MIL-P-46458F (AR)
29 JANUARY 1980
SUPERSEDING
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4 April 1977

MILITARY SPECIFICATION

PROPELLANT M30 FOR USE IN CARTRIDGE, 105MM, HEAT-T, M456A1 HEAT-T-MP, M456A1E2 and TP-T, M490

This specification is approved for use by the US Army Armament Research and Development Command, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 This specification covers M30 Propellant for use in the Cartridge HEAT-T, M456A1, HEAT-T-MP, M456A1E2 and TP-T, M490 for the 105MM, M68 Gun (See 4.5.4).

1.2 Classification. The propellant shall be Type 1 Cylindrical Multi-Perforated grains.

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. 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.

SPECIFICATIONS

MILITARY

MIL-A-48078 - Ammunition, Standard Quality Assurance Provisions, General Specification for

FSC: 1376

STANDARDS

MILITARY

MIL-STD-414	-Sampling Procedures and Tables for Inspection by Variables for percent defective
MIL-STD-652	-Propellants, Solid, for Cannons, Requirements and Packing

DRAWINGS (see 6.3)

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

8861065	-Cartridge, 105MM, HEAT-T, M456A1
8861071	-Projectile, 105MM, HEAT-T, M456A1
8865257	-Case Cartridge and Liner Assembly 105MM M148A1B1
8865533	-Cartridge, 105MM, TP-T, M490
9312816	-Cartridge, 105MM, HEAT-T-MP, M456A1E2
9312815	-Projectile, 105MM, HEAT-T-MP, M456A1E2 Assembly
9331305	-Cartridge, 105mm, HEAT-T, M456A1
9331331	-Cartridge, 105MM, TP-T, M490
10523473	-Projectile, 105MM, TP-T, M489 Metal Parts Assembly

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

3. REQUIREMENTS

3.1 Material The propellant shall be M30 Type I, conforming to the requirements of MIL-STD-652 except for the following:

3.1.1 Grain Length to Diameter Ratio The average grain length (L) shall be from 2.00 to 2.20 times the average grain diameter (D).

3.1.2 Grain Diameter to Perforation Diameter Ratio The average grain diameter (D) shall be from 11.5 to 15 times the average diameter of the perforation (d).

3.1.3 Web The nominal web sizes shall be 0.058 inch (in.) and 0.060 in.

3.1.3.1 The 0.058 in. web shall be used either with the M456A1 or the M490 Projectiles.

3.1.3.2 The 0.060 web shall be used with the M456A1E2 Projectile.

3.1.4 Bulk Density The nominal bulk density shall be 63.0 pounds per cubic foot (lb/ft^3) (See 4.5.2).

3.1.5 Graphite Content The graphite (Glaze) content shall not exceed 0.2 percent (See 4.5.3).

3.2 Ballistic assessment requirements. The propellant when fired in the M68 Gun with the M490, M456A1E2 or M456A1 projectile shall comply with the following requirements at 70 degrees Fahrenheit (^oF) (see 4.5.1) and standard weapon conditions . The propellant shall be capable of assessment to a velocity of 3850 feet per second (fps) with an expected average pressure not to exceed 58,700 pounds per square inch (psi) and a charge weight not to exceed 199 ounces.

3.3 Ballistic uniformity requirements. The propellant when fired in the M68 Gun with the M490, M456A1E2 or M456A1 projectile shall comply with the following requirements.

3.3.1 Uniformity of velocity. The standard deviation of velocity for the lot at 70^oF shall not exceed 7.8 fps.

3.3.2 Average pressure. At 70^oF and standard weapon conditions, the propellant shall not produce an average pressure greater than 58,700 psi. At 125^oF and standard weapon conditions, the propellant shall not produce an average pressure greater than 68,600 psi when fired either with the M490 or the M456A1.

3.3.3 Individual maximum pressure (IMP). The propellant shall not produce an individual pressure greater than 73,900 psi or an average pressure plus three (3) standard deviations greater than 73,900 psi at any operating temperature.

3.4 Preproduction inspection. This specification contains provisions for preproduction inspection. Requirements for the submission of preproduction inspection samples shall be as specified by the Contracting Officer.

3.5 Workmanship. The best commercial practices shall be used in the formulation of propellant furnished under this specification, and all other applicable documents. The propellant and its standard ingredients shall be protected from the action of direct sunlight and acid fumes. Unless otherwise specified, no reground propellant or nitrocellulose shall be used in the manufacture of propellant procured under this specification.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection and standard quality assurance provisions. Unless otherwise specified herein or in the contract, the provisions of MIL-A-48078 shall apply and are hereby made a part of this detail specification.

4.2 Classification of inspections. Preproduction Sample Inspection and Quality Conformance Inspection shall be conducted on this item.

4.3 Preproduction sample (Pilot lots). The preproduction sample is intended to provide necessary information to establish the propellant granulation needed to meet the required ballistic parameters.

4.3.1 Submission. The Contractor shall select three propellant granulations which, from experience, are expected to bracket the requirements of this specification. The contractor shall submit a preproduction sample as designated by the Contracting Officer for evaluation in accordance with 4.3.2, consisting of three pilot lots of a maximum of 3000 lb. each, representing the three candidate granulations.

4.3.2 Inspections to be performed. Each of the granulations comprising the preproduction sample and submitted in accordance with 4.3.1. may be subjected by the Government to any or all of the requirements of the applicable drawings and specificatons.

4.3.3 Authorization - Government Engineering and Product Assurance personnel and the Contractor shall review the pilot lot test data and shall select a granulation size which best fits the requirements of this specification. The Technical Agency shall notify the Contracting Officer of the selected granulation. The Contractor shall request approval from the Contracting Officer to produce the selected granulation. If none of the pilot lots submitted meets the requirements of this specification, a new preproduction sample shall be submitted in accordance with 4.3.1 . All future production lots shall be of the same basic granulation.

4.4 Quality conformance inspection

4.4.1 Inspection lot formation. Inspection lots shall comply with the lot formation provisions of MIL-A-48078.

4.4.2 Examination and testing.

PRECAUTION - This specification covers sampling and testing of chemical, toxic or explosive materials which are potentially hazardous to personnel. Accordingly, it is emphasized that all applicable safety rules, regulations and procedures must be followed in handling and processing these materials.

4.4.2.1 Sampling for laboratory testing (see 3.1). Each lot of propellant shall be sampled and tested for composition, form, dimensions and chemical/physical properites in accordance with MIL-STD-652. (see 6.4 and 6.5).

4.4.2.2 Sampling for ballistic testing (see 3.2). Each lot of propellant shall be sampled for Proving Ground tests in accordance with MIL-STD-652.

4.4.2.3 Charge establishment (see 3.2). If the lot does not meet the applicable requirements, testing shall cease and the Test Director shall immediately notify the procuring activity and the technical agency.

4.4.2.4 Velocity uniformity (see 3.3.1). If the product of the factor 0.74 times the velocity standard deviation of the rounds tested in accordance with 4.5.1.2 exceeds the applicable requirement, apply referral criteria in accordance with 4.5.1.4. If the referral criteria cited do not apply, the lot shall be rejected.

4.4.2.5 Average pressure (see 3.3.2). If the average pressure obtained exceeds the applicable requirement, apply referral criteria in accordance with 4.5.1.4. If the referral criteria cited do not apply, the lot shall be rejected.

4.4.2.6 Individual Maximum Pressure (IMP).

4.4.2.6.1 If any individual pressure observed during the uniformity series, when corrected to standard conditions, recommended charge weight, and standard projectile weight exceeds the applicable requirement, the lot shall be rejected.

4.4.2.6.2 If the average pressure plus three standard deviations exceeds the applicable requirement, apply referral criteria in accordance with 4.5.1.4. If the referral criteria cited do not apply, the lot shall be rejected.

4.5 Test methods and procedures

4.5.1 Proving ground assessments. These tests shall be conducted at a Government proving ground (designated by the contracting officer) in accordance with the applicable Proving Ground Acceptance Test Procedure. Tubes used for these assessments shall be restricted to firing only High Explosive Anti-Tank with Tracer (HEAT-T) ammunition. The wear of the tube shall be no greater than 0.015 inch when measured 25.25 inches from the rear of the tube. All test rounds shall be temperature conditioned in a large conditioning box, with adequate air circulation to assure uniform conditioning, at the required temperature for a minimum of 24 hours and assurance will be made that, when fired, the charges are at the conditioning temperature. The following tolerances shall apply to all temperature conditionings: -50°F +5°F; 70°F ±2.5°F; 125°F -5°F and 145°F -5°F. Copper crusher gages (2) shall be used to measure the maximum chamber pressure. Velocity coils will be used to measure the muzzle velocity. Test rounds shall be assembled in accordance with the applicable drawing.

4.5.1.1 Charge establishment (see Table 1).

4.5.1.1.1 Charge slope method. Three or more groups of three rounds each loaded with selected charge weights of propellant (weights selected should bracket expected service charge weight), shall be conditioned and fired at 70 °F. Three calibration rounds shall also be conditioned and fired at 70 °F prior to the test rounds. From the data obtained, a composite charge weight versus velocity versus pressure curve shall be established. A charge weight shall be calculated which will yield the prescribed service velocity (see 3.2). This calculated charge weight shall then be loaded into rounds for the uniformity series (see 4.5.1.2.1). The difference between the corrected velocity obtained during the uniformity series and the service velocity shall be compensated for by a final adjustment in charge weight using the slope of the velocity charge weight curve previously established. The resultant will be the recommended charge weight for the applicable items listed in Paragraph 4.5.4.

TABLE I

PROVING GROUND TEST SUMMARY

TEST PHASE	TEMP °F	SAMPLE SIZE Cal	SAMPLE SIZE Test	VELOCITY REQUIREMENTS Service Velocity (fps)	VELOCITY REQUIREMENTS Std Dev of Velocity (fps)	PRESSURE REQUIREMENTS IMP (psi)	PRESSURE REQUIREMENTS Average (psi)
CHG ESTAB	70	3	9	3850	INFO	INFO	58700
UNIF	-50*	N/A	10	INFO	INFO	INFO	INFO
	70	10	10	3850	7.8	INFO	58700
	125	N/A	10	INFO	INFO	73900	**
	145*	N/A	10	INFO	INFO	INFO	INFO

* Performed for initial production testing only.

** The average pressure plus three (3) standard deviations shall not exceed the IMP (see 3.3.3)

4.5.1.1.2 Constant slope method. After ten (10) lots of a given production series have been fired to provide a good knowledge of the propellant characteristics, the charge slope method of assessment may be discontinued and the charge weight determined by the constant slope method. A composite charge weight versus velocity versus pressure curve can be established from the already generated test results (see 4.5.1.1.1). This curve can then be used as in 4.5.1.1.1 to calculate the charge weight needed to achieve service velocity. This calculated charge weight is then to be loaded into rounds for the uniformity series and final adjustment is to be made as indicated above for the charge slope method (see 4.5.1.2.2). The resultant will be the recommended charge weight for the applicable items listed in Paragraph 4.5.4.

4.5.1.2 Uniformity (see Table I).

4.5.1.2.1 Initial production. Forty (40) rounds shall be assembled with the calculated charge weight (see 4.5.1.1.1) of propellant. Ten rounds each shall be conditioned to -50°F, 70°F, 125°F, and 145°F (as indicated by thermocoupled control round). Rounds fired at 70°F shall be fired alternately with calibration rounds and shall be corrected to standard weapon/firing conditions (i.e., the difference between calibration performance under test conditions and standard conditions). Firing results at all temperatures shall be corrected to standard projectile weight (see 4.5.4) and to recommended charge weight conditions (i.e., the difference between as fired charge weight and recommended charge weight).The means and standard deviations of the velocities and pressures at all firing temperatures shall be calculated using corrected results. Testing at -50°F and 145°F shall be for information only. The initial production lots represent the first ten consecutive lots from each manufacturer which have been produced and met the acceptance criteria of this specification.

4.5.1.2.2 Subsequent production. Twenty (20) rounds shall be assembled with the calculated charge weight (see 4.5.1.1.2) of propellant. Ten rounds each shall be conditioned to 70°F and 125°F (as indicated by thermocoupled control round). Rounds fired at 70°F shall be fired alternately with calibration rounds and shall be corrected to standard weapon/firing conditions (i.e., the difference between calibration performance under test conditions and standard conditions). Firing results at both temperatures shall be corrected to standard projectile weight (see 4.5.4) and to recommended charge weight conditions (i.e., the difference between as fired charge weight and recommended charge weight). The means

and standard deviations of the velocities and pressures at all firing temperatures shall be calculated using corrected results. Throughout production, if 3 consecutive lots fail on first test, testing shall revert back to the initial production plan (see 4.5.1.2.1).

4.5.1.3 Retest criteria. A lot shall be retested whenever any of the following conditions exist or whenever the proving ground deems it necessary.

a. The final adjustment in charge weight exceeds 2.0 oz of the charge weight used in uniformity firings, retest for uniformity in accordance with 4.5.1.2.

b. If for any reason, the Proving Ground considers that test conditions have detrimentally affected the test results, additional charges as required shall be tested.

4.5.1.4 Referral criteria - A test lot shall be referred to the procuring activity for disposition whenever any of the following conditions exist or whenever the proving ground deems it necessary.

a. Calibration rounds fired in any test phase fail to comply with Section 3 of this specification.

b. Calibration correction applied exceeds 25 fps, after allowance has been made for ballistic hump. Ballistic hump is characterised by a rise in velocity and pressure during the early life of a barrel.

c. Number of test or calibration results utilized in calculations is less than specified.

d. Any unusual occurrences during ballistic testing, such as excessive delays between rounds, poor projectile flights, etc. Each such event shall be reported in detail on the applicable firing record.

e. Test lot fails velocity standard deviation or average pressure requirement at 70°F and any extreme test value is an outlier. The following test shall be performed to determine if a single test result is an outlier. With a sample size of 10 at a significance level of 0.05, the critical value (T_c) is 0.477. Calculate a test value (T_t) as follows:

For Low Outlier

$$T_t = \frac{(X_2 - X_1)}{(X_9 - X_1)}$$

For High Outlier

$$T_t = \frac{(X_{10} - X_9)}{(X_{10} - X_2)}$$

Where:

X_1 = test result being tested as low outlier
X_2 = test result adjacent to X_1, after all the test results are ordered from smallest to largest
X_9 = test result adjacent to the largest test result
X_{10} = test result being tested as high outlier

X_1 or X_{10} is an outlier if T_t is greater than T_c.

4.5.2 Bulk Density. The bulk density shall be determined in accordance with Method 502.2 of MIL-STD-286 except that a sample size of approximately 0.25 cubic feet shall be used and the 1000 milliliter graduate cylinder shall be replaced with a M148A1B1 cartridge case Dwg. 8865257.

4.5.3 Graphite (Glaze). The graphite content shall be determined in accordance with Method 308.1 of MIL-STD-286.

4.5.4 Projectile Types. Projectiles may be of the following configurations:

Item	Type Obturator	Cart. Dwg.	Proj. Dwg.	Proj. Weight
105mm, HEAT-T-MP, M456A1E2	2-Piece	9312816	9312815	23.20 ± .02 lb.
105mm, HEAT-T, M456A1	2-Piece	9331305	8861071	22.72 ± .02 lb.
105mm, HEAT-T M456A1	1-Piece	8861065	8861071	22.72 ± .02 lb.
105mm, TP-T, M490	2-Piece	9331331	10523473	22.35 ± .02 lb.
105mm, TP-T, M490	1-Piece	8865533	10523473	22.35 ± .02 lb.

5. PACKAGING

5.1 Packing and marking. Packing and marking shall be in accordance with MIL-STD-652, except that all propellant designated for use as reference shall be packed level A.

6. NOTES

6.1 Ordering data. Ordering data shall be in accordance with MIL-A-48078 with the following exceptions:

6.1.1 Procurement requirements. Procurement requirements of MIL-A-48078 shall apply.

6.1.2 Contract data requirements.

One copy of all description sheets and firing records required by this specification shall be forwarded to:

Commander
US Army Armament Research and Development Command
ATTN: DRDAR-QAR-R
DRDAR-LCA-G
Dover, NJ 07801

Commander
US Army Armament Materiel Readiness Command
ATTN: DRSAR-QAM-A
Rock Island, IL 61299

6.1.3 Charge Weight If the recommended charge weight established for a cartridge is to be used in a different cartridge, the charge weight should be corrected for the difference in Projectile weight and obturator, when applicable (see 4.5.4).

6.2 Proving ground test summary (see Table I).

6.3 Drawings. Drawings listed in Section 2 of this specification under the heading US Army Armament Research and Development Command (ARRADCOM) may also include drawings prepared by, and identified as, Edgewood Arsenal, Frankford Arsenal, Rock Island Arsenal or Picatinny Arsenal drawings. Technical data originally prepared by these activities is now under the cognizance of ARRADCOM.

6.4 Surveillance sample. Samples shall be forwarded to US Army Armament Research and Development Command, Dover, NJ 07801, ATTN: DRDAR-LCE-MP for the propellant surveillance test program in accordance with MIL-STD-652.

6.5 Reference sample - Whenever a propellant lot is selected for reference use, a 5-lb sample shall be forwarded to US Army Armament Research and Development Command, Dover, NJ 07801, ATTN: DRDAR-LCA-G for use in evaluating the propellant stockpile.

6.6 Standard weapon conditions. Standard weapon conditions refer to the weapon model and conditions of the test at the time the calibration series was fired.

Custodian:
Army-AR

Preparing Activity:
Army-AR

Project Number: 1376-A155

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DOCUMENT IDENTIFIER *(Number)* AND TITLE

MIL-P-46458F Propellant M30 for use in Cartridge, M105MM, Heat-t M456A1

NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

☐ VENDOR ☐ USER ☐ MANUFACTURER

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B. RECOMMENDED WORDING CHANGE

C. REASON FOR RECOMMENDED CHANGE(S)

2. REMARKS

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DATE

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