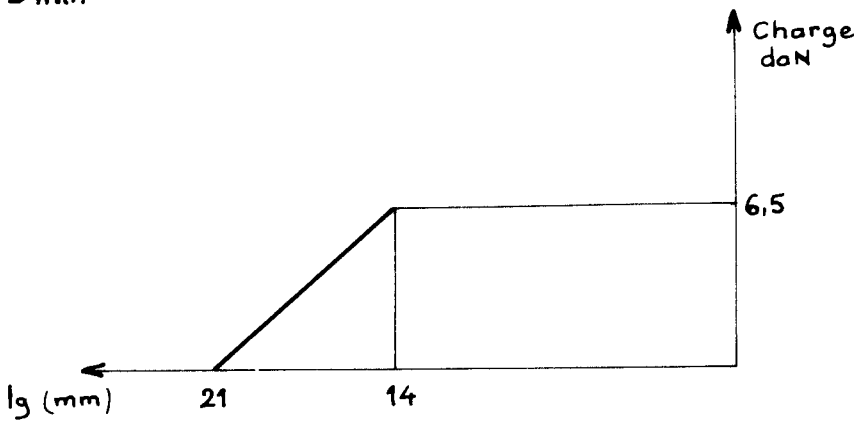
Nombre de spires : 5

Longueur libre : 21mm

Extrémités dressées

Pas : 3,75 mm





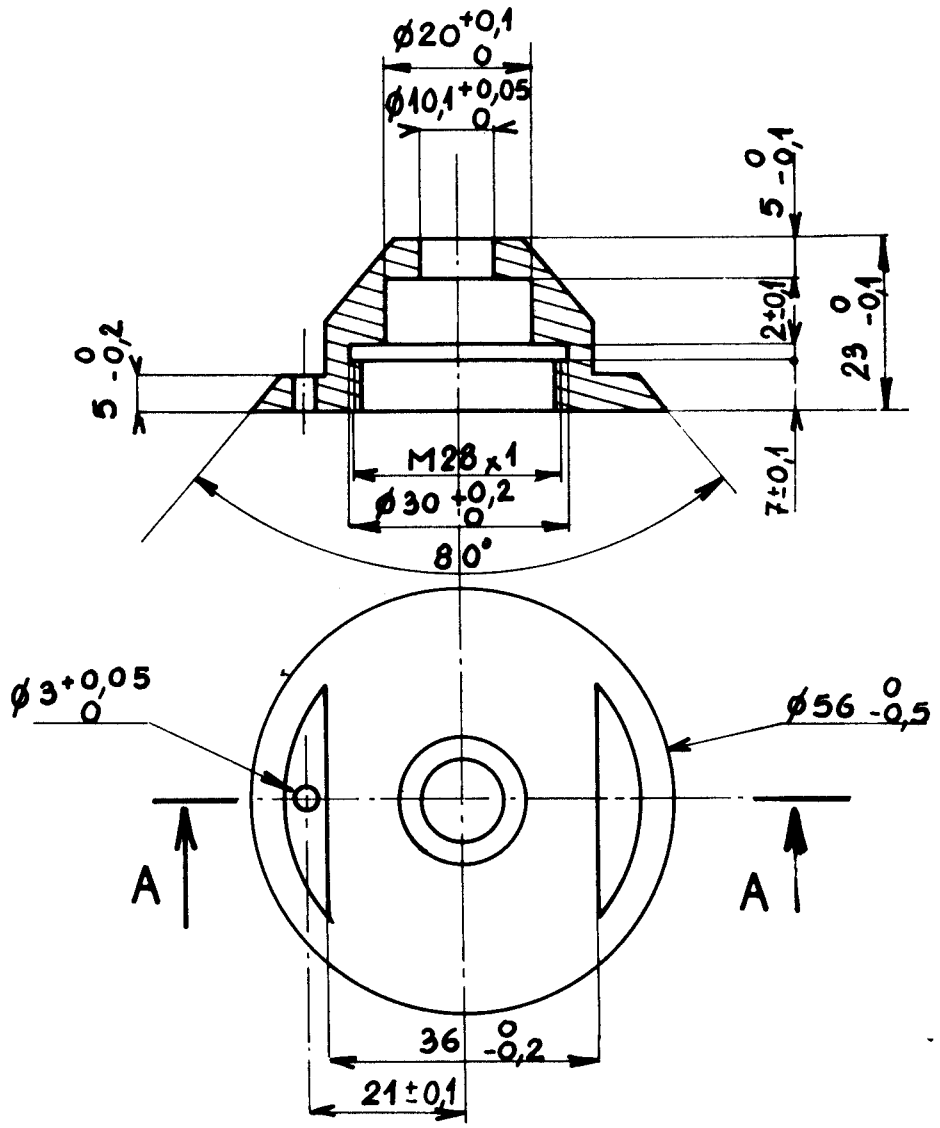
Marquage :					
Etat de surface :	25/3/81	04	Nouvelle définition		b
Echelle :		02	approbation		a
	Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices

INDICE

Matière : XC80	Support de produit	RESSORT
Traitement : Traité pour 28±2 HRc	N° de dossier OTAN AC 225.(CIII.SC 1) D/237	AT-MF 28A 204
Protection superficielle : Phosphatation		

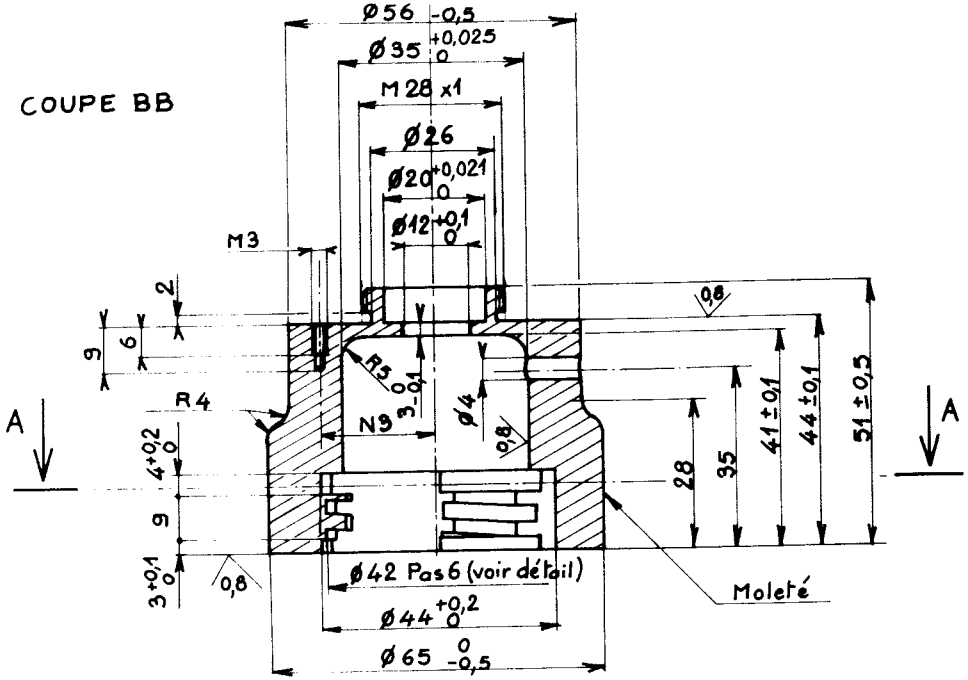
Ce document est conforme à l'instruction AT-AF-02.S.A. Mod. _____

COUPE A-A

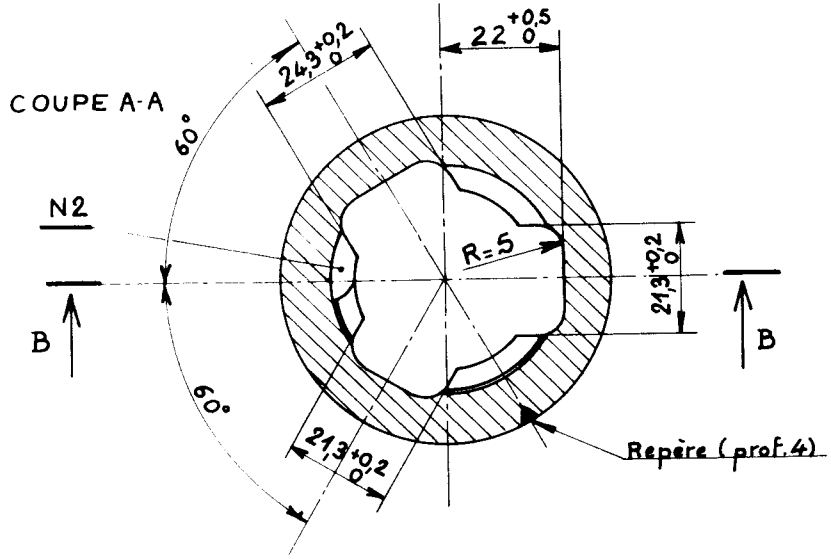


Marquage :					
Etat de surface : 3,2		02	Approbation		a
Echelle : 1	Visa	Date	Ref. Avis	MODIFICATIONS	Nbre d'indices
Matière : XC38	Support de produit		CHAPEAU		INDICE
Traitement :	N° de dossier OTAN AC 225.(CIII.SC 1) D/237		AT-MF 28A205		
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.				

COUPE BB



COUPE A-A

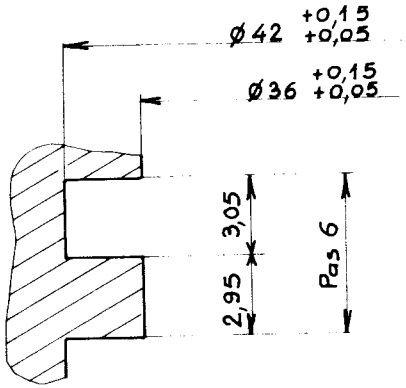


- NOTES -

N.1 - Filet carré (1 filet 1/2 ajusté avec pièce 2

N.2 - Araser le filet incomplet sur le secteur d'entrée d filetage.

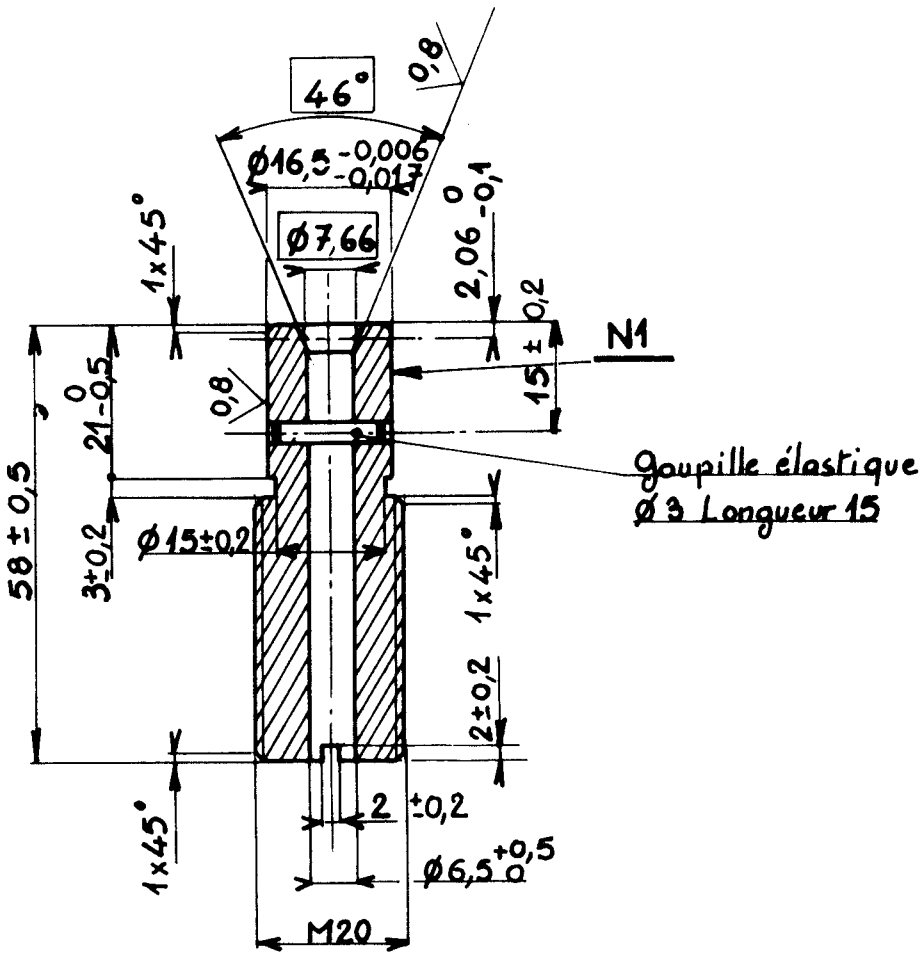
N.3 - Position du taraudage M3 en accord avec pièce



Détail filetage (éch. 5) N1

Marquage :					
Etat de surface : 3,2 0,8	15.7.86	Q6	Ajouter : Rayon R : 5 et cote 22 +0,5 0		b
Echelle : 1 (5)	17.3.80	02	Approbation		
	Visa	Date	Ref. Avis	MODIFICATIONS	Nbre d'indice
Matière : XC38	Support de produit			TÊTE	INDICE
Traitement :	N° de dossier OTAN AC 225.(CIII-SC1) D/237			AT-MF 28A206	
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod				

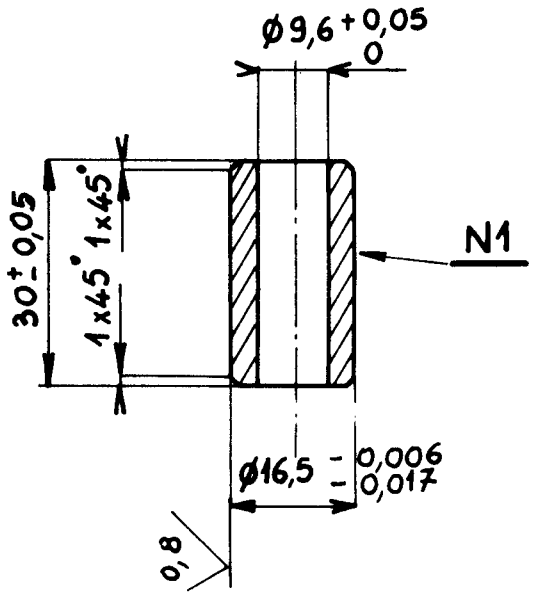
N.B. - MARQUER : CAL 5,56 - A.M



Marquage : N1						
Etat de surface : 0,8 1,6			02	Approbation		a
Echelle : 1	Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices	INDICE
Matière : 35 NCD 16	Support de produit			SUPPORT DE L'ETUI		
Traitement : Traité pour 51 ± 1 HRc	N° de dossier OTAN AC 225-(CIII.SC1) D/237			AT-MF 28A207		
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod					

- NOTE -

N.1 - MARQUER : CAL 5,56 - A.M



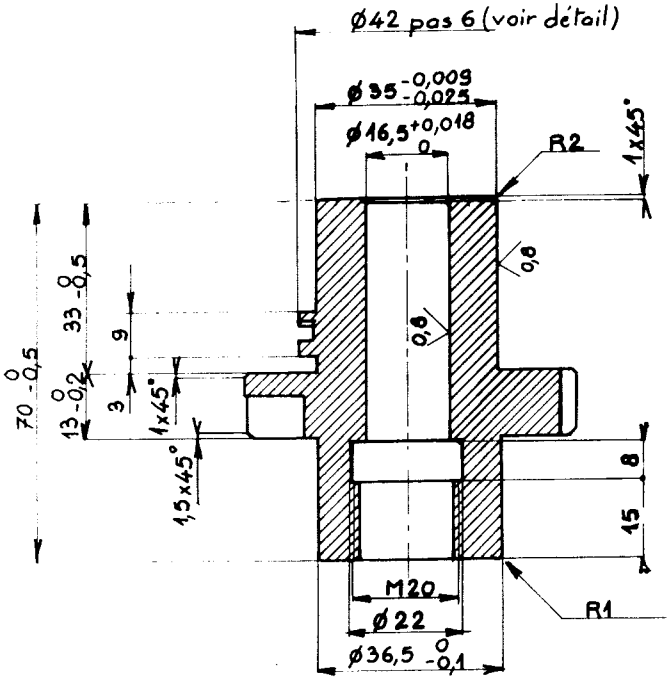
Marquage : N1					
Etat de surface : 0,8 1,6			C2	Approbation	a
Echelle : 1	Visa	Date	Ref. Avis	MODIFICATIONS	Nbre d'indices
Matière : 35 NCD16	Support de produit			BAGUE	INDICE
Traitement : traité pour 51 ± 1 HRc	N° de dossier OTAN AC 225.(CIII.SC1)D/237			AT-MF 28A208	
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-0[illegible] Edition A Version 1				

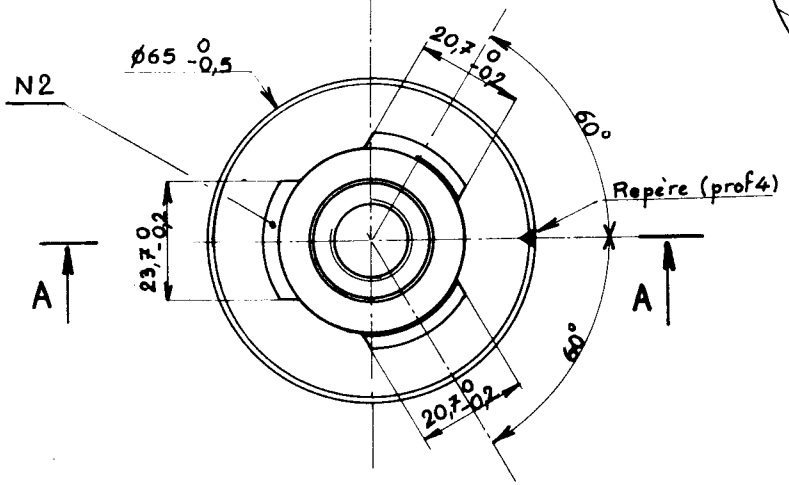
- NOTES -

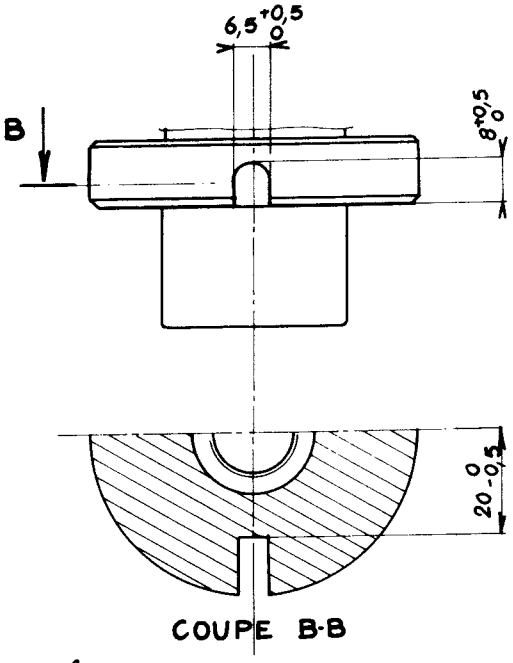
N.1 - Filet carré (1 filet 1/2 ajusté avec pièce [illegible] ou 28 A 243)

N.2 - Araser le filet incomplet sur le secteur d'engrenage filetage.

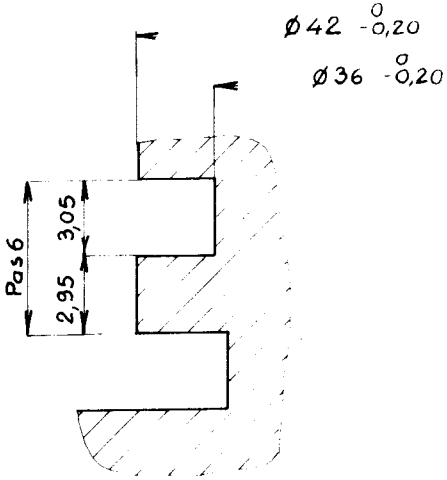
COUPE A-A





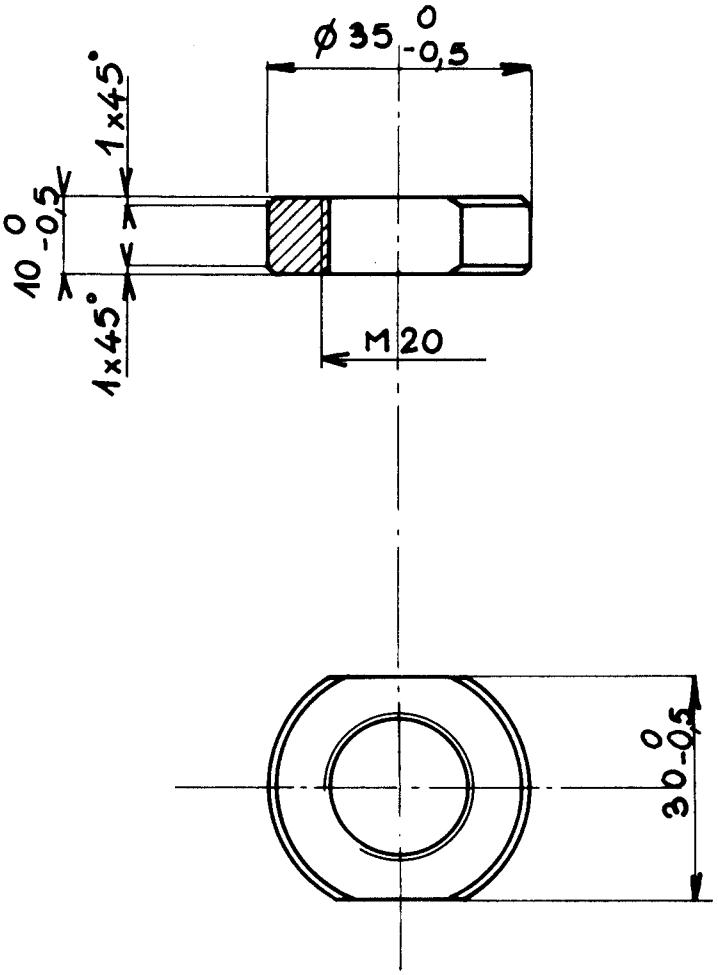


COUPE B-B

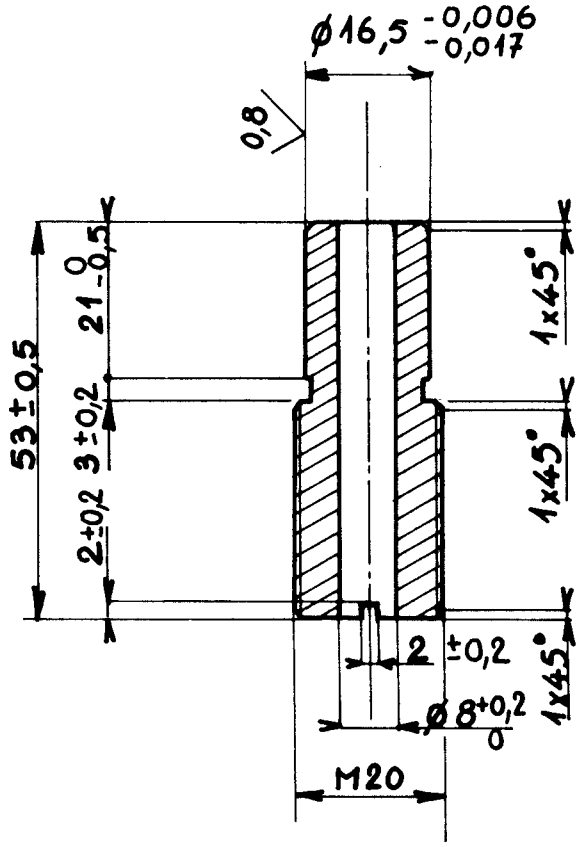


Détail filetage (éch5) N1

Marquage :						
Etat de surface : 3,2 0,8	17360	02	Approbation			
Echelle : 1 (5)	Visa	Date	Réf. Avis	MODIFICATIONS		Nbre d'indices
Matière : XC 38	Support de produit			CORPS		INDICE
Traitement :	N° de dossier OTAN AC 225.(CIII.SC 1) D/237			AT-MF 28A209		
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.5.A. Mod.					

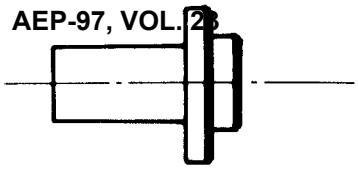


Marquage :						
Etat de surface : 3,2			02	Approbation		a
Echelle : 1		Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices
Matière : XC 38	Support de produit	ECROU				INDICE
Traitement :	N° de dossier OTAN AC 225.(CIII.SC 1) D/237				AT-MF 28 A 210	
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.					

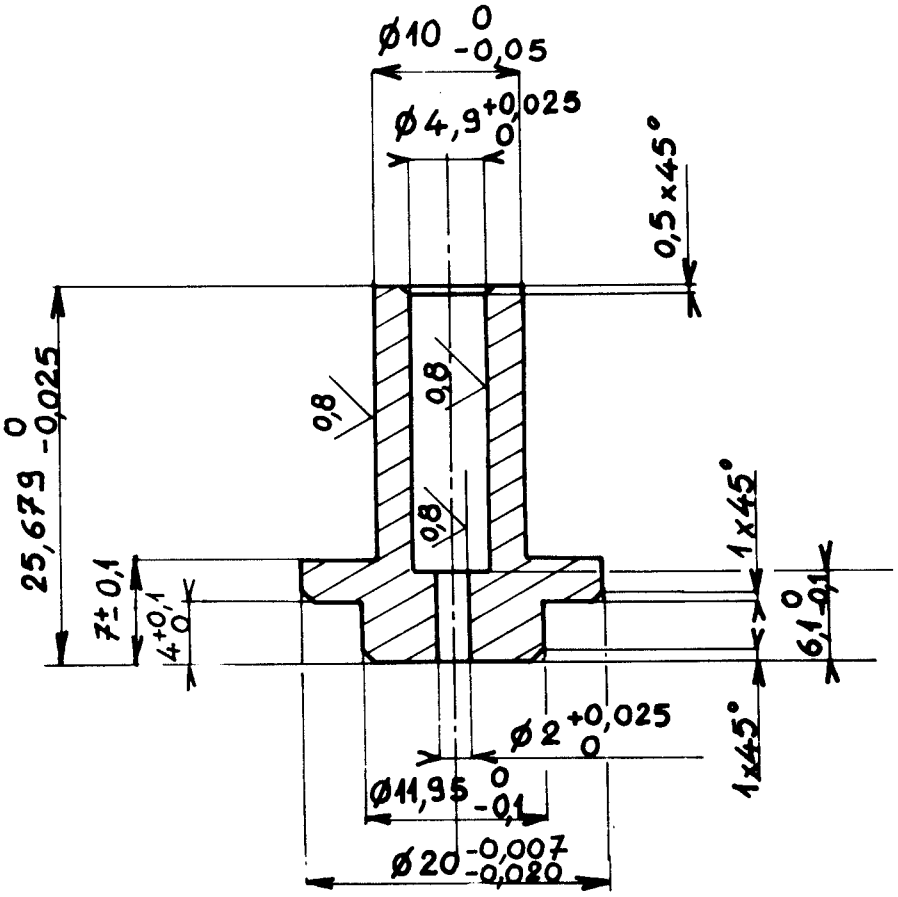


Marquage :						
Etat de surface : 0,8 1,6		02	Approbation			a
Echelle : 1	Visa	Date	Réf. Avis	MODIFICATIONS	Nlle. d'indice	INDICE
Matière : 35 NCD16	Support de produit			SUPPORT INFERIEUR		
Traitement : Traité pour 51±1 HRc	N° de dossier OTAN AC 225.(CIII.SC 1) D/237			AT-MF 28A213		
Protection superficielle : Phosphatation						

Ce document est conforme à l'instruction AT-AF-02.S.A. Mod. _____

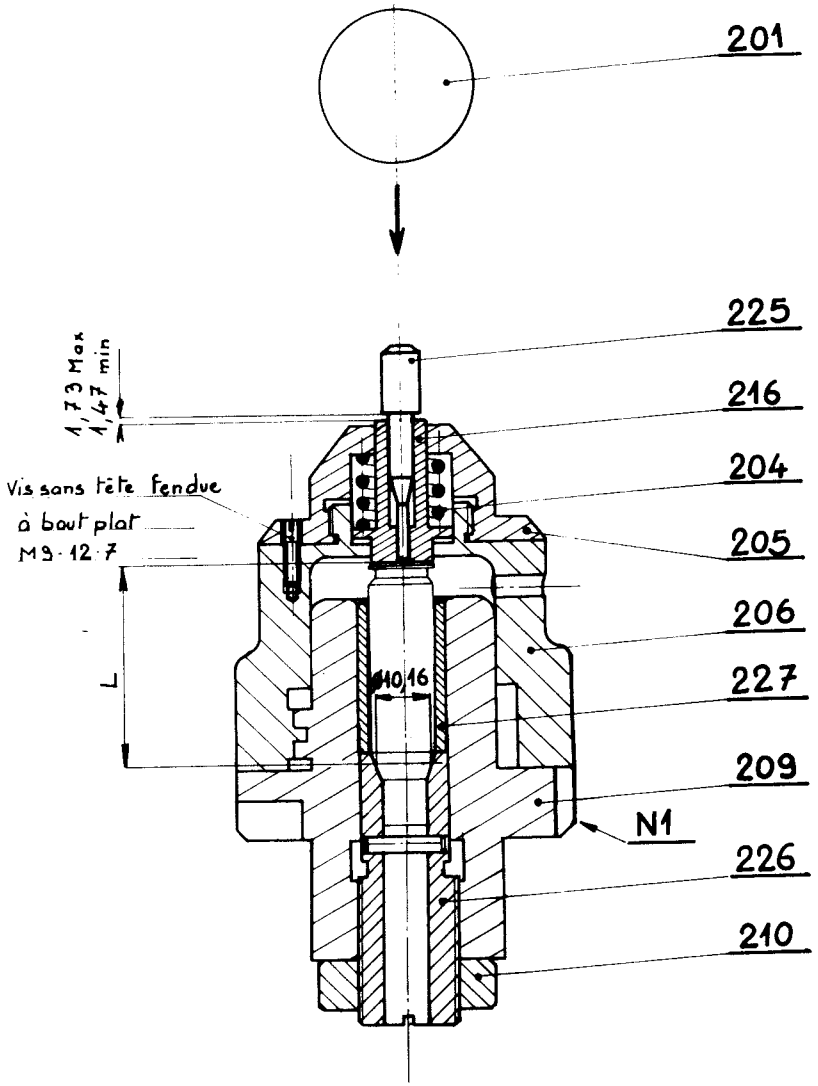


Echelle 1

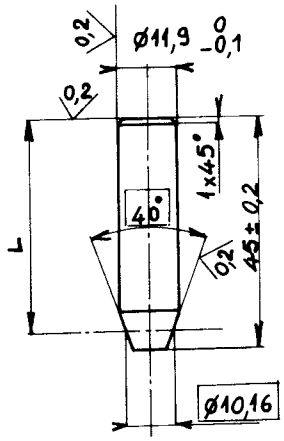


Marquage :				
Etat de surface : 3,2 0,8			02 Approbation	a
Echelle : 2 (1)	Visa	Date	Réf. Avis	MODIFICATIONS — Nbre d'indices — INDICE
Matière : 35 NCD16	Support de produit			GUIDE PERCUTEUR
Traitement : Traité pour 51 ± 1 HRc	N° de dossier OTAN AC 225.(CIII-SC1) D/237			AT-MF 28 A 216
Protection superficielle : Phosphatation				

Ce document est conforme à l'instruction AT-AF-02.S.A. Mod. _____



N.1 - MARQUAGE :



RAPPORTEUR DE REGLAGE

Matière : 90 MCW5

Traitement : Trempe

	L
Cartouche étui laiton	41,349 ± 0,03
Cartouche étui acier	41,299 ± 0,03
Cartouche à blanc NM1	40,897 ± 0,03

Marquage : N1					
Etat de surface :					
Echelle : 1					
Matière :					
Traitement :					
Protection superficielle :					
	2.3.86	06	La tolérance L devient ± 0,03		b
	17.3.86	02	Approbation		a
	Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices

INDICE

Calibre 7,62 N amorces montées

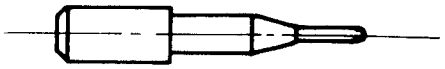
SUPPORT DE PRODUIT

N° de dossier OTAN AC 225/CIII.SC 1/LD/237

AT-MF 28A 224

Ce document est conforme à l'instruction AT-AF-02.5.A. Mod

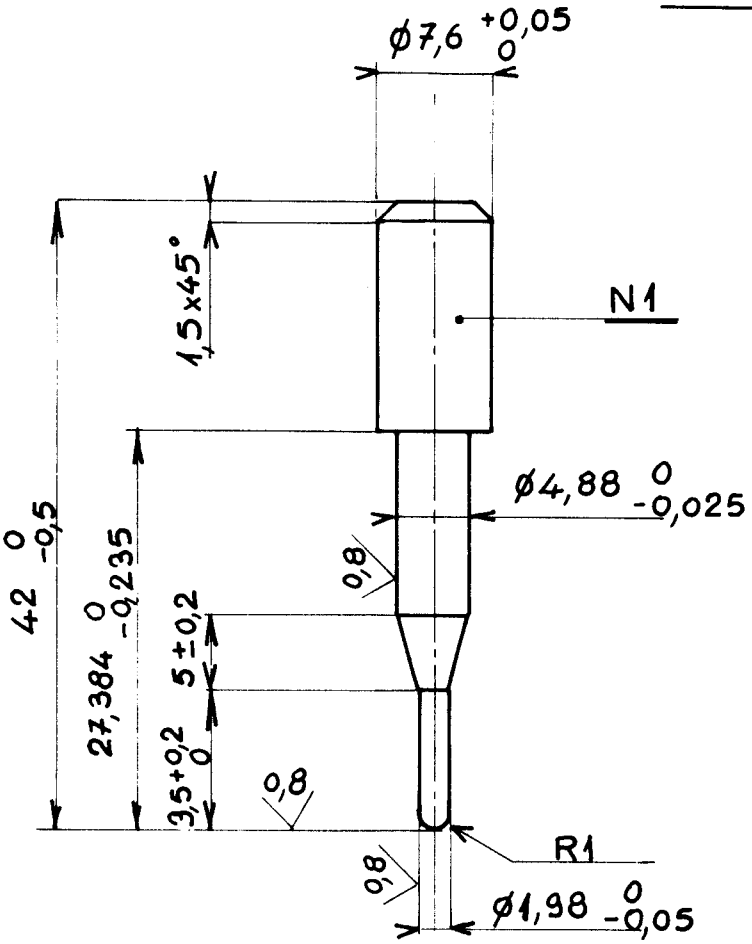
14



Echelle 1

- NOTE -

N.1 - MARQUER : CAL 7,62 N - 12,/



Marquage : N1					
Etat de surface : 0,8 1,6	25.11.94		Dans note, ajouter 12,7		b
Echelle : 2 (1)	[illegible] 380	2	Approbation		a
	Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices

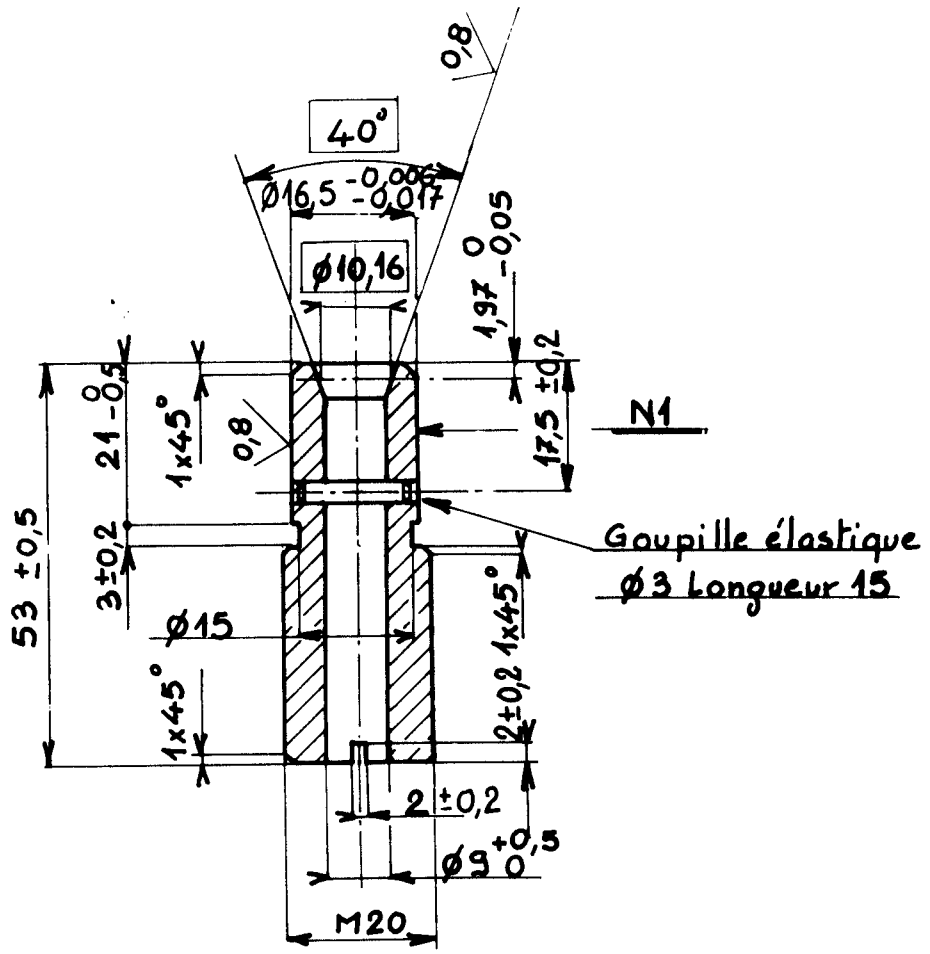
INDICE

Matière : 35 NCD 16	Support de produit	PERCUTEUR
Traitement : Traité pour 51±1 HRc	N de dossier OTAN AC 225(CIII.SC1) D/237	AT-MF 28A225
Protection superficielle : Phosphatation		

Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.

- NOTE -

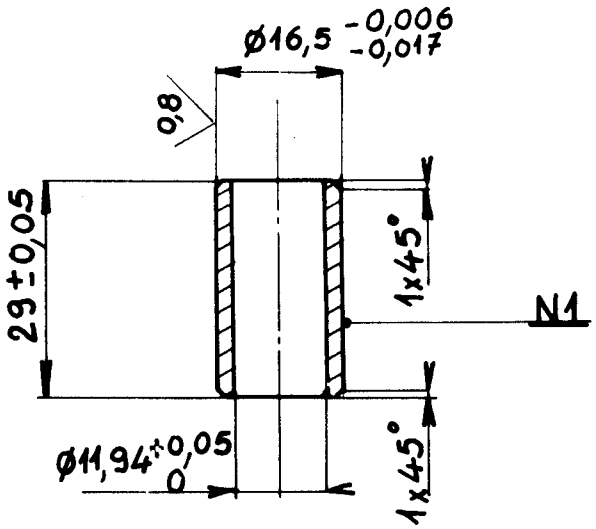
N.1 - MARQUER : CAL 7,62 N - A.M



Marquage : N1					
Etat de surface : 0,8 1,6			02	Approbation	a
Echelle : 1	Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices
Matière : 35 NCD16	Support de produit			SUPPORT DE L'ETUI	INDICE
Traitement : traité pour 51 ± 1 HRc	N° de dossier OTAN AC 225.(CIII.SC 1) D/237			AT-MF 28A226	
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.				

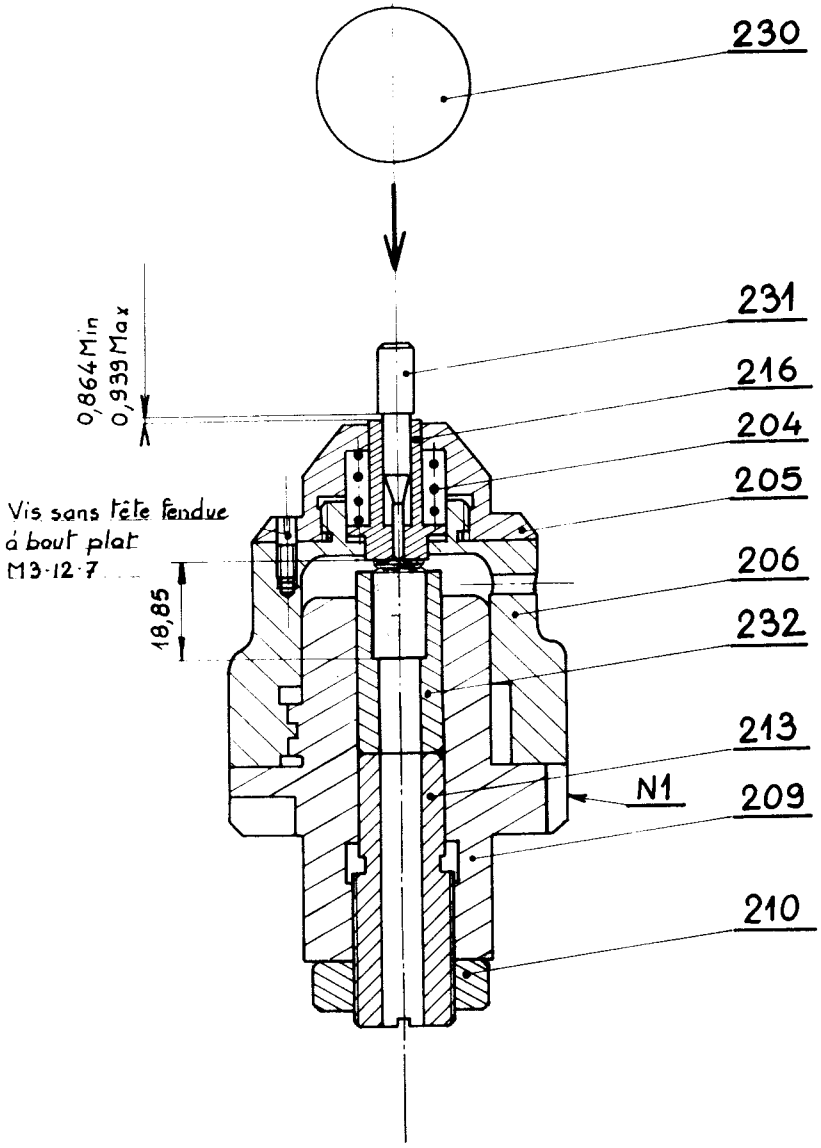
- NOTE -

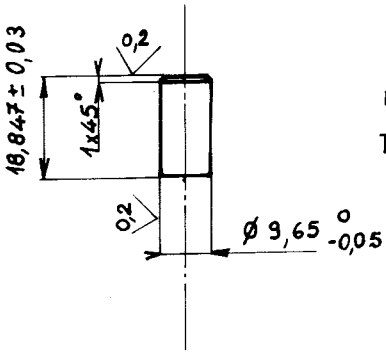
N.1 - MARQUER : [illegible] N - A.M



Marquage : N1					
Etat de surface : 0,8 1,6			02	Approbation	a
Echelle : 1	Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices
Matière : 35 NCD 16	Support de produit			BAGUE	INDICE
Traitement : Traité pour 51±1 HRc	N° de dossier OTAN AC 225(CIII-SC 1) D/237			AT-MF 28A227	
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.				

N.C - MARQUER : CAT [illegible] A.P





RAPPORTEUR DE REGLAGE

Matière : 90 MCW5

Traitement : Trempe

Marquage : N1					
Etat de surface :	2.3.86	06	La tolérance 18,847 ± 0,003 devient 18,847 ± 0,03		b
Echelle : 1	17.3.80	02	Approbation		
	Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices
Matière :	Calibre 9 amorces montées			SUPPORT DE PRODUIT	
Traitement :	N° de dossier OTAN AC 225 (CIII.SC1) D/237			AT-MF 28A 229	
Protection superficielle :	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod				

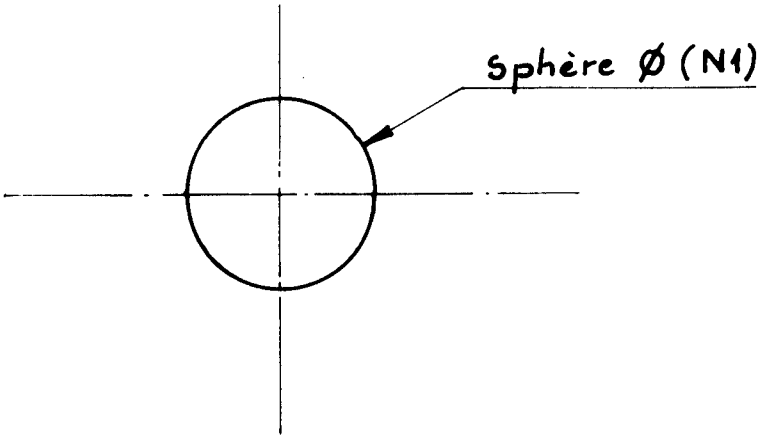
INDICE

15

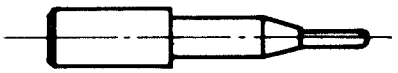
- NOTES -

N.1 - Le diamètre de la bille est à déterminer en fonction de la masse

N.2 - MASSE : 55 g ± 0,56 g

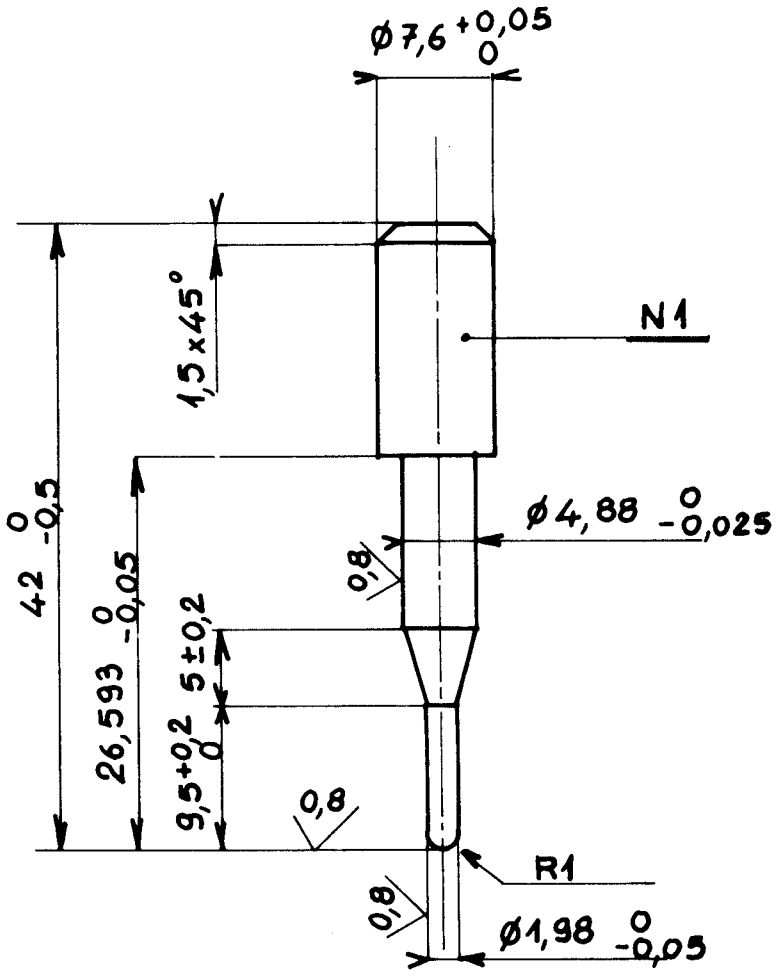


Marquage :						
Etat de surface :		17.5?	02	Approbation		a
Echelle : 1	Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices	INDICE
Matière :	Support de produit			BILLE		
Traitement :	N° de dossier OTAN AC 225.(CIII.SC 1)D/237				AT-MF 28A 230	
Protection superficielle :	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.					



Echelle 1

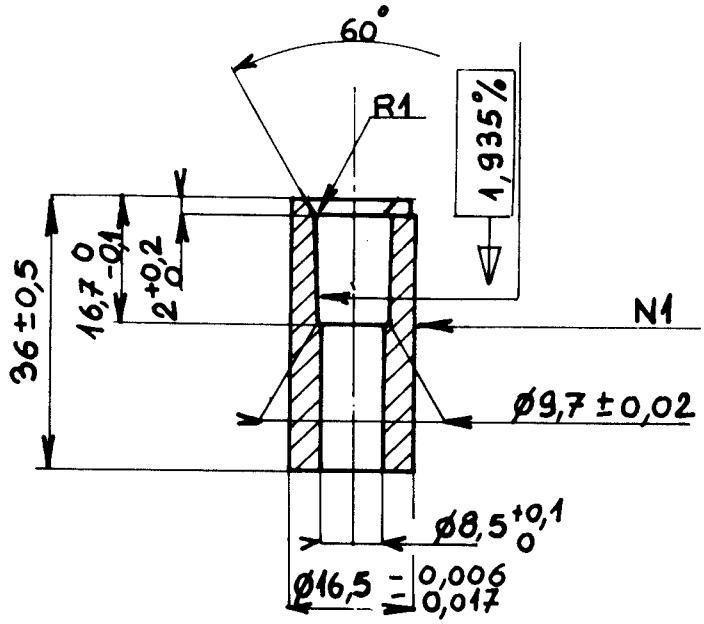
N.1 - MARQUER : CAL 9

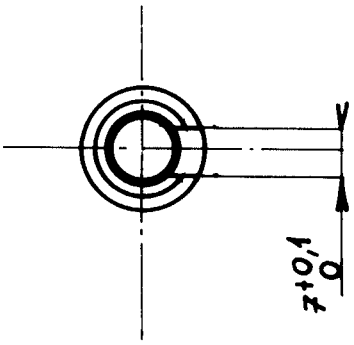


Marquage : N1						
Etat de surface : 0,8 1,6	12.83	02	Approbation			a
Echelle : 2 (1)	Visa	Date	Réf. Avis	MODIFICATIONS	Nlle. d'indice	INDICE
Matière : 35 NCD 16	Support de produit			PERCUTEUR		
Traitement : traité pour 51 ± 1 HRc	N° de dossier OTAN AC 225(CIII.SC1)D/237			AT-MF 28 A 231		
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.					

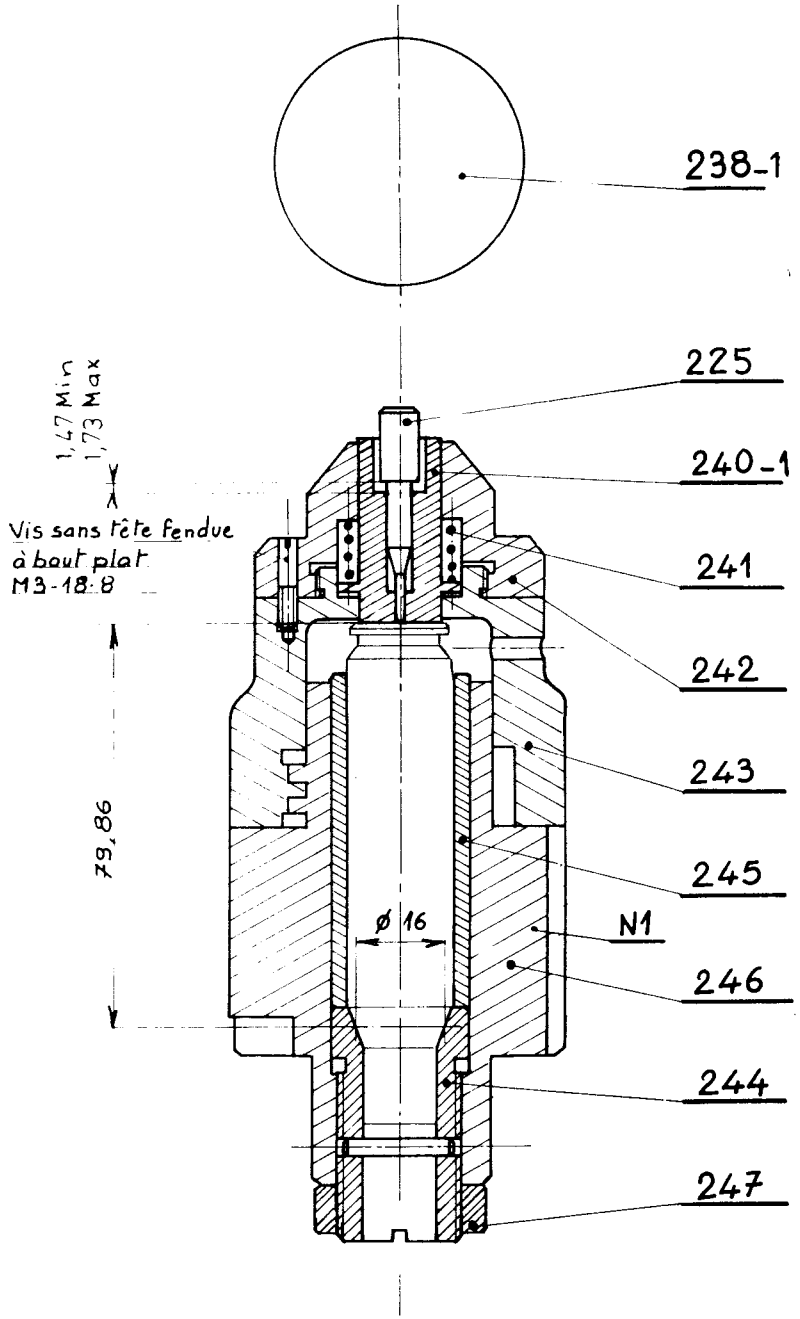
- NOTE -

N.1 - MARQUER : CAL 9 - A.M



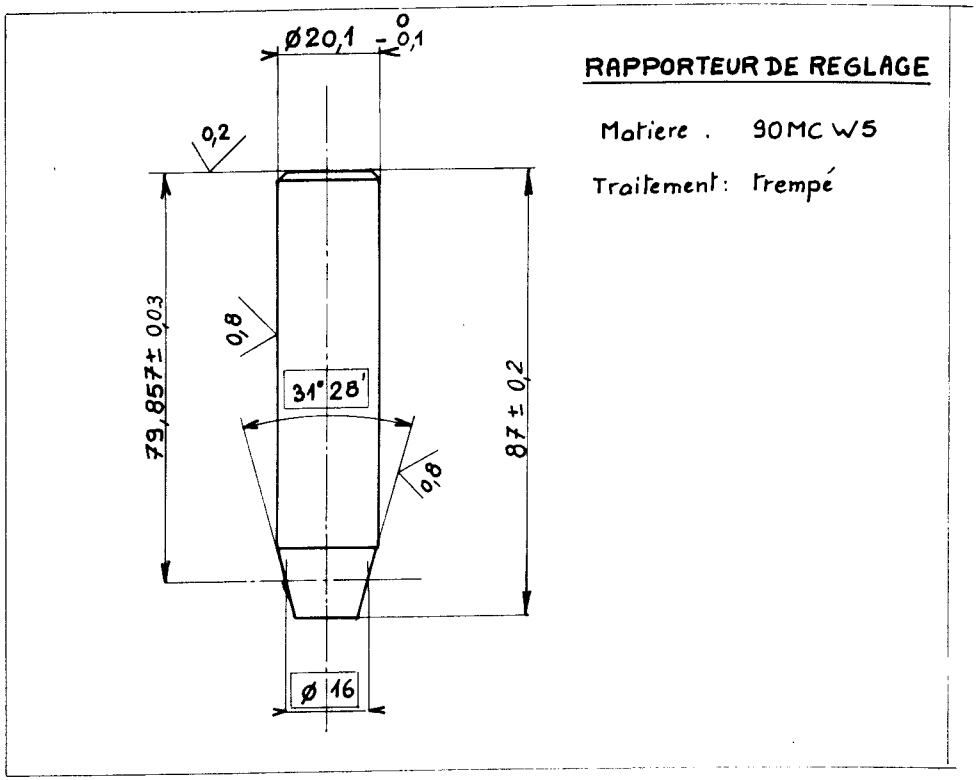


Marquage : N1					
Etat de surface : 0,8	12-3-80	C2	Approbation		a
Echelle : 1	Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices
Matière : 35 NCD16	Support de produit		SUPPORT DE L'ETUI		INDICE
Traitement : traité pour 51 ± 1 HRc	N° de dossier OTAN AC 225.(CIII.SC1) D/237		AT-MF 28A 232		
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.				



- NOTE -

N.1 - MARQUER : CAL 12,7 - A.M



Marquage : N1							
Etat de surface :							
Echelle : 1			25.11.94	02	Approbation		INDICE B
Matière :			Visa	Date	Ref. Avis	MODIFICATIONS	Nbr. d'indices
Traitement :	Calibre 12,7 amorces montées					SUPPORT DE PRODUIT	
Protection superficielle :	Original 1 CETAM	Contre-calque	Tirage		Nom	AT-MF	
					Date :	28A 237-1	
					DTAT		

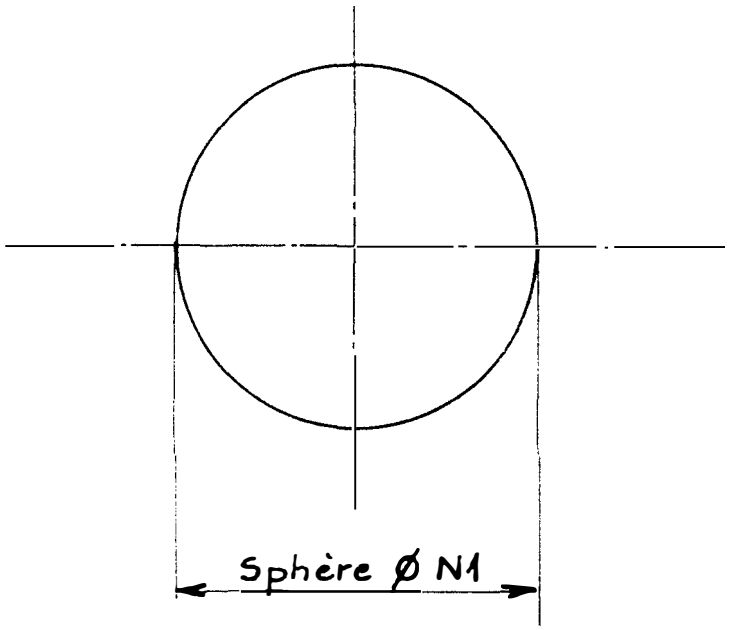
Ce document est conforme à l'instruction AT-AF-02.S.A. Mod. ___ - ___

16

- NOTES -

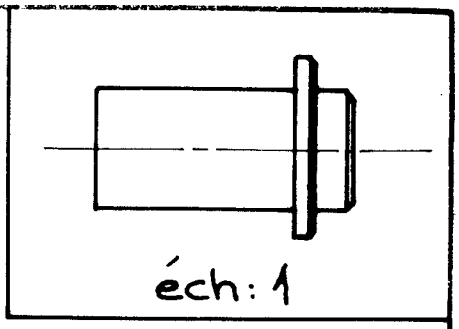
N.1 - Le diamètre de la bille est à déterminer en fonction de la masse.

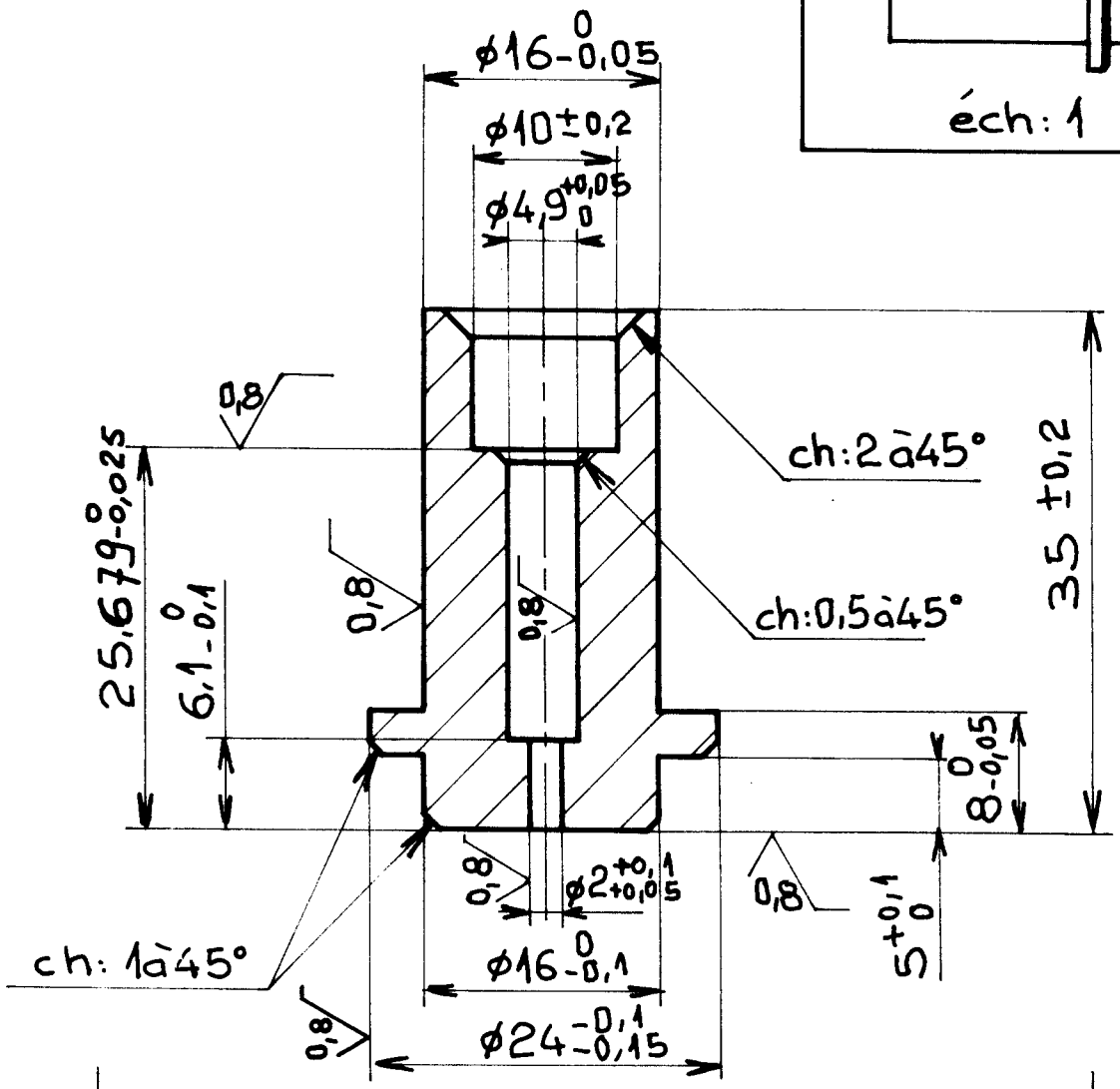
N.2 - MASSE : 225,1 ± 0,57g



Marquage :					
Etat de surface : 0,8	25.11.94	02	Approbation		INDICE a
Echelle : 1	Visa	Date	Réf. Avis	MODIFICATIONS	N°. d'ordre
Matière : Z 100 C D17	Support de produit		BILLE		
Traitement :	N° de dossier OTAN AC 225.(CIII.SC1)D/237		AT-MF 28A 238-1		
Protection superficielle :					

Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.





Date	Avis	Modifications	Indice
25.11.94		Approbation	a

Protection: Phosphatation

Tolérances Générales:

Date	Emargement	Echelle
Oct 94	Berthelot	1:2-1:1

Matière: 35 NCD 16

Caractéristiques mécaniques: traité pour Rm 51 ±1 HRc

Etat de surface: 3,2 (0,8)

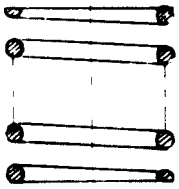
FOLIO N° Nb

GUIDE PERCUTEUR

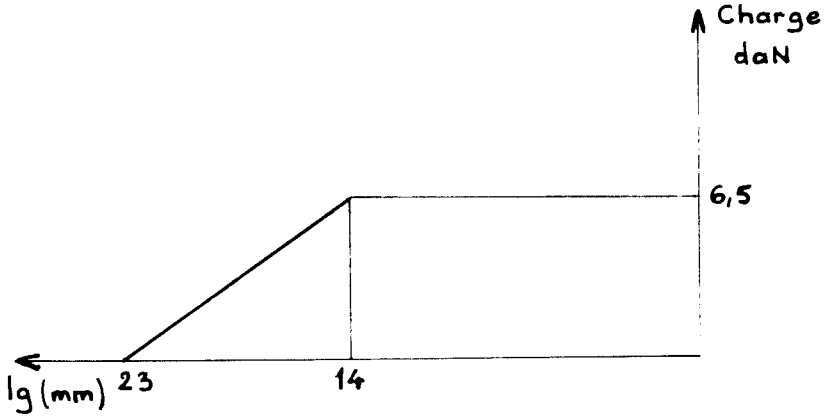
SUPPORT DE PRODUIT 12,7

MINISTERE DE LA DEFENSE
DGA
DIRECTION DES ARMEMENTS TERRESTRES
ETABLISSEMENT TECHNIQUE DE BOURGES

AT-MF-28A240-1



Ø du fil : 2 mm
Ø extérieur : 22 mm
Pas : 5 mm
Nombre de spires : 4
Longueur libre : 23 mm
Extremités dressées
Taré entre 5 et 8 daN



	25/3/	04	Nouvelle définition		b
		02	Approbation		a
Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices	INDICE

Marquage :
Etat de surface :
Echelle :
Matière : XC80
Traitement : Traité pour 28±2 HRc
Protection superficielle : Phosphatation

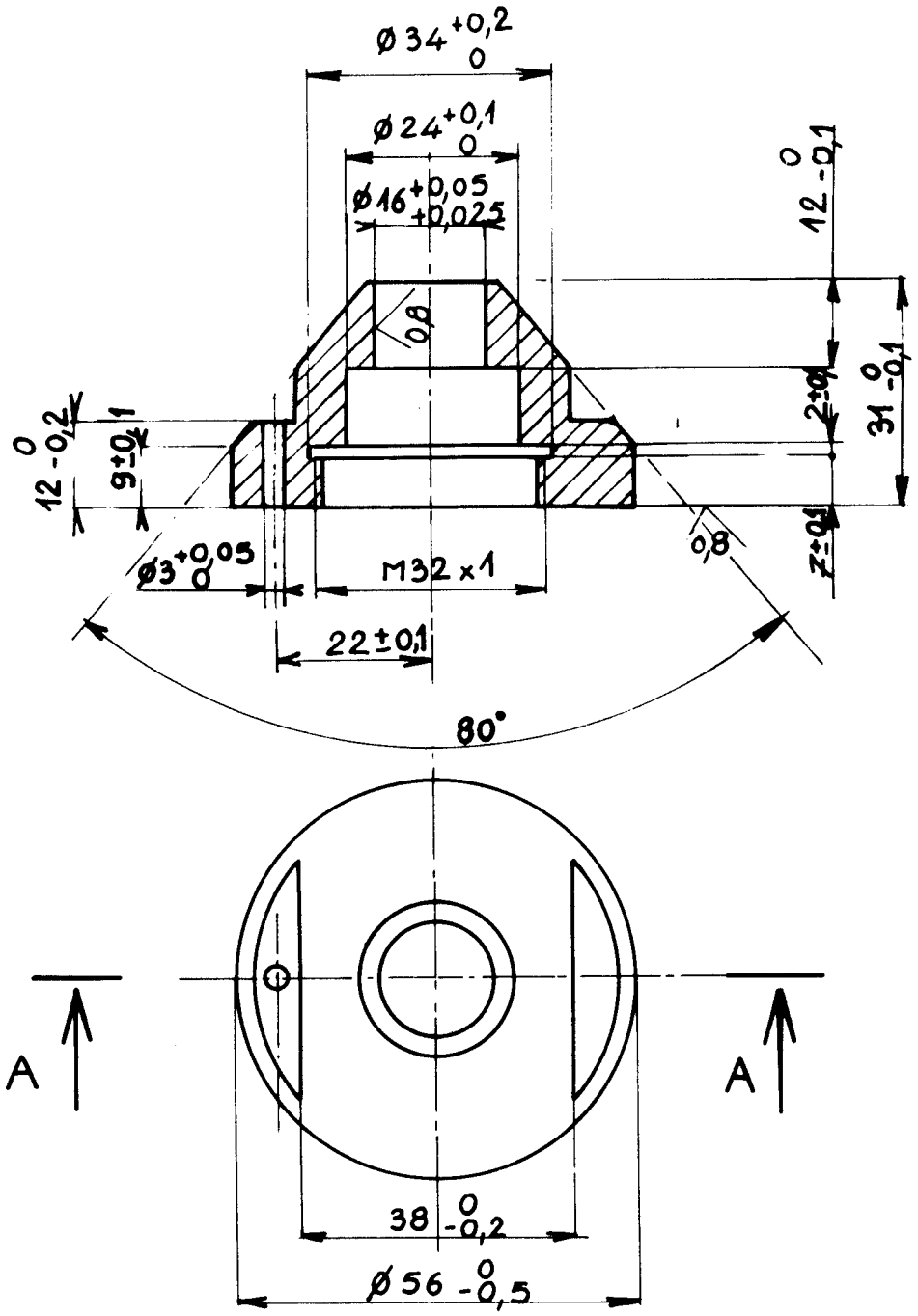
Support de produit — RESSORT

N de dossier OTAN
AC 225.(CIII.SC 1) D/237

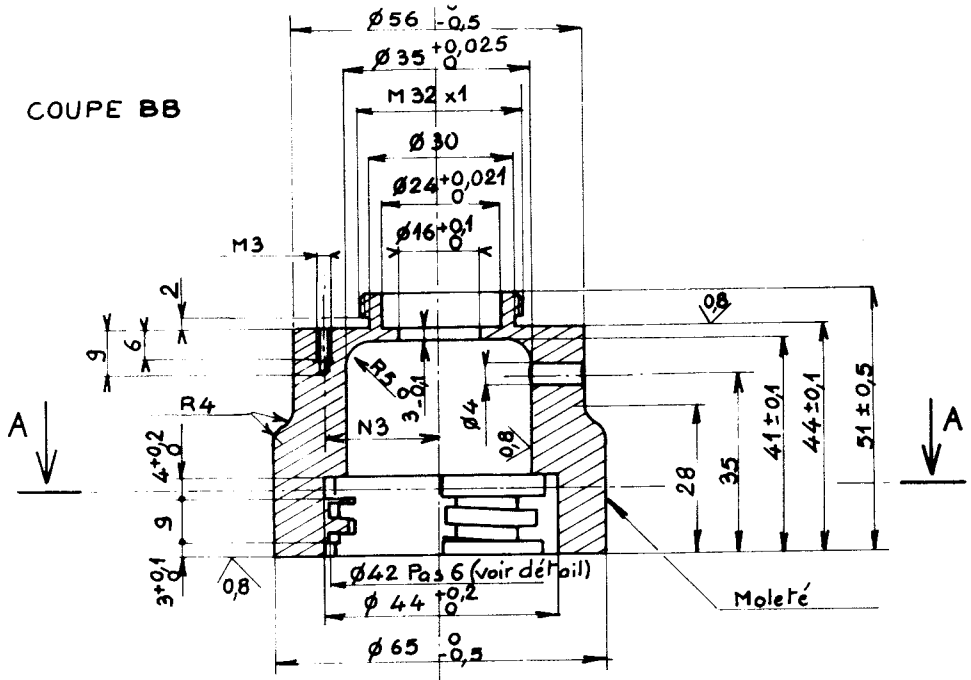
AT-MF
28A241

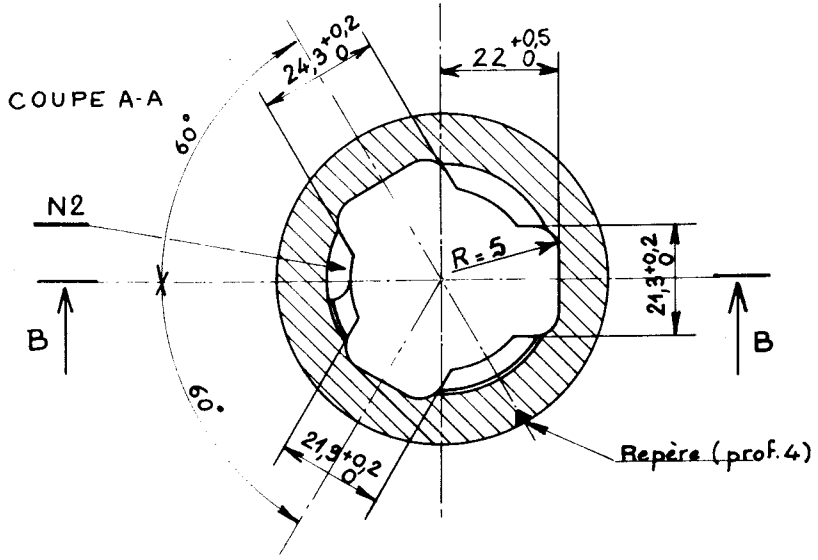
Ce document est conforme à l'instruction AT-AF-02.S.A. Mod. _____

COUPE A-A



Marquage :						
Etat de surface : 3,2 0,8	12-3-1	02	Approbation			a
Echelle : 1	Visa	Date	Réf. Avis	MODIFICATIONS	Réf. d'indices	INDICE
Matière : XC38	Support de produit			CHAPEAU		
Traitement :	N° de dossier OTAN AC 225.(CIII.SC1)D/237			AT-MF 28 A242		
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.					



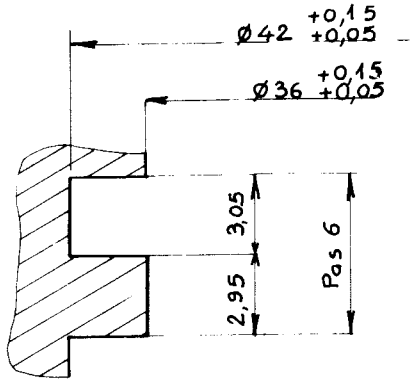


- NOTES -

N.1 - Filet carré (1 filet 1/2 ajusté avec pièce [illegible] ou 28 A 239).

N.2 - Arraser le filet incomplet sur le secteur d'entrée du filetage.

N.3 - Position du taraudage [illegible]

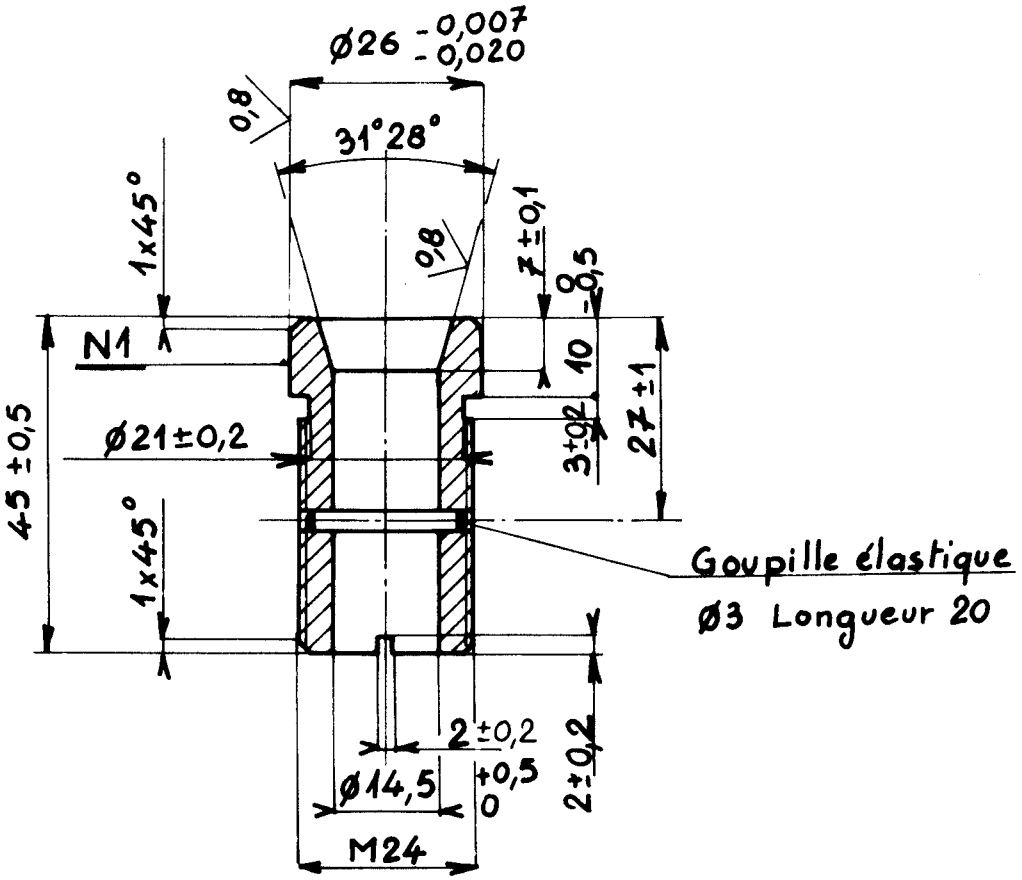


Détail filetage (éch. 5) N1

Marquage :					
Etat de surface : 3,2 0,8	1578	06	Ajouter : Rayon R=5 et cote 22 +0,5 0		b
Echelle : 1 (5)	17360	02	Approbation		a
	Visa	Date	Réf. Avis	MODIFICATIONS	Nbr. d'indices
Matière : XC38	Support de produit			TÊTE	INDICE
Traitement :	N° de dossier OTAN AC 225.(CIII.SC1) D/237			AT-MF 28A243	
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.5.A. Mod				

22

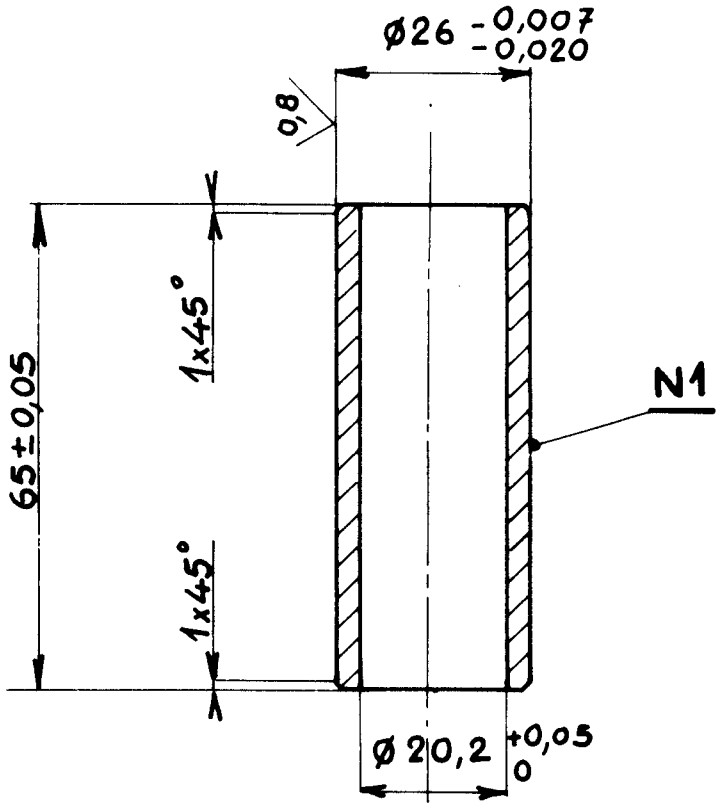
N.1 - MARQUER : CAL 12,7 - A.M



Marquage : N1						
Etat de surface : 0,8 3,2	12-3-30	02	Approbation			
Echelle : 1	Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices	INDICE a
Matière : 35 NCD 16	Support de produit			SUPPORT DE L'ETUI		
Traitement : traité pour 51±1 HRc	N° de dossier OTAN AC 225.(CIII.SC1) D/237			AT-MF 28A244		
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.					

- NOTE -

N.1 - MARQUER : CAL 12,7 - A.M

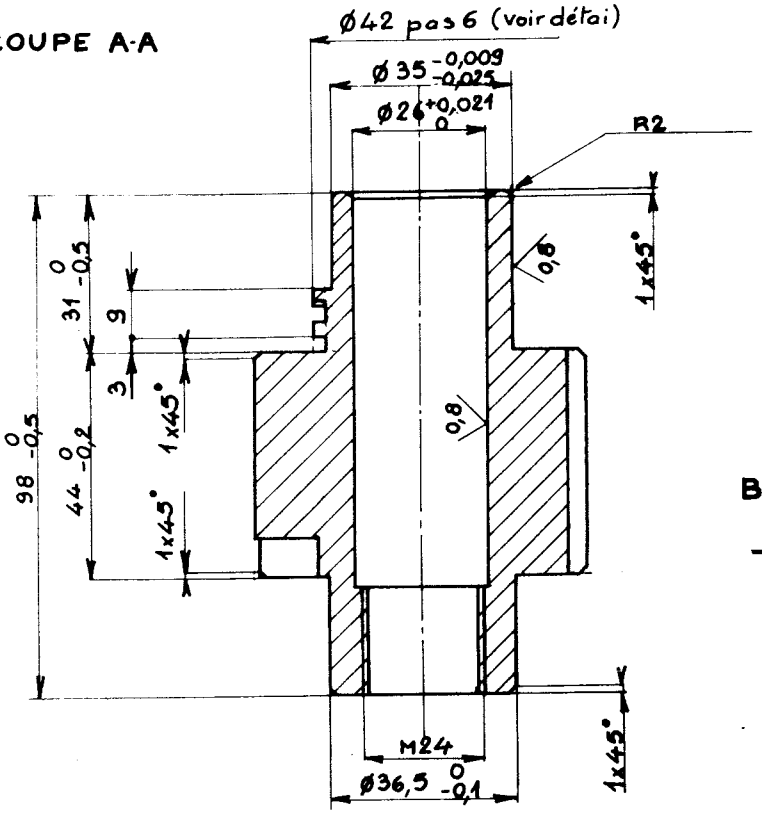


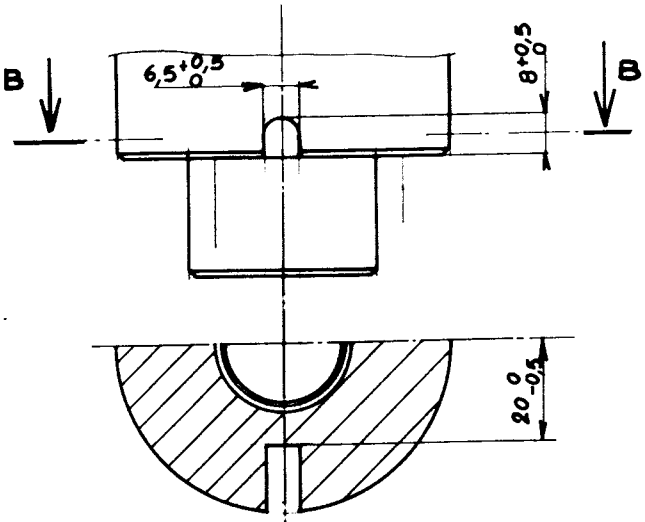
Marquage : N1						
Etat de surface : 0,8 3,2			17.3.92	C2	Approbation	a
Echelle : 1	Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices	INDICE
Matière : 35 NCD16	Support de produit		BAGUE			
Traitement : Traité pour 51 ± 1 HRc	N° de dossier OTAN AC 225.(CIII.S C 1) D/237		AT-MF 28A245			
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.					

N.1 - Filet carré (1 filet 1/2 ajusté avec pièce 28 A 247)

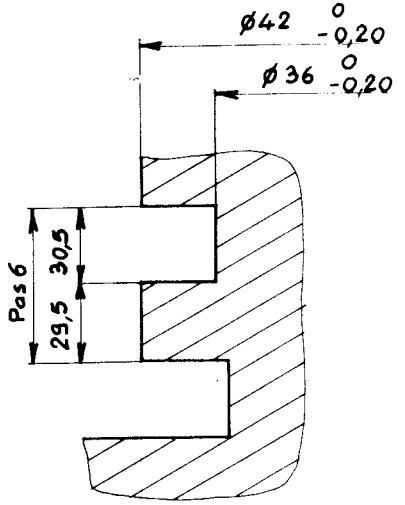
N.2 - Araser le filet incomplet sur le secteur d'entrée du filetage.

COUPE A-A

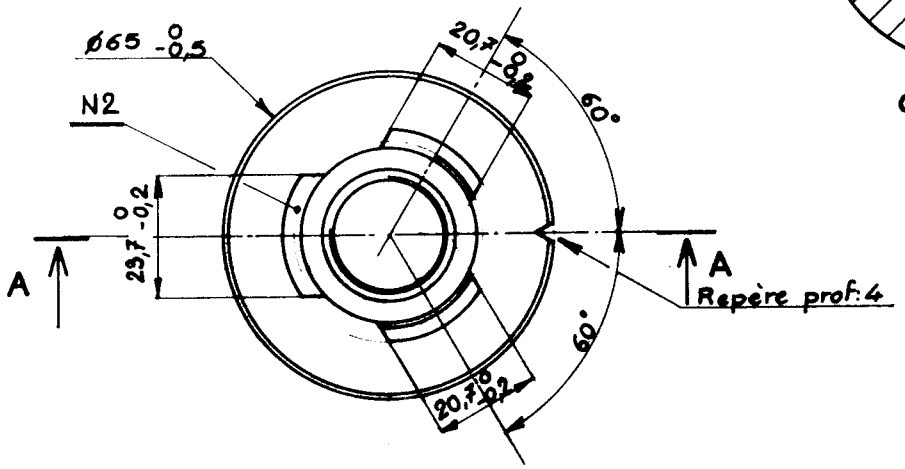




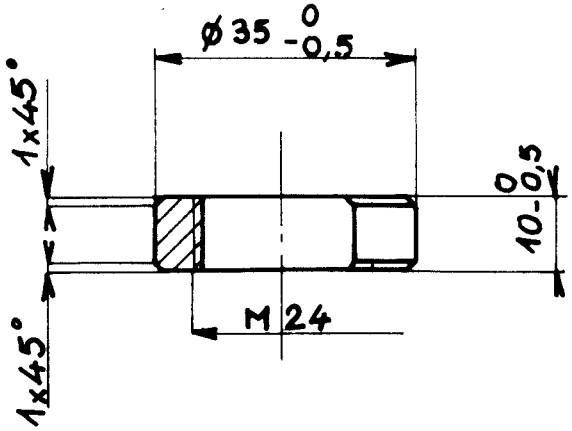
COUPE B-B

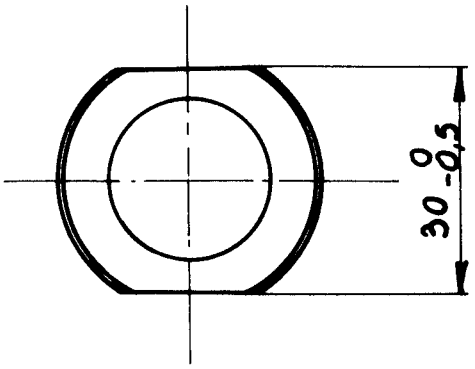


Détail Filetage (échelle 5) N1

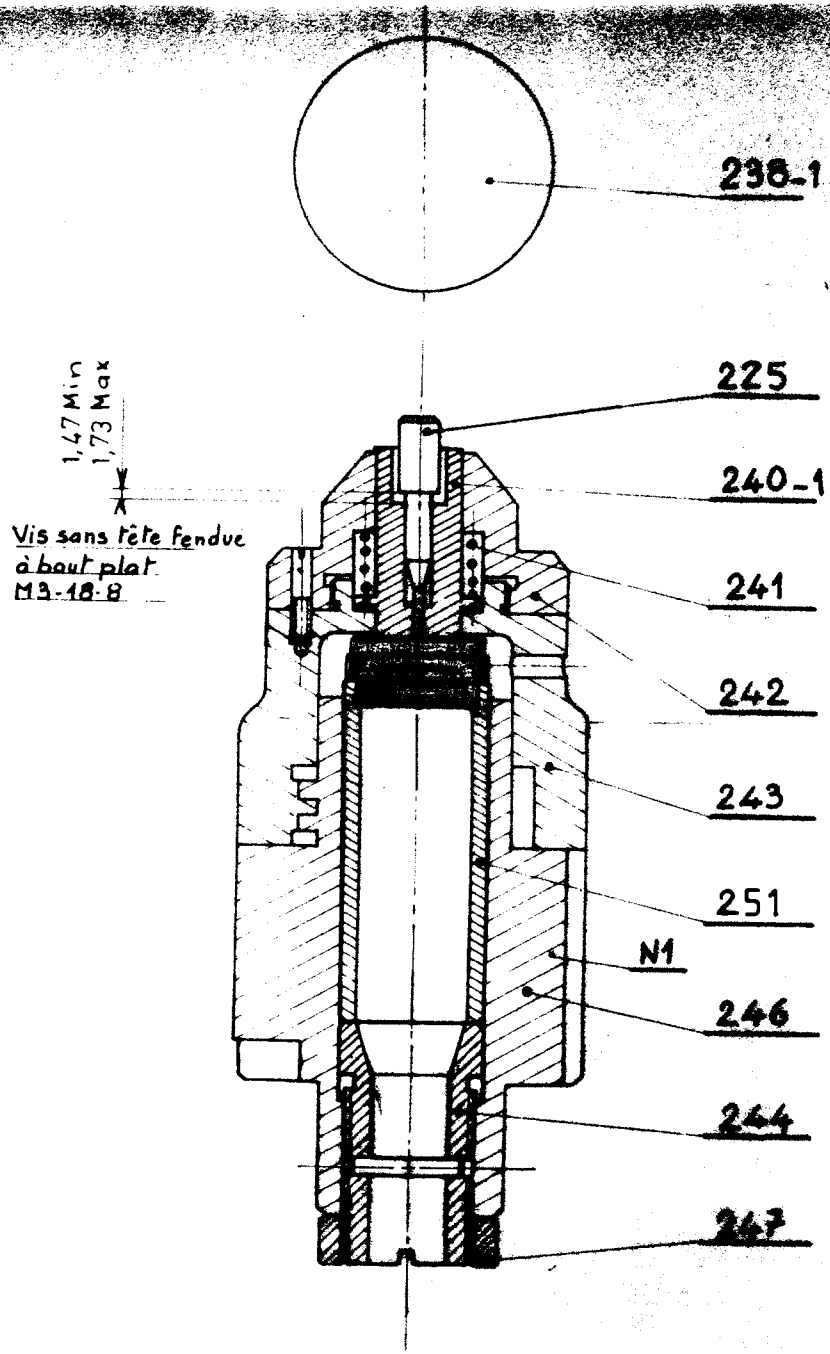


Marquage :				
Etat de surface : 3,2 / 1,6	97.3.26	02	Approbation	
Echelle : 1 (5)	Visa	Date	Rev. Avis	MODIFICATIONS — Nbre d'indice — INDICE B
Matière : XC38	Support de produit		CORPS	
Traitement :	N° de dossier OTAN AC225(CIII.SC1)D/237		AT-MF 28A246	
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.			



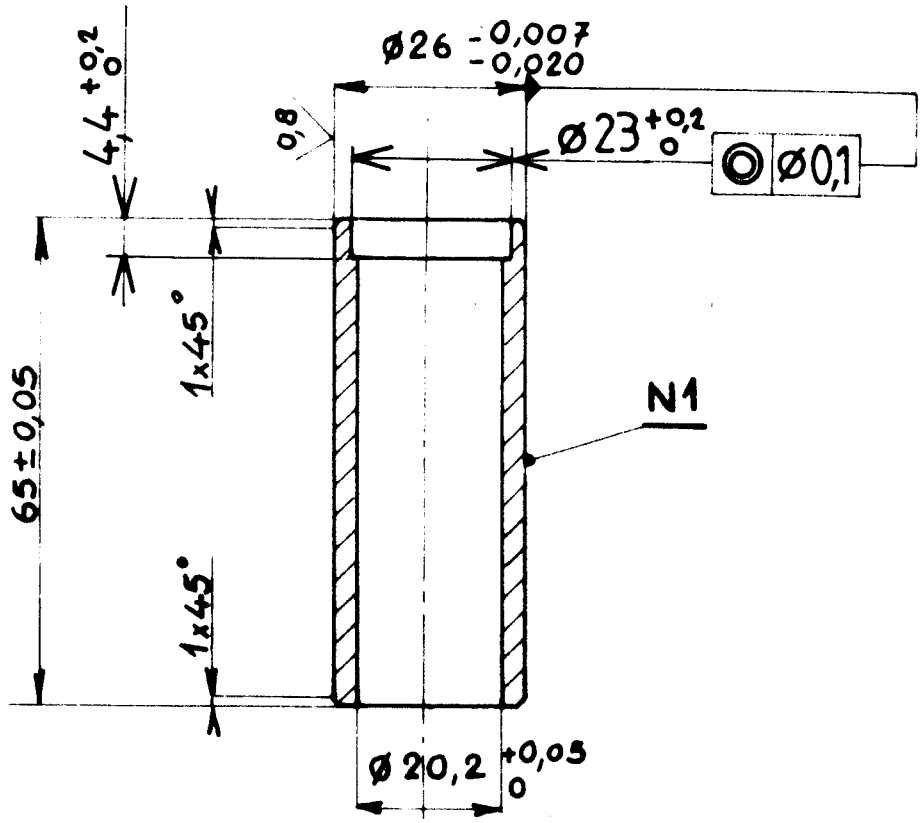


Marquage :						
Etat de surface : 3,2		17-3-97	02	Approbation		a
Echelle : 1	Visa	Date	Réf. Avis	MODIFICATIONS	Nbre d'indices	INDICE
Matière : XC 38	Support de produit			ECROU		
Traitement :	N° de dossier OTAN AC 225.(CIII.SC1) D/237			AT-MF 28A247		
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.S.A. Mod.					



Marquage: N1					
Etat de surface:					
Echelle: 1		Visa	Date	Avis	MODIFICATIONS
Matière:	Grenade 40mm embase amorcée				SUPPORT DE PRODUIT
Traitement:	Original: 1 CETAM	Contre-calque	Tirage		Nom:
Protection superficielle:					Date: DTAT
					AT-MF 28A 250

Ce document est conforme à l'instruction AT-AF-92.S.A. Mod



Marquage : N1				
Etat de surface : 0,8 3,2			Approbation	
Echelle : 1	Visa	Date	Réf. Avis	MODIFICATIONS
Matière : 35 NCD16	Support de produit		BAGUE	
Traitement : Traité pour 51 ± 1 HRc	N° de dossier OTAN AC 225.(CIII.S C 1) D/237		AT-MF 28A 251	
Protection superficielle : Phosphatation	Ce document est conforme à l'instruction AT-AF-02.5.A. Mod.			

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 24

BULLET EXTRACTION TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

24.1 Applicability

4.6 mm, 5.56 mm, 5.7 mm, 7.62 mm, 9 mm and 12.7 mm ammunition submitted for NATO Qualification Approval or NATO Production Testing shall be subjected to the Bullet Extraction Test Procedure defined in this volume.

24.2 NATO Requirements

24.2.1 Need for Consistency of Chemical Content

Bullet extractive effort in newtons (N) shall not be less than the requirement listed below for the relevant calibre:

Calibre	Requirement
4.6 mm	200 N
5.56 mm	200 N
5.7 mm	200 N
7.62 mm	265 N
9 mm	200 N
12.7 mm	900 N

24.3 Ammunition Quantity

Test Ammunition	20 Cartridges
Re-Test Ammunition	20 Cartridges

24.4 Equipment

Required equipment is listed.

a. A tensile testing machine capable of recording the maximum force required to extract the bullet (may be 5,000 N pull force or greater depending on the calibre and design). The rate of travel of the pulling head shall be 7.5 cm to 15 cm per minute (or alternatively the rate of loading shall be 1,800 N to 2,200 N per minute).

b. Holding block suitable for holding a cartridge case head at the extractor groove and with jaws that can grasp the bullet securely.

24.5 Test Procedure

24.5.1 Equipment Set-Up

The machine shall be calibrated at least annually or sooner if directed by national requirements or as needed if doubt arise about the performance of the equipment. Calibration points shall include at least 100 N, 200 N, 400 N, 700 N or 1,100 N. If calibration errors exceed 15 N at scale readings below 900 N, or 30 N at scale readings above 900 N, then the necessary corrective action shall be taken to reduce the errors below these limits before the Bullet Extraction Test is conducted. The method of

calibration shall be by calibrated proof rings or calibrated spring balances which shall yield values within one percent (1%) of true values over the calibrating range.

24.5.2 Method of Conducting the Test

The cartridge shall be inserted into the case holding block on the pulling head and be aligned with the jaws. The jaws shall be secured to the bullet just above the neck of the case and then the load shall be applied. If unexpected or out of specification results are obtained then ammunition of known performance is to be tested to establish confidence in the results being obtained. When the bullet has been extracted from the case, the machine shall be stopped. The tensile indicator records the force required to extract the bullet.

24.6 Recording of Results

All details on Bullet Extraction Test Form No. 24 (Annex 24-A) shall be completed. Each of the twenty (20) bullets extracted shall be weighed and the results recorded for use in determining muzzle energy, if applicable, to the calibre being tested. The ambient temperature, which shall be within the limits of + 15 °C to + 25 °C, is to be recorded on the form.

24.7 Sentencing

The ammunition shall be considered to have met the NATO requirements with respect to Bullet Extraction if the force required to remove each bullet from the cartridge case is not less than:

Calibre	Requirement
4.6 mm	200 N
5.56 mm	200 N
5.7 mm	200 N
7.62 mm	265 N
9 mm	200 N
12.7 mm	900 N

24.8 Re-Test Procedures

If one cartridge fails to meet the requirements of paragraph 24.7, a re-test shall be conducted. The re-test sample size shall be the same as the original test sample. If more than one (1) cartridge fails to meet the requirements of paragraph 24.7, the sample shall be rejected outright with no re-test conducted.

24.9 Re-Test Sentencing

The ammunition shall be considered to have met the NATO requirement if no defects are recorded in the re-test.

ANNEX 24-A
FORM NUMBER 24 – BULLET EXTRACTION TEST

Per the applicable Recording of Results paragraph in Volume 24, the following form for recording the Bullet Extraction Test results is presented on page 24-A-2 of this Annex.

24.A.1 FORM 24 – BULLET EXTRACTION TEST RESULTS

Form Number 24	Page 1of 1		**BULLET EXTRACTION**
Test Centre		Test Reference	
Submitting Country		Lot Number	
Manufacturer		Cartridge Type	
Date Tested		NATO Design No.	

Cartridge No.	Extraction Force (N)	Bullet Mass (g)
1		
2		
3		
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Units: Force - Newtons (N), mass - Grams (g)

Type of Machine	
Rate of Loading - N/min	
Travel Rate of the Pulling Head - cm/min	

Calibration Points (N)	Calibration Error (N)

Room Temperature ^{o}C	

Test Statistics	
Mean Bullet Mass (g)	
Mean Extraction Force (N)	
Maximum Individual Extraction Force (N)	
Minimum Individual Extraction Force (N)	

Remarks

NATO STANDARD

AEP-97

MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 25

PROPELLANT AND PRIMER TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

25.1 Applicability

An analysis of the propellant and primer composition shall be conducted on the 4.6 mm, 5.56 mm, 5.7 mm, 7.62 mm, 9 mm or 12.7 mm ammunition lot being submitted for NATO Qualification Approval. For NATO Production Tests, a Certificate of Conformity is required.[1]

Note 1: See paragraphs 25.5 and 25.5.1 for details and exceptions.

25.2 NATO Requirements

25.2.1 Need for Consistency of Chemical Content

NATO does not specify the chemical composition for propellant or primer composition contained in ammunition submitted for NATO qualification. However, once the acceptability of an ammunition design is established and the design is qualified, then all subsequent production of that ammunition design, which bears the NATO Symbol of Interchangeability on the basis of that qualification, must contain the same propellant and primer composition as identified in the NATO Qualification Approval documentation. Evidence of conformity with the original NATO Qualified Design will be required on submission of subsequent NATO Production Tests.

25.3 Equipment

Equipment used shall be in accordance with the specific analysis techniques.

25.4 NATO Qualification Approval Test

When a nation submits an ammunition sample for NATO Qualification Approval testing, it shall provide the following:

a. The build standard for the propellant which shall comprise a list of chemical constituents of the propellant contained in the ammunition, including the nationally acceptable limits for each constituent.

b. The build standard for the primer composition which shall comprise a list of chemical constituents of the primer composition contained in the ammunition, including the nationally acceptable limits for each constituent.

c. An analysis result for the propellant, showing the amount of each of the constituents present in the sample.

d. An analysis result for the primer composition, showing the amount of each of the constituents present in the sample.

Note: This information will be held by the RTC, in strict confidence, as part of the official NATO design and will only be released to a third party with the permission of the national delegate of the submitting nation.

25.4.1 Compliance with Design

The RTC shall check that the analyses results supplied comply with the chemical build standard supplied.

25.5 Production Test

When a nation submits an ammunition sample for a NATO Production Test, it shall provide a Certificate of Conformity for the propellant and primer compositions confirming that the compositions meet the build standard and tolerances defined in the technical data package for the original NATO qualified ammunition design.

25.5.1 Requirement for a Primer and/or Propellant Analysis

If any results obtained during any phase of the NATO Production Test indicate a possible problem with either the propellant or primer composition, the submitting nation will be requested to conduct an analysis for comparison with the build standard limits provided with the NATO Qualification Approval sample. The results of the analysis will be forwarded to the RTC for sentencing. **This information will be held by the RTC, in strict confidence and will only be released to a third party with the permission of the national delegate of the submitting nation.**

25.6 Sentencing

NATO requirements will be considered to have been met if for:

a. **NATO Qualification Approval Test:** The results of the chemical analysis of the propellant and primer composition, provided by the submitting nation, are within the build standard limits provided with the NATO Qualification Approval sample.

b. **NATO Production Test:** Acceptance will be by provision of a Certificate of Conformity. If it is deemed necessary for a propellant and/or primer composition analysis to be conducted, the results of the chemical analysis of the propellant and primer composition, provided by the submitting nation, shall be acceptable if they are within the build standard limits provided with the NATO Qualification Approval sample.

25.6.1 Notification of Discrepancies

25.6.1.1 Minor Discrepancies

Chemical analysis is not an exact science and is dependent on laboratory techniques appropriate to the particular composition undergoing analysis. This may therefore lead to slight differences in results and very minor departures from the agreed build standard, especially with constituents that are often near their tolerance limit. If a constituent is slightly outside the permitted tolerance, a statement from the testing laboratory is to accompany the result, with an opinion on its relevance and effect on the suitability of the propellant and primer composition. If it is evident that the minor departure from the build standard is not significant, then the propellant and/or primer composition shall be deemed

as acceptable. If a minor difference is regarded as significant by the testing laboratory, then the discrepancy shall be reported by the RTC Superintendent to SG/1 which may call for a new NATO Qualification Approval sample.

25.6.1.2 Major Discrepancies

If significant differences are found between the propellant or primer composition contained in the test sample and the build standard supplied with the NATO Qualification Approval sample, the discrepancy shall be reported by the RTC Superintendent to SG/1 which may call for a new NATO Qualification Approval sample.

25.7 Other Relevant Test Failures

In the event of a failure of any other test in the MOPI that may be related to the propellant or primer composition, the RTC Superintendent may request that the submitting nation conduct a further analysis of the propellant and/or primer composition to assist in determining the cause of the failure. If this is not agreed to by the submitting nation, then for:

a. **NATO Qualification Approval Tests,** the ammunition may be withdrawn from testing by the submitting nation or the submitting delegate may refer the matter to SG/1 for a decision.

b. **NATO Production Tests,** the RTC Superintendent will refer the matter to SG/1 for a decision.

NATO STANDARD

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MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 26

WATERPROOF TEST PROCEDURES

Edition A Version 1

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

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NATO STANDARDIZATION OFFICE (NSO)

26.1 Applicability

4.6 mm, 5.56 mm, 5.7 mm, 7.62 mm, 9 mm and 12.7 mm ammunition submitted for NATO Qualification Approval or NATO Production testing shall be subjected to the Waterproof Test Procedure.

26.2 NATO Requirements

The ammunition shall be considered to have met NATO requirements if no more than fifteen percent (15%) of the cartridges tested display leaks in accordance with the technical parameters of paragraph 26.6.

26.3 Ammunition Quantity

Test Sample Condition	NATO Qualification Approval		NATO Production Test	
	Test Quantity	Re-Test Quantity	Test Quantity	Re-Test Quantity
Untreated	20	20	20	20
Exposed Desert	20	20	NA	NA
Continuous Heating	20	20	NA	NA
Continuous Arctic	20	20	NA	NA

26.4 Equipment

The required equipment is listed below:

a. Vacuum pump, water-type or mechanical.

b. Vacuum gauge capable of recording 100 kPa.

c. Glass desiccator.

d. Metal vacuum reservoir.

e. Tubing, taps, valves and connections as shown on the arrangement drawing at the end of this volume (Annex 26-A).

f. Timing device to indicate thirty (30) second intervals.

g. Petroleum jelly or vacuum grease.

26.5 Test Procedure

26.5.1 Preparation for Testing

Prior to testing, the following procedure shall be followed:

a. Convenient configurations for the reservoir and desiccator are shown in the arrangement drawing at the end of this volume. The desiccator should be at least of sufficient diameter to accommodate five (5) cartridges lying horizontally on a perforated rack or tray, and be of sufficient depth to allow at least five (5) cm of water above the cartridges for the test. The volume of the reservoir should be about five (5) times to fifteen (15) times the volume of air remaining in the desiccator when the desiccator contains sufficient water for conducting the test. A suitable reservoir can be constructed from metal tubing about 0.5 m to 1.5 m long with a diameter 10 cm to 20 cm, the dimensions depending upon the size of the desiccator to be evacuated. The desiccator should be provided with fittings as illustrated in the drawing at the end of this volume.

b. The vacuum pump shall be connected through a screw valve to the vacuum reservoir; a vacuum gauge shall be incorporated in this line between the valve and the reservoir. The desiccator shall be connected to the end of the reservoir by a length of rubber pressure tubing; the lead-in to the desiccator shall be through a two-way ground-glass tap in the lid by which the desiccator can be connected either to the vacuum reservoir or to the atmosphere.

c. The desiccator shall contain a sufficient amount of freshly boiled water to allow approximately a 5 cm head of water above the cartridges. A perforated metal tray shall be placed across the narrow part of the body. The ground glass surface on the lid and body of the desiccator and the glass tap shall be smeared with petroleum jelly or vacuum grease.

26.5.2 Method of Conducting the Test

The procedure described in the following paragraphs shall be repeated until the required number of cartridges have been tested.

a. With the desiccator closed to the vacuum reservoir and the valve open from the reservoir to the vacuum pump, the vacuum pump shall be set in operation. The pressure in the reservoir shall be reduced until the vacuum gauge shows some predetermined reading greater than 50 kPa. This predetermined reading is the vacuum in the reservoir which will, when the reservoir is connected to the desiccator, produce a resulting vacuum of 50 kPa in both. The desired vacuum in the reservoir, approximately 55 kPa to 60 kPa, should be determined by experiment with the particular apparatus to be used and recorded for future reference. When the desired vacuum in the reservoir has been obtained, the valve from the reservoir to the vacuum pump shall be closed, and the pump operation may be stopped.

b. The ammunition to be tested (not exceeding five (5) cartridges at a time) shall be placed horizontally on the tray in the desiccator and the lid placed in position. The glass tap shall be turned to allow the vacuum reservoir to evacuate the desiccator to the required 50 kPa below atmospheric pressure and shall be held at that pressure for thirty (30) seconds (s). The number of bubbles liberated from the mouth and/or the primer of each cartridge shall be observed. At the end of the

specified time (30 s), the vacuum shall be released from the desiccator, the lid removed and the ammunition removed.

26.6 Recording of Results

All details on the Waterproof Test Form No. 26 (Annex 26-B) shall be completed. For recording purposes only, there will be five divisions into which the leaks will be classified:

a. No leak.

b. Slow leak - Case Mouth. A series of two or more air bubbles appearing at the mouth of the case, being liberated at such a rate that only one is in transit to the surface at any one time. A total of at least two bubbles must have been liberated within the 30 second period for it to be classified as a leaking cartridge.

c. Slow leak - Primer. A series of two or more air bubbles appearing at the primer/case interface, being liberated at such a rate that only one bubble from the primer/case interface is in transit to the surface at any one time. A total of at least two bubbles must have been liberated within the 30 second period for it to be classified as a leaking cartridge

d. Fast leak - Case Mouth. A series of air bubbles appearing at the mouth of the case liberated at such a rate that more than one bubble is in transit to the surface at any one time.

d. Fast leak - Primer. A series of air bubbles appearing at the primer/case interface, liberated at such a rate that more than one bubble is in transit to the surface at any one time.

NOTE: One bubble being liberated from the case mouth and/or one bubble being liberated from the primer/case interface within the thirty (30) second time period does not constitute a leaking cartridge.

26.7 Sentencing

The ammunition shall be considered to have met the NATO requirement with respect to watertightness if not more than fifteen percent (15%) of the cartridges tested displayed leaks in accordance with the technical parameters of paragraph 26.6. The samples from each of the climatic conditions and the untreated sample shall be sentenced separately.

26.8 Re-Test Procedures

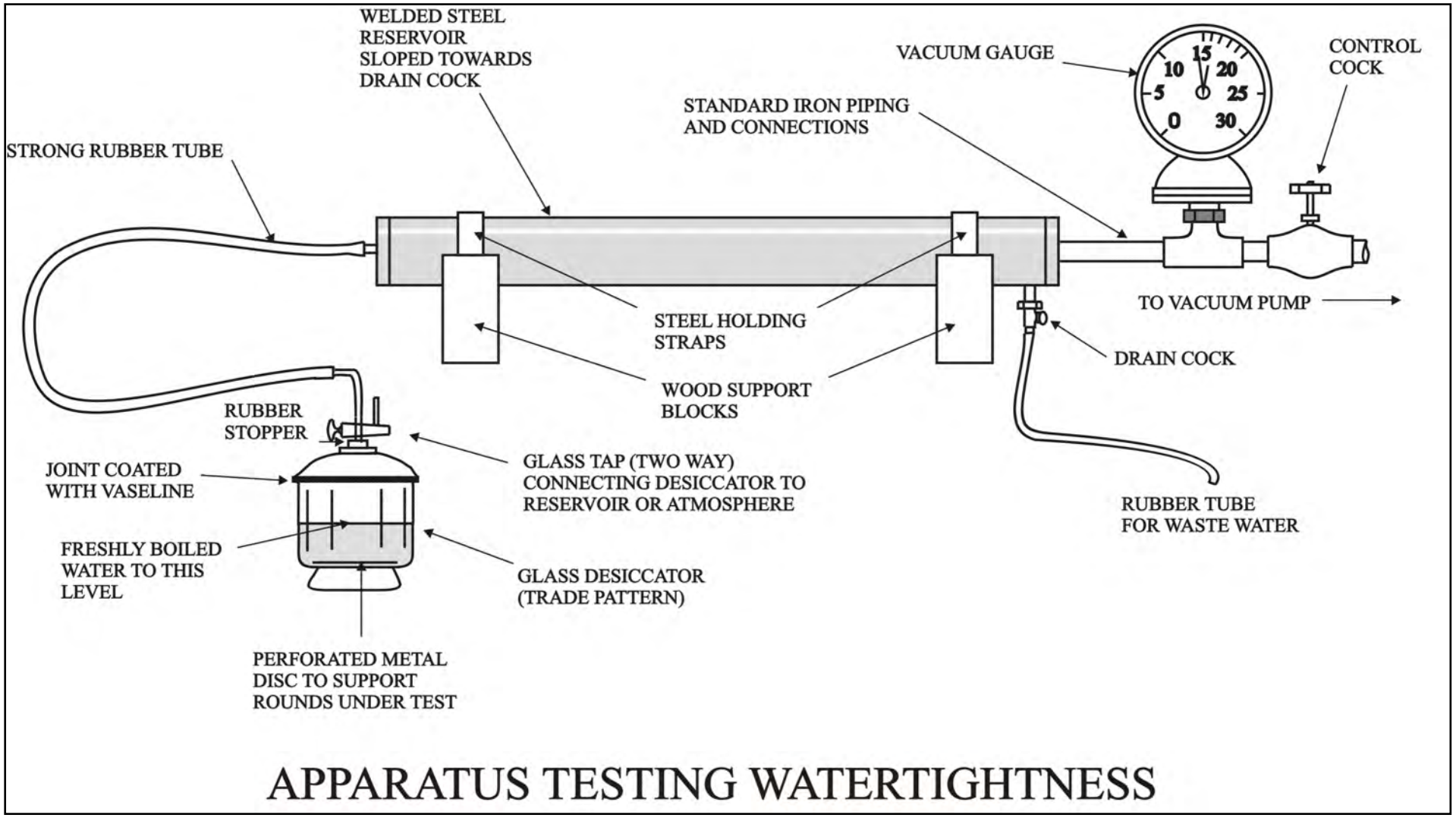
If any of the original test samples fails to meet the specified requirements a re-test is to be conducted for that particular test (Untreated, Exposed Desert, Continuous Heating or Continuous Arctic). The re-test sample size shall be the same as the original test sample for the particular condition(s) being re-tested.

26.9 Re-Test Sentencing

The results from the original test and the re-test shall be combined. The ammunition shall be considered to have met the NATO requirement with respect to watertightness if

not more than fifteen percent (15%) of the combined quantity of cartridges tested displayed leaks in accordance with the technical parameters of paragraph 26.6. The samples from each of the climatic conditions and the untreated sample shall be sentenced separately.

ANNEX 26-A
WATERPROOF TEST APPARATUS



ANNEX 26-B

FORM NUMBER 26 – WATERPROOF TEST

Per the applicable Recording of Results paragraph in Volume 26, the following form for recording the Cook-Off Test results is presented on page 26-B-2 of this Annex.

26.B.1 FORM 26 – WATERPROOF TEST RESULTS

Form Number 26	Page 1of 1		**WATERPROOF / CLIMATIC STORAGE**
Test Centre		Test Reference	
Submitting Nation		Lot Number	
Manufacturer		Cartridge Type	
Date Tested		NATO Design No.	

	Ammunition Test Condition			
Sample Size				
Defects Recorded	**Local Ambient**	**Exposed Desert**	**Continuous Heating**	**Continuous Arctic**
Slow Leak Case Mouth				
Slow Leak Primer				
Fast Leak Case Mouth				
Fast Leak Primer				
No Leaks Total				
Total Percentage Waterproof				

	Ammunition Test Condition			
Retest Sample Size				
Cumulative Sample Size				
Defects Recorded	**Local Ambient**	**Exposed Desert**	**Continuous Heating**	**Continuous Arctic**
Slow Leak Case Mouth				
Slow Leak Primer				
Fast Leak Case Mouth				
Fast Leak Primer				
No Leaks Total				
Cumulative Percentage Waterproof				

NOTE: Primer means the interface between the Cartridge Case and the Primer

Remarks

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MULTI-CALIBRE MANUAL OF PROOF AND INSPECTION (M-CMOPI) FOR NATO SMALL ARMS AMMUNITION

VOLUME 27

COOK-OFF TEST PROCEDURE

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27.1 Applicability

12.7 mm ammunition that contain projectiles with explosive effects submitted for NATO Qualification Approval (QA) testing shall be subjected to the Cook-Off Test Procedure defined in this volume. If a cook-off test was conducted on the design submitted for NATO QA during ammunition development and the test was conducted in accordance with the procedures specified in this volume, then the nation nominating the ammunition may submit those results to the RTC Superintendent who will determine whether the national test results can be accepted in place of the RTC conducting the test.

27.2 NATO Requirements

Ammunition containing projectiles with explosive effects shall meet the NATO requirements if no projectile cooks off within twenty (20) minutes after the cartridge has been chambered in a weapon barrel heated by firing two-hundred (200) cartridges in a single burst.

27.3 Ammunition Quantity

For each NATO Nominated Weapon:

a. 625 cartridges (rounds) of the test sample ammunition.

b. Three (3) cartridges of the test sample ammunition made incapable of being fired by rendering the propellant and primer inert.

27.4 Equipment

a. One (1) of each NATO Nominated Weapon.

b. M9 type links.

c. Suitable mount.

d. Cyclic-Rate Timer. A suitable recording instrument that permits measurements of the rate of fire to within ± 2 % of the true rate of fire.

e. Temperature recording device.

f. Timing device.

27.5 Equipment Set-Up

27.5.1 The test ammunition shall be visually examined for obvious defects. If a defect is found, the defective cartridge shall be replaced and the defect shall be categorized in accordance with AEP-97, Volume 11 and sentenced in accordance with the sentencing requirements of AEP-97, Volume 7.

27.5.2 For each NATO Nominated Weapon, the ammunition shall be linked in one (1) 25-round belt to be used to check the weapon for proper functioning and correct rate of

fire and three (3) 201-round belts for the test. The last cartridge in each of the 201-round belts shall be the cartridge incapable of being fired.

27.5.3 The linked belts shall be visually examined to ensure that each link is correctly positioned on each cartridge and that there are no obvious defects with the links. Any link with an obvious defect shall be removed from the test and replaced with a new link.

27.5.4 Each NATO Nominated Weapon in the test shall be prepared and thoroughly checked. Headspace, firing pin protrusion and barrel gauging shall conform to the dimensions listed in AEP-97, Volume 10.

27.5.5 The weapon shall be installed in the mount.

27.6 Method of Conducting the Test

27.6.1 The weapon shall be checked for proper functioning and applicable rate of fire by firing the 25-round belt of test ammunition in a single burst.

27.6.2 The weapon (barrel and chamber) shall be conditioned to + 20 °C ± 5 °C prior to the firing of the first 201-round belt of test ammunition.

27.6.3 The first belt shall be fired in a single burst with the last cartridge in the belt (inert propellant and primer) being chambered. If a stoppage that exceeds ten (10) seconds occurs during the 200-round burst, the test will be considered invalid and the test shall be repeated.

27.6.4 The weapon shall be observed for twenty (20) minutes for any indications of projectile cook-off.

27.6.5 If a projectile cook-off does not occur, the procedures in paragraphs 27.6.2 through 27.6.4 shall be repeated on the two (2) additional belts.

27.6.6 If a projectile cook-off does occur, the ammunition fails to meet the NATO requirements.

27.7 Recording of Results

All relevant test data shall be recorded on Form No. 27 (Annex 27-A).

27.8 Sentencing

The ammunition shall be considered to have met the NATO requirements if no projectile cooks off within the twenty (20) minute time period in any of the three (3) tests in each NATO Nominated Weapon.

27.9 Re-Test in the Event of Failure

No retest is permitted unless the projectile design is modified and a new ammunition sample submitted.

27.10 Other Defects and Incidents - Sentencing

During any test, if any defects occur that are not related to this particular test, either during firing, or visually after firing, they shall be categorised in accordance with AEP-97, Volume 11 and sentenced in accordance with the cumulative sentencing requirements of AEP-97, Volume 7.

ANNEX 27-A

FORM NUMBER 27 – COOK-OFF TEST

Per the applicable Recording of Results paragraph in Volume 27, the following form for recording the Cook-Off Test results is presented on page 27-A-2 of this Annex.

27.A.1 FORM 27 – COOK-OFF TEST RESULTS

Form Number 27 Page 1of 1					**COOK-OFF**
Test Centre			Test Reference		
Submitting Nation			Lot Number		
Manufacturer			Cartridge Type		
Date Fired			NATO Design No.		

Weapon Type	**Weapon Serial Number**	**Weapon Life**	**Barrel Serial Number**	**Barrel Start Life**	**Head Space (mm)**	**Pin Protrusion (mm)**

Qualification of Test Weapon (Utilizing Test Ammunition)

Serial	Belt Size		Rate of Fire	Keyholing
1	25 Cartridges			

Test Data

		Information Only		
Serial	Belt Size	Rate of Fire	Keyholing	Indications of Projectile Cook-Off
2	201 Cartridges			
3	201 Cartridges			
4	201 Cartridges			

Remarks	Supply Video and or Photographs as supporting evidence if used

AEP-97 (A)(1)