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Barrier-Penetrating Tear Gas Munitions

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This standard was formulated by the Law Enforcement Standards Laboratory (LESL) of the National Bureau of Standards under the direction of Ronald C. Dobbyn and Ralph Gorden, Jr., successive Program Managers for Protective Equipment, and Lawrence K. Eliason, Chief of LESL. Technical research was performed by C. J. Schneider of Calspan Corporation, Buffalo, NY. The standard was written by D. C. Becker with assistance in editing and copy preparation from K. L. Bernard and T. W. Beck, all of Calspan, and revised by Paul H. Krupenie of LESL with technical advice from B. Cadoff of the NBS Gas and Particulate Science Division. The standard has been reviewed and approved by the Technology Assessment Program Advisory Council and adopted by the International Association of Chiefs of Police (IACP) as an IACP standard.

FOREWORD

This document, NIJ Standard-0111.00, Barrier-Penetrating Tear Gas Munitions, is an equipment standard developed by the Law Enforcement Standards Laboratory of the National Bureau of Standards. It is produced as part of the Technology Assessment Program of the National Institute of Justice. A brief description of the program appears on the inside front cover.

This standard is a technical document that specifies performance and other requirements equipment should meet to satisfy the needs of criminal justice agencies for high quality service. Purchasers can use the test methods described in this standard to determine whether a particular piece of equipment meets the essential requirements, or they may have the tests conducted on their behalf by a qualified testing laboratory. Procurement officials may also refer to this standard in their purchasing documents and require that equipment offered for purchase meet the requirements. Compliance with the requirements of the standard may be attested to by an independent laboratory or guaranteed by the vendor.

Because this NIJ standard is designed as a procurement aid, it is necessarily highly technical. For those who seek general guidance concerning the selection and application of law enforcement equipment, user guides have also been published. The guides explain in nontechnical language how to select equipment capable of the performance required by an agency.

NIJ standards are subjected to continuing review. Technical comments and recommended revisions are welcome. Please send suggestions to the Program Manager for Standards, National Institute of Justice, U.S. Department of Justice, Washington, DC 20531.

Before citing this or any other NIJ standard in a contract document, usérs should verify that the most recent edition of the standard is used. Write to: Chief, Law Enforcement Standards Laboratory, National Bureau of Standards, Gaithersburg, MD 20899.

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NIJ STANDARD
FOR
BARRIER-PENETRATING TEAR GAS MUNITIONS

CONTENTS

COMMONLY USED SYMBOLS AND ABBREVIATIONS

A	ampere	H	henry	nm	nanometer
ac	alternating current	h	hour	No.	number
AM	amplitude modulation	hf	high frequency	o.d.	outside diameter
cd	candela	Hz	hertz (c/s)	Ω	ohm
cm	centimeter	i.d.	inside diameter	p.	page
CP	chemically pure	in	inch	Pa	pascal
c/s	cycle per second	ir	infrared	pe	probable error
d	day	J	joule	pp.	pages
dB	decibel	L	lambert	ppm	part per million
dc	direct current	L	liter	qt	quart
°C	degree Celsius	lb	pound	rad	radian
°F	degree Fahrenheit	lbf	pound-force	rf	radio frequency
diam	diameter	lbf·in	pound-force inch	rh	relative humidity
emf	electromotive force	lm	lumen	s	second
eq	equation	ln	logarithm (natural)	SD	standard deviation
F	farad	log	logarithm (common)	sec.	section
fc	footcandle	*M*	molar	SWR	standing wave ratio
fig.	figure	m	meter	uhf	ultrahigh frequency
FM	frequency modulation	min	minute	uv	ultraviolet
ft	foot	mm	millimeter	V	volt
ft/s	foot per second	mph	mile per hour	vhf	very high frequency
g	acceleration	m/s	meter per second	W	watt
g	gram	N	newton	λ	wavelength
gr	grain	N·m	newton meter	wt	weight

area = unit^2 (e.g., ft^2, in^2, etc.); volume = unit^3 (e.g., ft^3, m^3, etc.)

PREFIXES

d	deci (10^{-1})	da	deka (10)
c	centi (10^{-2})	h	hecto (10^2)
m	milli (10^{-3})	k	kilo (10^3)
μ	micro (10^{-6})	M	mega (10^6)
n	nano (10^{-9})	G	giga (10^9)
p	pico (10^{-12})	T	tera (10^{12})

COMMON CONVERSIONS
(See ASTM E380)

ft/s × 0.3048000 = m/s
ft × 0.3048 = m
ft·lbf × 1.355818 = J
gr × 0.06479891 = g
in × 2.54 = cm
kWh × 3 600 000 = J
lb × 0.4535924 = kg
lbf × 4.448222 = N
lbf/ft × 14.59390 = N/m
lbf·in × 0.1129848 = N·m
lbf/in^2 × 6894.757 = Pa
mph × 1.609344 = km/h
qt × 0.9463529 = L

Temperature: $(T_{°F} - 32) \times 5/9 = T_{°C}$

NIJ STANDARD FOR BARRIER-PENETRATING TEAR GAS MUNITIONS

1. PURPOSE AND SCOPE

This standard establishes minimum performance requirements and methods of test, including safety and handling aspects, for barrier-penetrating tear gas (less-than-lethal) munitions. These munitions are used by law enforcement officers to dispense tear gas within buildings, from protected positions a safe distance away, to temporarily incapacitate barricaded persons. The tear gas is contained in a projectile that is propelled from a variety of launchers, including the 37-mm riot gun and 12-gage shotgun. The scope of this standard is limited to barrier-penetrating tear gas munitions that incorporate ortho-chlorobenzylidene malononitrile (CS) or alpha-chloroacetophenone (CN) as the active agent (lacrimator), regardless of the means of dissemination of the tear gas.

2. CLASSIFICATION

2.1 Type I—Light-Duty Penetrator

A munition that is not designed to penetrate barriers as a primary mission, but may do so in some circumstances.

2.2 Type II—Single-Thickness Penetrator

A munition that penetrates single-thickness barrier materials. Dissemination occurs after or while penetrating materials such as single-glazed windows, plywood sheathing, or plasterboard.

2.3 Type III—General-Purpose Penetrator

A munition that penetrates multiple layers of lightweight construction material. Dissemination of the tear gas occurs after the penetration of barriers such as hollow-core doors, residential partitions, or nonmasonry exterior walls, and double- or triple-glazed windows.

3. DEFINITIONS

3.1 Active Agent

The chemical constituent that is the lacrimator in a barrier-penetrating tear gas munition.

3.2 Explosive Dissemination

A means of dispersing the active agent that uses an explosive charge to vent and empty the chamber containing the agent, regardless of the fusing method used.

3.3 Fair Hit

A fair hit is an impact on the test target material at least 5 cm (2 in) from any structural member of the test stand.

3.4 Kinetic Dissemination

Dispersion of the active agent contained in a projectile upon its impact resulting solely from the kinetic energy of the projectile.

3.5 Lacrimator

A chemical that is an irritant upon contact with the eyes, causing blinding tears (CS, CN).

3.6 Less-than-Lethal

A controlled level of force used as an alternative to firearms, *not* intended to create a high risk of death or permanent injury. A less-than-lethal chemical agent (e.g., tear gas, whose active agent is classed as an irritant) is capable of rapidly producing a temporary and fully reversible incapacitating physiological reaction in humans, except under exceptional circumstances. Recovery should be fast and complete when an affected individual is removed from contact with it. No matter how discrete the use of an irritant agent is, there always exists some risk of injury or of a lethal exposure.

3.7 Lot

The lesser of:

1) All units of identical design constituting a single delivery from a manufacturer, all of which are from the same production batch.
2) All units of identical design continuously produced by a manufacturer without a change in batch number of agent, carrier, chemicals used for dissemination of agent, fuse, or container.

3.8 Manufacturer

The manufacturer is the company whose name or brand name appears on the label of the munition.

3.9 Pyrotechnic Dissemination

Dispersion of the active agent contained in a projectile resulting from the burning of a pyrotechnic mixture that vaporizes the agent, which escapes and condenses in the cooler air.

3.10 Riot Gun

A weapon designed specifically to fire tear gas munitions of 37-mm diam (also termed 1 1/2-in gun, 38-mm gun, or gas gun).

3.11 Tear Gas

See Lacrimator.

3.12 Tear Gas Munition

For the purpose of this standard, a tear gas munition is a device that is or includes a projectile containing tear gas that can be propelled to a distant target to dispense the tear gas during or after impact with the target. The device may include an integral means of propulsion, such as a primer and gunpowder for firing from a conventional shotgun or riot gun, or it may be designed to be propelled from a separate launching mechanism. The device may rely upon kinetic energy to dispense the tear gas, or it may use either a pyrotechnic or explosive dispensing system.

4. REQUIREMENTS

4.1 Acceptance Criteria

A barrier-penetrating tear gas munition (hereafter referred to simply as munition) shall meet all of the requirements of this standard.

4.2 Labeling and Workmanship

Five of five units selected at random from a lot shall conform to this requirement as determined by section 5.2; i.e., the label shall be legible and complete, and workmanship shall conform to standard machine practice.

4.2.1 Minimum Labeling on Munition

The information supplied to the user by the manufacturer, in the form of legible labeling on the munition itself, shall include:

1) Name and/or model number identifying the munition, lot number, and caliber, if appropriate.
2) Name and address of the manufacturer, and that of the company that assembled and/or filled the munition, if other than the manufacturer.
3) The generic name of the active agent (CS or CN) with or without its chemical name. If a color of labeling is used, it shall conform to the convention that indicates agent identity: blue for CS, red for CN.
4) Net weight in grams.
5) An expiration date corresponding to storage life at a maximum of 25 °C (77 °F) and 95 percent RH, under the assumption that the munition will experience no extraordinary vibration or handling.
6) A caution against direct fire at individuals.
7) A caution concerning secondary wall penetration (see sec. 4.5.4).
8) An unequivocal caution concerning incendiary potential if any pyrotechnic material is carried in the projectile, whether for fusing or dissemination.

Note: Items 5–8 are considered "Additional Information" for 12-gage munitions (see sec. 4.2.2).

4.2.2 Additional Information

The additional information supplied to the user by the manufacturer, in the form of labeling on the munition, on unit packaging, or on supplementary printed matter which shall accompany each munition, shall include:

1) Classification of the munition in accordance with section 2.
2) The name and/or model number identifying the munition. The lot number shall appear on each package or box.
3) The name and address of the manufacturer.
4) A description of the launching system(s) for which the munition is designed, including any cautions to the user.
5) The dissemination mode of the munition, using generic terminology to describe both initiation and the mode (e.g., impact-triggered kinetic dissemination, pyrotechnic, delay-fused pyrotechnic dissemination, impact-triggered blast dispersion dissemination).
6) Effective dispersal region, stated as an approximate diameter or volume of an enclosure within which the concentration of active agent dispersed by the munition may cause incapacitation.
7) Maximum range and effective range of the munition when fired from the appropriate launcher.
8) Cleaning instructions for residue of active agent.
9) Storage instructions and statement of any environmental conditions which might alter the performance or penetration characteristics of the munition.
10) First aid information, including instructions such as: Remove exposed individual to fresh air, face into wind with eyes open. Avoid rubbing eyes or scratching irritated skin. If necessary, flush affected body areas with *cool* water, especially eyes. After removal to fresh air, an incapacitated individual can normally be expected to recover completely in 15 min or so with no medical attention.

4.3 Reliability

No more than one of the munitions fired during tests in accordance with sections 5.5 and 5.6 shall fail to fire or to disseminate the tear gas (i.e., 28 of 29 specimens shall function properly).

4.4 Accuracy

At least 12 of 24 rounds shall fall within a 0.5-m diam circle when tested in accordance with section 5.5.

4.5 Penetration

4.5.1 Type I Munition—Light-Duty Penetrator

When tested in accordance with section 5.6, a type I munition shall penetrate one thickness of 1/2-in insulation board at a range of 50 m and, in addition, shall not penetrate more than two thicknesses of 1/2-in insulation board witness panels. The board surfaces shall be perpendicular to the horizontal and to the plane of the munition trajectory. At least four of five fair hit test specimens shall meet this requirement.

4.5.2 Type II Munition—Single-Thickness Penetrator

When tested in accordance with section 5.6, a type II munition shall penetrate one thickness of 1/2-in plywood sheathing at a range of 50 m and, in addition, shall not penetrate more than two thicknesses of 1/2-in insulation board witness panels. The plywood sheathing surface shall be 60° from the horizontal plane and perpendicular to the plane of the munition trajectory (as shown in fig. 4). The witness panels shall be perpendicular to the horizontal and to the plane of the munition trajectory. At least four of five fair hit test specimens shall meet this requirement.

4.5.3 Type III Munition—General-Purpose Penetrator

When tested in accordance with section 5.6, a type III munition shall penetrate two thicknesses of 1/2-in plasterboard at a range of 50 m and, in addition, shall not penetrate more than two thicknesses of 1/2-in insulation board witness panels. The plasterboard surface shall be 60° from the horizontal plane and perpendicular to the plane of the munition trajectory (as shown in fig. 4). The witness panels shall be perpendicular to the horizontal and to the plane of the munition trajectory. At least four of five fair hit specimens shall meet this requirement.

4.5.4 Secondary Wall Penetration

When tested in accordance with section 5.6, a munition that penetrates three thicknesses of 1/2-in insulation board witness panels shall be classified as a secondary wall penetration munition. Such munition must include in the additional information (sec. 4.2.2) a statement such as: "CAUTION: This device may penetrate a second barrier, resulting in dissemination in a room beyond the primary target."

4.6 Range

When tested in accordance with section 5.7, the maximum range of a munition projectile shall not exceed that stated by the manufacturer (sec. 4.2.2) by more than 20 percent. Five of five munitions shall conform to this requirement.

4.7 Active Agent

When tested in accordance with section 5.8, the active agent shall be that stated by the manufacturer, and the net weight of the active agent contained in the munition shall be within ± 20 percent of the manufacturer labeled quantity (see sec. 4.2.1). Five of five munitions shall conform to this requirement.

4.8 Storage Stability

When tested in accordance with section 5.9, following a 30-d period of storage at elevated temperatures, each munition shall exhibit a weight loss of no more than two percent; four of five munitions shall assay within ± 20 percent of the labeled agent quantity; and upon dissection, five of five munitions shall show no evidence of corrosion or any deterioration that would make the munition unsafe to handle, store, or transport. At least three of five munitions shall meet the requirements of section 4.5 appropriate for the type of munition when tested in accordance with section 5.6.

4.9 Rough Handling

When tested in accordance with section 5.11, five of five munitions shall show no evidence of failure or damage that renders handling, storage, or transportation of the munition (or parts thereof) unsafe, and all five units shall function normally when fired.

5. TEST METHODS

Caution: These tests are to be conducted only by persons familiar with the materials and precautions involved. Some of these tests would be hazardous if performed without proper training or facilities.

5.1 Test Specimens

A minimum of 59 test specimens, selected at random from a single lot, are required to conduct the tests that follow.

5.2 Physical Inspection

Inspect five units and manufacturer-provided user information for compliance with section 4.2 of this standard.

5.3 Test Conditions

Indoor tests shall be performed under laboratory conditions, i.e., at ambient atmospheric pressure and room temperature [approx. 20 °C (68 °F)]. Outdoor tests shall be performed with an air temperature of 10 to 35 °C (50 to 95 °F), a wind speed of less than 16 km/h (10 mph), and no precipitation.

5.4 Instrumentation and Miscellaneous Equipment

The following items are necessary to perform the required tests:

a) Gas chromatograph(s) equipped with thermal conductivity or flame ionization detector.
b) A recorder or similar device to obtain a record of each chromatogram.
c) A suitable device or method for obtaining areas under the gas chromatographic peaks.
d) Volumetric pipets and flasks.
e) Hacksaw and/or metal shears.
f) Microsyringes.
g) Chemicals, best purity available.
h) CS and CN of known purity.
i) Environmental chamber capable of maintaining 65±2 °C (149±3.6 °F) for 30 d.
j) Laboratory balances capable of weighing devices $\geq$100 g to an accuracy of ±0.1 g and devices $<$100 g to an accuracy of ±0.01 g.
k) Laboratory ball mill.
l) An outdoor test range approved for tear gas, of sufficient size to provide a minimum safety zone of 400 m behind the test targets. The firing point shall be equipped with a firing bench, chair, spotting telescope, and sandbag rests.
m) Weapons (launchers) appropriate for the munition under test.
n) The penetration test target support, which simulates frame building walls, shall be constructed as shown in figure 1. The stand shall be adjustable to permit the test target to be held either in a vertical position or at an angle of 60° from the horizontal, as shown in figure 4. The test targets consist of 33.7×61-cm (4×24-in) pieces of 1/2-in construction grade (five ply) plywood, 1/2-in plasterboard, or 1/2-in insulating fiberboard as appropriate for the munition under test.
o) The witness material stand shall be constructed as shown in figure 2. The witness material consists of 1.22×1.22 m (4×4 ft), 1/2-in insulating fiberboard.

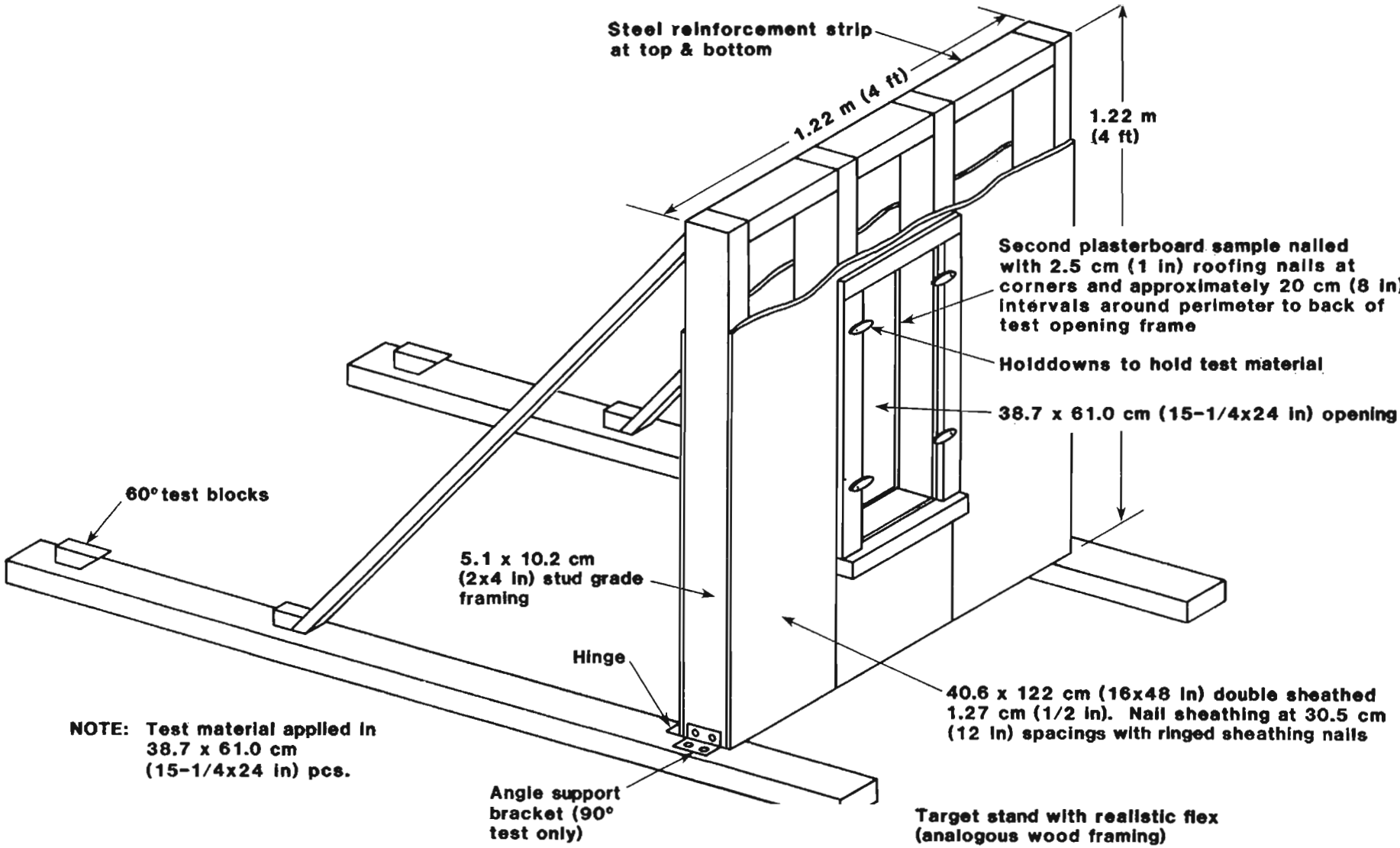

FIGURE 1. *Penetration test target support.*

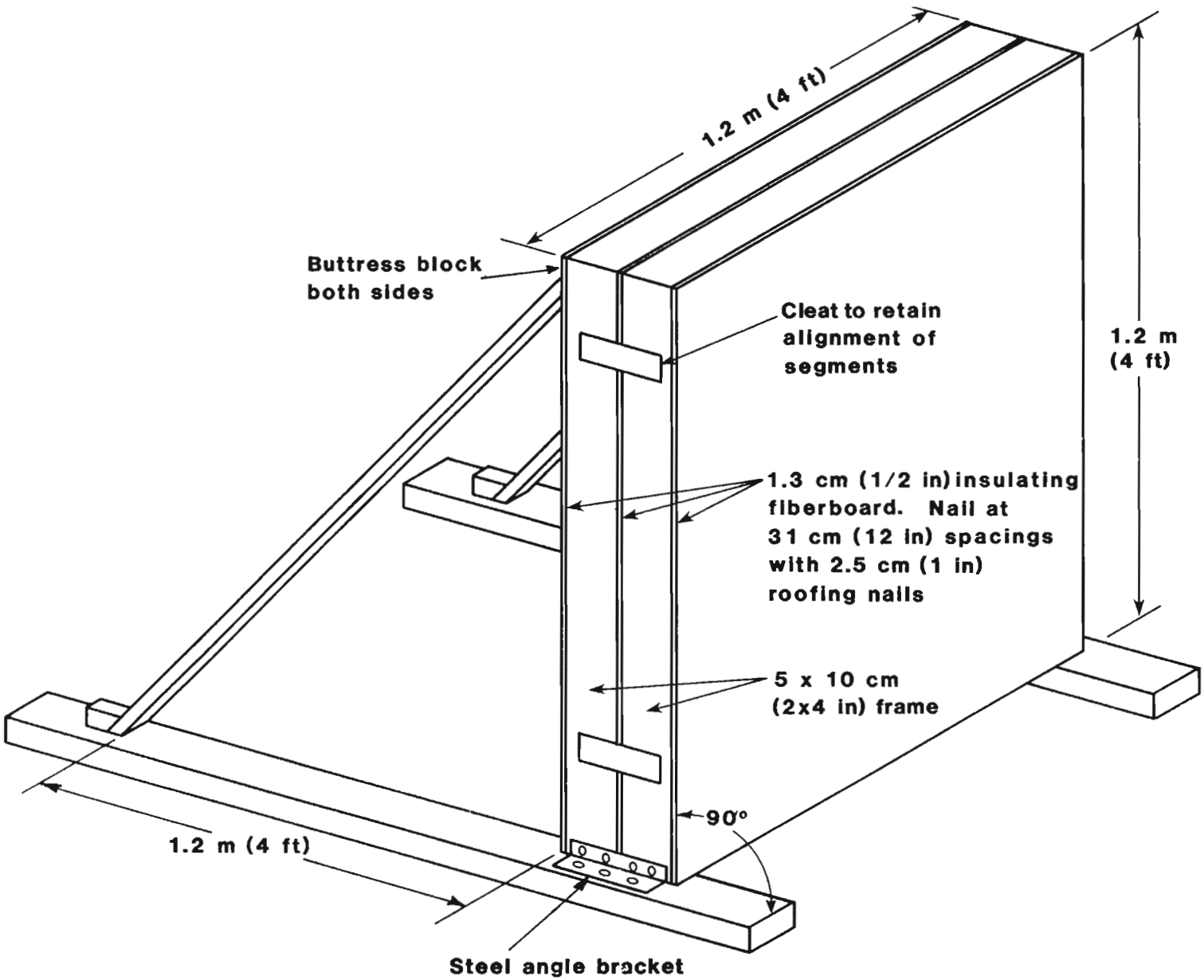

FIGURE 2. *Witness material stand.*

5.5 Accuracy Test

All munition firing is to be done by a single individual, qualified as a weapon marksman and experienced in bench shooting. All firing tests shall be performed using sandbag support.

5.5.1 Test Target

The accuracy test target shall consist of a square white- or buff-colored paper sheet 1.5×1.5 m (4.9×4.9 ft). The center of the target shall be marked with a blackened 4×4 cm (1.6×1.6 in) aim point, and the horizontal and vertical lines that bisect the target shall be marked with lines 5 mm in width, extending to the edges of the target. For convenience, the entire target can be divided into 1-cm squares as shown in figure 3. Mount the test target on the test support stand perpendicular to the line of fire at a distance of 50 m from the firing point.

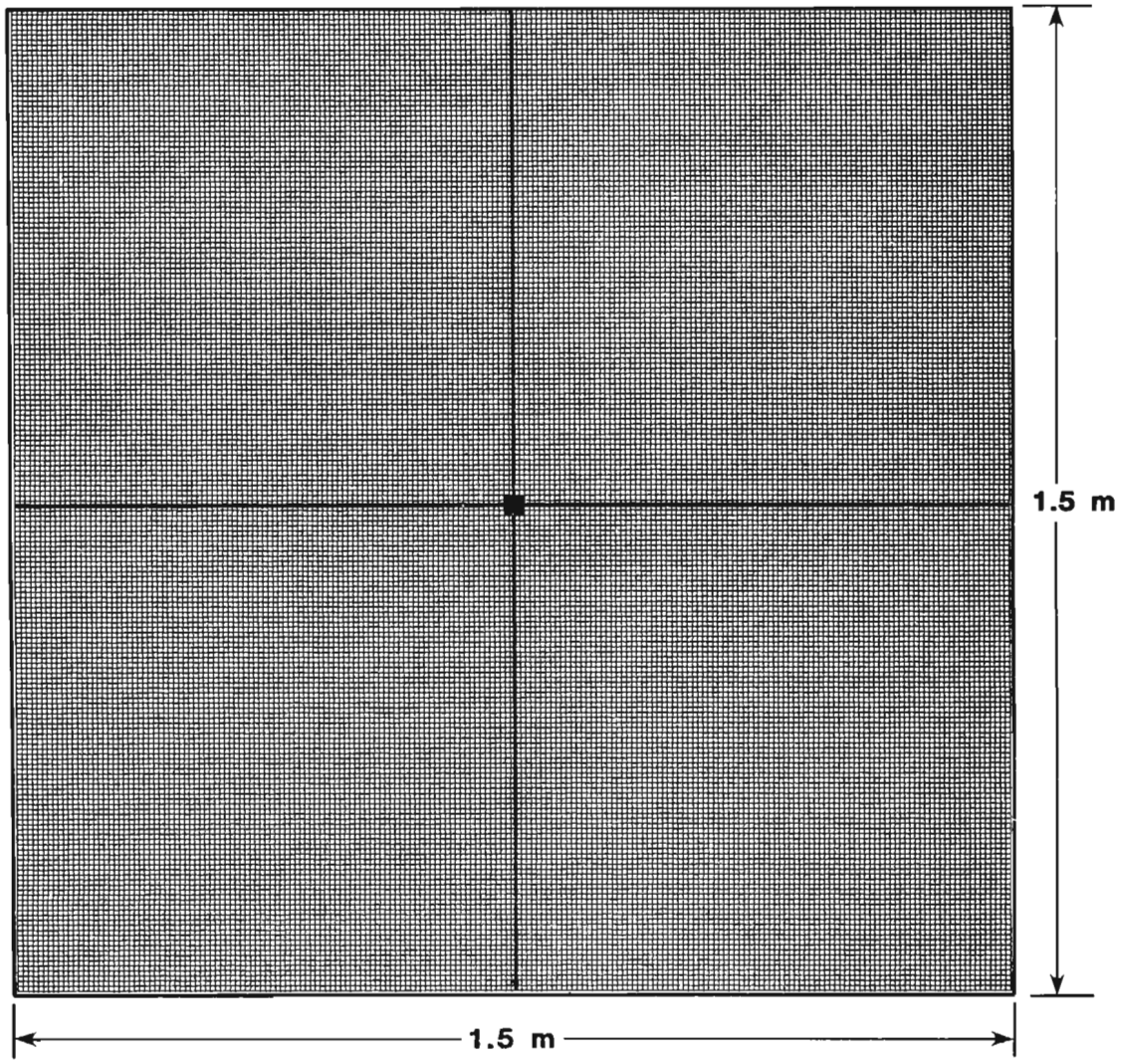

FIGURE 3. *Target marking accuracy test.*

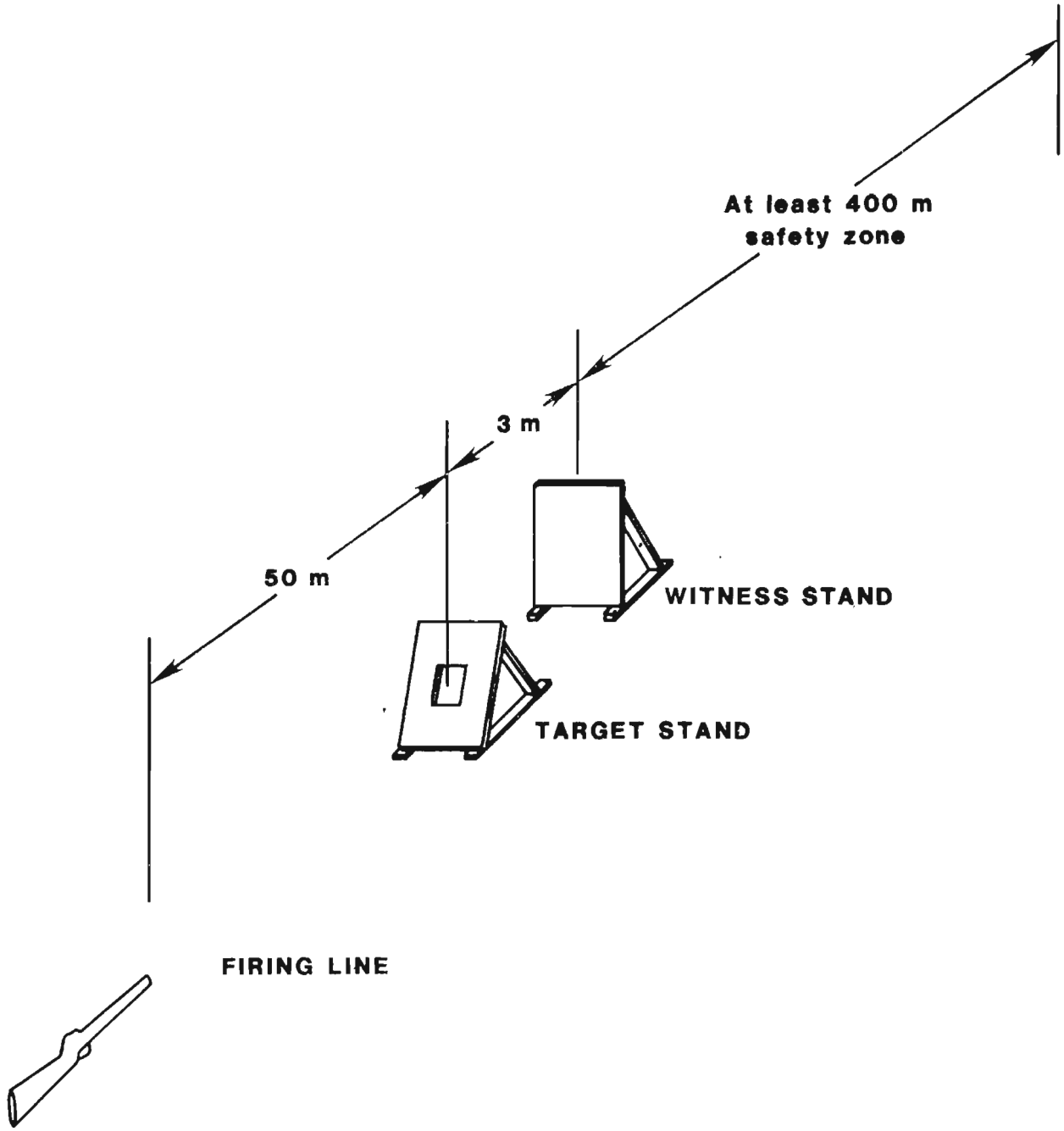

FIGURE 4. *Penetration test setup.*

5.5.2 Test Procedure

Prior to firing actual test specimens, three rounds of any available ammunition for the test weapon shall be fired in a direction away from the target to stabilize and condition the weapon. The test engineer and/or the assistant shall then unpack one test specimen, record its lot number and any visible anomalies, chamber the round, sight the weapon on the center of the target, and fire the munition. The approximate point of impact on the target shall be observed visually by use of the spotting telescope and recorded on the test data sheet. Similarly, the observed agent dissemination and overall behavior of the munition following impact on the range shall be recorded.

This procedure shall be repeated, firing a munition at intervals of 3 to 5 min, until all 24 test specimens have been chambered and fired, or recorded as duds.

After completion of the test firings, remove the target from the test stand and determine the center point of all specimen impacts by: 1) measuring the distance of the center of each impact hole from the bottom edge of the target and calculating the average distance, 2) measuring the distance of the center of each impact hole from one side edge of the target and calculating the average distance. Mark the impact center point on the target (or an underlaid sheet) at the intersection of the two average distances and construct a circle of 0.25-m radius about the center point.

Count the number of impact holes having centers within the 0.5-m diam circle and record the number on the data sheet. Overlapping holes may be identified from the data sheet for the observed impact points of individual test rounds.

5.6 Penetration Tests

Position the test support stand, perpendicular to the line of fire, 50 m from the firing point, with the witness stand 1.5 m directly behind it. Mount the barrier target material, appropriate for the type of munition under test, on the test stand and witness segments of 1.27-cm (1/2-in) insulating fiberboard on the witness material stand.

Condition the weapon as described in section 5.5.2. Unpack a test specimen and record the lot number and other information as in section 5.5.2, chamber the round, sight the weapon on the center of the target and fire. The penetration performance, impact point, the events at the witness stand (missed, impacted and whether penetration occurs), and the dissemination performance shall be observed and recorded on the data sheet. This procedure shall be repeated until five fair hits have been made on the target material. A new test target shall be used for each firing test, and the witness material should be replaced as necessary. Note whether four of the five fair hits penetrate the barrier target.

5.6.1 Type I Munition

Test each type I munition with the target stand in the vertical position, using one thickness of 1/2-in insulating fiberboard as the target insert.

5.6.2 Type II Munition

Test each type II munition with the target stand adjusted to an angle of 60° from the horizontal position (as in fig. 4), using one thickness of 1/2-in (five ply) sheathing plywood as the target insert.

5.6.3 Type III Munition

Test each type III munition with the target stand adjusted to 60° from the vertical and two thicknesses of 1/2-in plasterboard as the target insert.

5.7 Range Test

Unpack five test specimens, one at a time, and record the lot number and other information as in section 5.5.2. Condition the weapon, if required, in accordance with section 5.5.2. Chamber the round, aim the weapon along the center of the test range at an elevation that lies in the range between 30° and 40° from the horizontal and fire. Record the distance from the firing point to the point of projectile impact as the maximum range. Note whether the maximum range exceeds that stated by the manufacturer by more than 20 percent. Repeat the test until all five specimens have been fired.

In the event that the munition uses a timing mechanism or delay fuse to dispense the agent, such systems shall be disabled by a competent munitions technician prior to conducting this test.

5.8 Chemical Assay

The chemical analysis of the munition agent shall be performed by gas-liquid chromatographic techniques.

5.8.1 Sampling

A competent munitions technician, observing proper safety precautions, shall disassemble five test specimen munitions, removing primer and propellant, disabling any mechanical arming mechanism, and removing any explosive used for agent dissemination. The projectile or any separable unit that contains the agent shall be removed.

Munitions that employ a projectile filled with the active agent dissolved in a liquid carrier shall be frozen in liquid nitrogen, or dry ice and acetone, as appropriate, and cut open with a hacksaw in a chemical fume hood. The contents shall be placed in a covered Petri dish of known weight and the volatile carrier allowed to evaporate at room temperature.

A munition that contains loose powder or solid cakes of the active agent shall be cut open with a hacksaw in a chemical fume hood and have the contents removed.

Prior to preparation of the sample for chemical analysis, determine the net weight of the active agent to the nearest 0.01 g if its weight is ≥ 100 g and to the nearest 0.01 g if its weight is < 100 g. Note whether the net weight of the active agent agrees with that stated by the manufacturer.

5.8.2 Analysis Procedure

Either a thermal conductivity or flame ionization detector is recommended. Operating parameters and detection sensitivities will depend on the particular gas chromatograph and detector combination. Recent publications give the following gas chromatographic conditions for analysis of CS and CN:

A. Column: 1.8-m glass column packed with 3 percent OV-101 on 80–100 mesh Supelcoport.

Column Temperature: Programmed from 150 to 250 °C over a 5-min period and held at 250 °C for 5 min [1][1].

B. Column: 1-m by 2-mm i.d. glass column packed with 2 percent OV-17 coated on Supelcoport acid washed-dimethydichlorosilane (AW-DMCS) (100–120 mesh).

Column Temperature: Programmed from 100 to 270 °C at 15 °C/min.

Detector Temperature: 260 °C [2].

Dissolve a weighed sample of CS or CN of known purity, as appropriate for the munition under test, in (undenatured) absolute ethanol and dilute the solution serially to yield three standard solutions spanning the concentration range of interest, based upon the manufacturer-stated net weight of contents and agent concentration. A suitable internal standard may be used to obtain results of greater precision. At least two syringe injections of each of the three standards are then run on the gas chromatograph and the average area responses are plotted vs. the concentration (mg/mL or μg/mL) of agent, corrected to 100 percent purity. This calibration curve is used in determining the quantity of active agent.

Following calibration of the chromatograph, prepare for analysis a sample of the munition agent obtained in accordance with section 5.8.1. Agents in the form of a solid cake must first be broken down to particles approximately 1 mm in size by gently crushing with nonsparking tools in a chemical fume hood.

Weigh a portion of the particles and place the sample in a sealable Mason jar with a known volume of ethanol and complete the extraction by running the jar on a ball mill for 2 h. Weighed samples of agent in the form of loose powder or as residue from liquid carrier solution can be dissolved directly into a known volume of ethanol.

Once the initial agent/ethanol solution has been prepared, perform serial dilution if necessary to adjust the concentration to the calibration range of the chromatograph.

Perform the gas chromatographic analyses of each test specimen in the same manner as for the calibration standards. Use the calibration curve to determine the percent by weight of the agent, taking into account the weight of the test sample and the serial dilution factors.

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[1] Numbers in brackets refer to the references in appendix A.

Calculate the total weight of active agent in the munition as the product of the measured concentration (%w/w) of the active agent and the weight of the contents (or residue) of the munition as determined in section 5.8.1. Note whether the quantity of agent agrees with that stated by the manufacturer.

5.9 Thermal Storage Test

Select 10 specimens of the munition under test and record the lot number and other information in accordance with section 5.5.2. Weigh each specimen $\geq$100 g to the nearest 0.1 g and each specimen $<$100 g to the nearest 0.01 g. Place the specimen in a chamber meeting the requirements of section 5.4 and store the munition at a controlled temperature of 65$\pm$2 °C (149$\pm$3.6 °F) for a period of 30 d. Inspect each munition periodically, at least once a week throughout the storage period, for any evidence of deterioration or leakage.

At the end of the 30-d high temperature storage, the munition shall be allowed to cool to ambient temperature. Weigh each munition to the accuracies specified above, and calculate the percent weight loss, if any.

Subject five of the test specimens to the penetration test specified in section 5.6, as appropriate for the type of munition under test. Note whether at least three of the five specimens meet the requirements of section 4.5.

Disassemble five of the test specimens in accordance with section 5.8.1 and inspect all parts for any evidence of corrosion or deterioration that would make the munition unsafe to handle, store, or transport. Following the inspection, subject each munition to the chemical analysis test in accordance with section 5.8.2. Note whether four of the five specimens assay within $\pm$20 percent of the labeled agent quantity.

5.10 Rough Handling Test

Subject five munitions to test method 102.1 of MIL-STD-331A [3].

Following completion of this jumble test, inspect each munition for any visible damage that would pose a safety problem in handling, storage, or transport.

Those munitions that show no visible safety-related damage shall be chambered in a suitable weapon and fired on the outdoor range. Note whether the munition functions properly and disseminates the agent in a normal manner.

APPENDIX A—REFERENCES

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☆ U.S. Government Printing Office: 1985—491-518/46683