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30 November 1964
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16 March 1966

MILITARY SPECIFICATION

INCREMENTS, PROPELLANT M1A1, M2A1, M3A1, M181 and XM182 (MADE FROM PROPELLANT, M8)

1. SCOPE

1.1 Scope.-This specification covers five propellant increments made from M8 propellant for use in mortar ammunition.

1.2 Classification.-The propellant increments shall be of the following designations:

M1A1	For use in 81MM Mortars, M1 and M29, w/Cartridges, HE, M43A1 and M43A1B1.
M2A1	For use in 81MM Mortars, M1 and M29, w/Cartridges, HE, M56 and M56E1; Illuminating, M301A1 and M301A2: Smoke, M57 and M57E1.
M3A1	For use in 60MM Mortars, M2 and M19, w/Cartridges, HE, M49A2 and M49A3 (A2E1); Smoke, M302; TP, M50A2.
M181	For use in 60MM Mortars, M2 and M19, w/Cartridges, HE, M49A4 (A2E2); Smoke, M302A1 (E1); TP, M50A3 (A2E1).
XM182	For use in 60MM Mortars, M2 and M19, w/Cartridges, Illuminating, M83A3

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein.

FSC: 1376

SPECIFICATIONS

FEDERAL

PPP-B-621	-	Boxes, Wood, Nailed and Lock-Corner

MILITARY

MIL-B-117	-	Bags and Sleeves, Interior Packaging
MIL-B-2427	-	Boxes, Ammunition Packing; Wood, Nailed
MIL-A-2[illegible]50	-	Ammunition and Special Weapons; General Specification for
MIL-B-3106	-	Board, Composition, Water-Resistant, Solid
MIL-B-13239	-	Barrier Material, Waterproofed, Flexible, All Temperatures
MIL-I-45607	-	Inspection Equipment, Supply and Maintenance of

STANDARDS

MILITARY

MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes (ABC-STD-105).
MIL-STD-109	-	Quality Assurance Terms and Definitions
MIL-STD-286	-	Propellants, Solid, Sampling, Examination and Testing
MIL-STD-414	-	Sampling Procedures and Tables for Inspection by Variables for Percent Defective
MIL-STD-652	-	Solid Propellant for Cannon Requirements and Packing
MIL-STD-1168-		Lot Numbering of Ammunition
MIL-STD-1235-		Single and Multilevel Continuous Sampling Procedures and Tables for Inspection by Attributes

DRAWINGS

ARMY

20-4-619	Marking Diagram and Sealing of Fiberboard Cartons for Shipment of Propellant Increments
71-12-15	Increment, Propellant, M1A1 for 81MM Mortar Ammunition, Assembly and Details
76-4-46	Box, Packing, with Metal Liner, M24 for Smokeless Powder, Assembly and Details
76-4-59	Box, Packing, Metal-Wood, M18 for Smokeless Powder Assembly
7548645	Carton, Packing, Reusable Collapsible for High Explosive, Assembly Details, Packing and Marking
7549033	Container, Metal, Universal, M25, for Propellants and Explosives

8796522	Marking Diagram for Sealing for Wooden Packing Boxes
8858577	Marking Diagram and Sealing of Container, Metal, Universal, M25, for Shipment of Propellants
8858848	Marking Diagram and Sealing of Metal Lined Wooden Packing Boxes for Shipment of Propellants
8865214	Increment, Propellant, M2A1, Assembly
9205610	Increment, Propellant, M3A1, for 60MM Mortar Ammunition; Assembly and Details
9216090	Charge, Propelling, Increment, M181
9216363	Charge, Propelling, Increment, XM182

(Copies of specifications, standards, drawings and publications required by the contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer).

2.2 Other publications.-The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

CODE OF FEDERAL REGULATIONS

Title 49 - Transportation, Parts 171-179

The Code of Federal Regulations is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., 20402. Orders for the above publication should cite: "49 CFR 171-179 (latest revision)."

3. REQUIREMENTS

3.1 M8 Propellant

3.1.1 Material.-The propellant shall be M8 in sheet form, conforming to the requirements of Standard MIL-STD-652.

3.1.2 Form.-The finished propellant shall be made in the form of square or rectangular sheets. The sheets shall be in accordance with the applicable drawings (dwgs.).

3.1.3 Weight.-The individual increment weight necessary for the velocity prescribed in Table II shall be pre-determined by the contractor on the basis of an advance estimate of the propellant charge weight-velocity relationship. The estimate shall be made by a proving ground ballistic test unless otherwise authorized by the Government. The weight of the individual increments shall be adjusted tc the desired weight within the tolerance specified in Table I.

TABLE I

Increment Designation	Specified Tolerance
M1A1	± 6 grains
M2A1	± 7 grains
M3A1	± 5 grains
M181	± 5 grains
XM182	± 5 grains

3.2 Increment assembly.-The propellant increment assembly and all components thereof shall be in accordance with the applicable drawings and specifications.

3.3 Ballistic functioning

3.3.1 Velocity.-The muzzle velocity shall be as specified in Table II when determined in accordance with paragraph 4.3.1.

TABLE II
Prescribed Velocity

Increment Designation	mps Min.	mps Max.	fps Min.	fps Max.	Loading Zone (No. of Increments)
M1A1	212.4	217.3	697	713	6
M2A1	171.3	176.2	562	578	4
M3A1	155.4	160.3	510	526	4
M181 (W/M302A1 only)	129.5	138.7	425	455	4
XM182	133.8	143.0	439	469	4

The following projectile weights shall be used to attain a velocity level within the prescribed limits (see Table II and 4.3.1).

TABLE III

Increment Designation	Projectile Model	Projectile Weight, lbs.
M1A1	81MM, HE, M43A1	7.04
M2A1	81MM, HE, M56	10.92
M2A1	81MM, Illum., M301A2	10.15
M3A1	60MM, HE, M49A2	2.90
M181	60MM, WP, M302E1	4.08
M181	60MM, HE, M49A2E2	3.12
XM182	60MM, Illum., M83A3	4.08

3.3.2 Velocity uniformity.-The lot standard deviation of velocity shall not exceed those specified in Table IV when determined as specified in paragraph 4.3.1 (see 4.2.3.1.2.1 and 6.9).

TABLE IV

Increment Designation	Prescribed Maximum Velocity Standard Deviation	
	mps	fps
M1A1	1.65	5.4
M2A1	1.65	5.4
M3A1	1.65	5.4
M181 (w/M302A1 only)	1.37	4.5
XM182	2.44	8.0

3.3.3 Pressure.-No individual corrected pressure during the velocity uniformity series shall exceed the limits specified in Table V.

TABLE V

Increment Designation	Maximum Individual Pressure (psi)
M1A1	7,200
M2A1	7,200
M3A1	6,000
M181 (w/M302A1 only)	6,000
XM182	5,500

3.4 Workmanship.-The propellant increments shall show no visible evidence of moisture and shall be free of cracked, torn, deformed or otherwise distorted propellant sheets. The stitches, bags and seals shall be without breaks, tears, grease or noticeable foreign matter. The best commercial practices shall be used in the formulation under this specification, and all other applicable documents.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.-Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements. Reference shall be made to Standard MIL-STD-109 in order to define terms used herein. The provisions of Specification MIL-A-2550 shall apply.

4.1.1 Submission of product.-At the time the completed lot of product is submitted to the Government for acceptance, the contractor shall supply the following information accompanied by a certificate which attests that the information provided is correct and applicable to the product being submitted:

a. A statement that the lot complies with all of the quality assurance provisions specified within this specification.

b. Number of batches of product inspected (shall be made available upon request by the contracting officer).

c. Results obtained, by defect code, for all inspections performed (shall be made available upon request by the contracting officer).

d. Drawing, specification number and date, together with an identification and date of changes.

e. Certificates of conformance on all material purchased by the contractor when such material is controlled by Government or commercial specifications referenced in any of the contractual documents (shall be made available upon request by the contracting officer).

f. Number of items in the lot.

g. Date submitted.

h. Eight copies of propellant description sheet AMC Form 1047 (00 Form 1204) containing the applicable data (see 6.6).

4.1.2 The certificate shall be signed by a responsible agent of the certifying organization. The initial certificate submitted shall be substantiated by evidence of the agent's authority to bind his principal. Substantiation of the agent's authority will not be required with subsequent certificates unless, during the course of the contract, this authority is vested in another agent of the certifying organization.

4.2 Inspection provisions.-The term "lot" as used throughout this specification refers to an inspection lot, which is defined as an essentially homogeneous quantity of propellant from which a representative sample is drawn and inspected to determine conformance of the lot with applicable requirements. The sample selected shall represent only that quantity of propellant from which the sample was drawn and shall not be construed to represent any prior or subsequent quantities presented for inspection. A lot shall consist of one or more batches of propellant produced by one manufacturer, in accordance with the same specification and same specification revision, under one continuous set of operating conditions. Each lot shall consist of that quantity of propellant which has been subjected to the same unit chemical or physical process intended to make the final product homogeneous. The criteria and procedures for the assignment of lot numbers shall be in accordance with Standard MIL-STD-1168.

4.2.2 Examination.-Inspection for critical defects, (and major defects, when so specified), shall be 100 percent. Sampling plans and procedures for major and minor defects shall be in accordance with Standard MIL-STD-105 except that continuous sampling plans in accordance with Standard MIL-STD-1235 may be used if approved by the procuring activity. Also, at the option of the procuring activity, AQL's and sampling plans may be applied to individual characteristics listed using an AQL of 0.65 percent for each minor defect and an AQL of 0.40 for each major defect, except where 100 percent inspection is specified. Equipment necessary for the performance of the inspections listed shall be in accordance with paragraph 4.2.4.

4.2.2.1 Final pull

Categories	Defects	Method of Inspection	Code No.
Critical:	None defined.		

Major:	100 percent inspection		
101.	Thickness other than prescribed (see paragraph 4.2.3.3).....	Gage	01001

Minor: None defined.

4.2.2.2 Increment, propellant, prior to bag assembly (see drawing 71-12-15, 8865214, 9205610, 9216090, or 9216363, as applicable).

Categories	Defects	Method of Inspection	Code No.
Critical:	None defined.		
Major:	100 percent inspection		
101.	Weight other than prescribed (see paragraph 4.2.3.4).....	Mechanical Weight Classifier	02001
Major:	AQL 1.0 percent		
102.	Diameters of holes other than prescribed.....	Approved Tooling	02002
103.	Length of sides other than prescribed.....	Gage	02003
104.	Distance between centers of holes other than prescribed.....	Approved Tooling	02004
105.	Stitching other than prescribed....	Visual	02005
106.	Notching improper.....	Visual	02006
107.	Evidence of poor workmanship (see 3.4).....	Visual	02007

Minor: None defined.

4.2.2.3 Cellophaned increment (see drawing 71-21-15, 8865214, 9205610, 9216090, or 9216363, as applicable).

Categories	Defects	Method of Inspection	Code No.
Critical:	None defined.		
Major:	100 percent inspection		
101.	Additional or missing propellant that would cause contents of bag to be outside of the increment weight tolerance.....	Visual	03001

Major:	AQL 0.65 percent		
102.	Bag torn or perforated	Visual	03002
103.	Crimp seal incomplete, too narrow, brittle, or otherwise improper	Visual	03003
104.	Evidence of poor workmanship	Visual	03004
Minor:	AQL 1.50 percent		
201.	Length of sides other than prescribed	Scale	03005
202.	Marking missing, misleading, or unidentifiable	Visual	03006

4.2.2.4 Sealed inner liner, (see drawing 7548645).

Categories	Defects	Method of Inspection	Code No.
Critical:	None defined.		
Major:	AQL 0.40 percent		
101.	Liner damaged so that contents are exposed	Visual	04001
102.	Bag incompletely sealed	Visual	04002
Minor:	None defined.		

4.2.2.5 Sealed wood packing box (see paragraph 5.1.1 if applicable). Sealed fiberboard carton (see drawing 20-4-619 if applicable).

Categories	Defects	Method of Inspection	Code No.
Critical:	None defined.		
Major:	AQL 0.65 percent		
101.	Banding or strapping missing, broken or loose	Visual-Manual	05001
102.	Board broken or split	Visual	05002
103.	Contents exposed	Visual	05003
Minor:	AQL 1.50 percent		
201.	Banding or strapping improperly engaged	Visual-Manual	05004
202.	Contents move when shaken	Manual	05005
203.	Marking missing, misleading, or illegible	Visual	05006
204.	Nails, screws or fasteners loose	Visual	05007

4.2.2.6 Box or container, prior to filling (see drawing 76-4-59).

Categories	Defects	Method of Inspection	Code No.
Critical:	None defined.		
Major:	AQL 0.40 percent		
101.	Cracks or holes in metal liner (as applicable)	Visual	06001
102.	Foreign matter on interior	Visual	06002
Minor:	None defined.		

4.2.2.7 Sealed box or container, (see drawing 76-4-59).

Categories	Defects	Method of Inspection	Code No.
Major:	AQL 0.65 percent		
101.	Cover incompletely closed	Visual-Manual	07001
102.	Gasket missing or broken	Visual	07002
103.	Wooden cover split or otherwise damaged (when applicable)	Visual	07003
Minor:	AQL 2.50 percent		
201.	Car seal missing, unsealed or improperly positioned	Visual-Manual	07004
202.	Crack or hole in metal container	Visual	07005
203.	Hardware improperly engaged	Visual	07006
204.	Marking misleading or unidentifiable	Visual	07007
205.	Bare areas in exterior coating of metal container the sum of which is in excess of 1/4 square inch	Visual	07008

4.2.3 Testing

4.2.3.1 Sampling.-Seven containers shall be randomly selected from the lot, one from a sub lot. Where the lot consists of fewer than seven sub lots, each sub lot shall be represented by at least one container. Sub lot identities shall be marked on each container.

4.2.3.1.1 Surveillance sample.-1.[illegible] pounds of increments shall be taken from each of three randomly chosen sub lots. The total sample weight of approximately 5 pounds shall be appropriately marked and packaged to indicate sub lot identities prior to packing for shipment (see 6.3). Preparation for shipment shall be in accordance with Standard MIL-STD-286, Section 2.

4.2.3.1.2 Ballistic sample.-An approximately equal number of increments shall be withdrawn from each of seven containers to provide the minimum ballistic sample for 70 degrees F. tests indicated in Table VI. Each portion of the sample shall be packed in a separate air-tight container and labeled in accordance with Standard MIL-STD-286, Section 2.

TABLE IV

Increment Designation	Ballistic Sample (No. of Increments, Minimum)
M1A1	42
M2A1	28
M3A1	28
M181 (See 6.8)	28
XM182	28

4.2.3.1.2.1 Velocity.-If the mean velocity of the sample differs from the applicable requirement specified in 3.3.1, the lot shall be rejected, Code No. 08001.

4.2.3.1.2.2 Velocity uniformity.-If the product of 0.69 times the standard deviation of velocity for the sample exceeds the applicable requirement specified in 3.3.2, the lot shall be rejected, Code No. 09001.

4.2.3.1.2.3 Individual Pressure.-If any individual corrected pressure fails to comply with the applicable requirement specified in 3.3.3, the lot shall be rejected, Code No. 10001.

4.2.3.2 Retest.-If for any reason the proving ground considers that test conditions have detrimentally affected the test results, and it declares the results invalid, a new test shall be conducted using additional charges as necessary.

4.2.3.3 Final roll sheet thickness inspection.-Check every pull from each final roll by measuring four (4) randomly selected sheets. Measure the sheet in four (4) places, right side, left side, tail end, and pull end. Measurements should be approximately at the center of the edge being measured. If one thickness measurement is outside of the limit, the pull shall be rejected.

4.2.3.4 Weight inspection (Major defect)

4.2.3.4.1 Each increment shall be weighed on a mechanical weight classifier, or other approved weighing apparatus, to determine acceptability with applicable weight requirements. Only increments with acceptable weights shall be added to the lot.

4.2.3.4.2 A sample of increments shall be randomly selected throughout each lot in accordance with Standard MIL-STD-105. The lot shall be considered acceptable provided that no individual increment weight of the total number inspected exceeds the established weight limits of 3.1.3. The weight of the increments sampled shall be determined by shadowgraph scales or other approved equivalent weighing apparatus.

4.2.4 Inspection equipment.-For the performance of all tests and examinations specified in 4.2 and 4.3, commercial inspection equipment should be employed (see 6.10). The contractor shall have available, and utilize correctly, this equipment, and is charged with the responsibility of insuring that proper calibration procedures are followed. Government approval of all inspection equipment is required prior to its use for acceptance purposes.

4.3 Test methods and procedures

4.3.1 Proving ground tests.-These tests shall be conducted at a Government Proving Ground in accordance with the Aberdeen Proving Ground Acceptance Test Procedure, P-VAT, and Supplements P60M-1, P60M-2 and P81M/60M-1, as applicable.

4.3.1.1 Uniformity test. Seven (7) rounds shall be assembled with the designated projectiles (see Table III) and number of randomly chosen increments as specified in Table II to obtain the prescribed velocity. The charge for each round shall consist of propellant increments from one sample container only, with appropriate identification between the container and complete round. Seven (7) standard reference rounds shall be similarly assembled, but with reference propellant. Both groups shall be conditioned to constant temperature at 70 degrees Fahrenheit (see 6.7).

No more than five minutes shall elapse from the time the round is removed from the conditioning chamber until it is fired and the temperature of the day at the time of firing shall be recorded. Velocity mean and standard deviation shall be calculated after reducing results to standard conditions. Test results shall be reported in accordance with 6.4.

4.3.1.2 Extreme temperature firings.-A seven round uniformity series shall be fired at -65 degrees F and at +145 degrees F. for information only on the first three lots of a production run.

5. PREPARATION FOR DELIVERY

5.1 Packing

5.1.1 Level A.-Propellant increments shall be packed in heat sealed barrier bags complying with Type I, Class E of Specification MIL-B-117. The barrier bag size shall be 22 1/2 inches long by 22 1/2 inches wide, nominal. Approximately 15 pounds of propellant shall be packed in each bag and closed by means of heat sealing. Two heat sealed bags shall be packed in a wooden box conforming to Grade A, Type I, Class 3 of Specification MIL-B-2427. Both ends, top, bottom and sides of wooden box shall be lined with composition board conforming to Type I or II of Specification MIL-B-3106. The box shall be closed and strapped in accordance with Appendix of the box specification. The net weight shall not exceed 30 pounds of propellant.

5.1.2 Level B.-Propellant increments shall be packed in accordance with paragraph 4.3 of MIL-STD-652.

5.1.3 Level C.-Propellant increments shall be packed in fiberboard carton conforming to Carton No. 1 of Drawing 7548645 except that liner shall be manufactured from barrier material conforming to Type I, Class E of Specification MIL-B-117. Alternatively, a wood box meeting the requirements of the Code of Federal Regulations, Parts 171-179, may be used in lieu of the fiberboard carton.

5.2 Marking

5.2.1 Level A.-Exterior containers shall be marked in accordance with Drawing 8796522. The DOT marking shall be "Propellant Explosive - Class A."

5.2.2 Level B.-The M17, M18 and M24 containers shall be marked in accordance with Drawing 8858848. The M25 container shall be marked in accordance with Drawing 8858577.

5.2.3 Level C.-The fiberboard carton or other container shall be marked in accordance with Drawing 20-4-619.

6. NOTES

6.1 Ordering data.-Procurement documents shall specify the following:

a. Title, number and date of this specification.
b. Packing requirements (see 5.1).
c. Designation of increment.

6.2 Inspection code numbers.-The five-digit code numbers assigned to the inspections herein are to facilitate future data collection and analysis by the Government.

6.3 Surveillance samples.-Samples shall be forwarded to Picatinny Arsenal, Dover, New Jersey, ATTN: SMUPA-VG, for the propellant surveillance test program in accordance with MIL-STD-652.

6.4 Submission of test data.-In addition to the normal distribution of records, when propellant is procured by the Department of the Army, one copy of all ballistic test data shall be forwarded to: Commanding Officer, Picatinny Arsenal, ATTN: SMUPA-ND2, and one copy to ATTN: SMUPA-DE2, Dover, New Jersey, 07801.

6.5 Standard deviation.-The standard deviation will be calculated using (n-1) as the divisor in a standard statistical technique equivalent to that shown in Standard MIL-STD-414, Section B, Example B1.

6.6 Submission of AMC Form 1047.-Information contained in propellant description sheet, AMC Form 1047, need not be resubmitted in the form of a certificate provided the provisions regarding certifying of responsible agents are adhered to (see 4.1.1.).

6.7 Tolerance.-A tolerance of plus or minus 2 degrees F. applies to all 70 degrees F. requirements.

6.8 In addition to the ballistic acceptance test fired with M302A1 cartridges, a duplicate ballistic test for 10 consecutive lots shall be conducted with M49A2E2 cartridges for information only. Both groups of rounds shall be similarly conditioned at 70 degrees F. and the individual velocities and peak pressures recorded.

6.9 Factor 0.69.-The factor 0.69 makes allowance for the possibility that a standard deviation from a seven round sample exceeds the true standard deviation by chance alone.

6.10 Inspection equipment

6.10.1 Commercial inspection equipment is defined in AMC Regulation 702-2.

6.10.2 Contractor-designed equipment.-In the event that a contractor elects to design his own inspection equipment, details of the designs (drawings, description, materials, etc.) shall be submitted to: Commanding Officer, Picatinny Arsenal, ATTN: SMUPA-ND12, Dover, New Jersey, for approval prior to fabrication and use. Approval of such designs may be delegated to the contract administration office for minor or unlisted defects only.

6.11 Proving Ground test summary:

INCREMENTS, M1A1, M2A1, M3A1, and XM182:

Test	Sample Size	Requirements		
		Velocity (Average)	Vel. Std. Dev. Test Value X Factor	Pressure (Maximum)
Uniformity	7	See Table II	See Table IV	See Table V

INCREMENT M181

Test	Sample Size	Requirements		
		Velocity (Average)	Vel. Std. Dev. Test Value X Factor	Pressure (Maximum)
Uniformity				
(W/M302A1 Ctg.)	7	See Table II	See Table IV	See Table V
(W/M49A2E2 Ctg).*	7	----------FOR INFORMATION ONLY.....		

*Applicable only until data for ten lots is generated.

Custodian:
ARMY-MU

Preparing Activity:
ARMY-MU

Project Number: 1376-A-017