

UNCLASSIFIED

AD-741868

Security (Page 1 of 1)

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Comp. code number)

U.S. Army Test and Evaluation Command
Aberdeen Proving Ground, Maryland 21005

22. REPORT SECURITY CLASSIFICATION

Unclassified

23. GROUP

3. REPORT TITLE

U.S. Army Test and Evaluation Command Systems Engineering Test Operations
Procedure - "Bakery Equipment."

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Final

5. AUTHOR(S) (First name, middle initial, last name)

6. REPORT DATE

30 December 1971

7A. TOTAL NO. OF PAGES

7

7B. NO. OF REFS

29

8A. CONTRACT OR GRANT NO.

A. PROJECT NO.

c. AMCR 310-6

d.

9A. ORIGINATOR'S REPORT NUMBER(S)

TOP 10-2-011

9B. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT

Approved for public release; distribution unlimited.

11. SUPPLEMENTARY NOTES

12. SPONSORING MILITARY ACTIVITY

Headquarters
U.S. Army Test and Evaluation Command
Aberdeen Proving Ground, Maryland 21005

13. ABSTRACT

Describes a method for evaluation of bakery equipment operational and performance characteristics. Identifies supporting tests, facilities, and equipment required. Provides procedures for preformed polyurethane board, mechanical flour sifter, and dough mixing machine performance tests. Applicable to flour sifters, dough mixers, dough troughs, dividing machines, molding machines, mixing and make-up outfits, proofing cabinets, ovens, and accessory sets.

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U.S. ARMY TEST AND EVALUATION COMMAND

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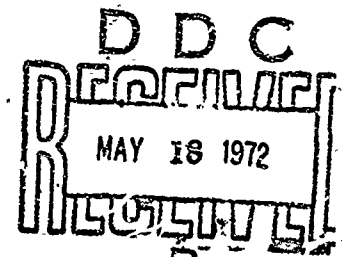
Security Classification

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1964-1965

AD 741868

U.S. ARMY TEST AND EVALUATION COMMAND
SYSTEM ENGINEERING TEST OPERATIONS PROCEDURES



AMSTE-RP-702-109

Test Operations Procedure 10-2-011

30 December 1971

BAKERY EQUIPMENT

Section I.	GENERAL	Paragraph	Page
	Purpose and Scope	1	1
	Background	2	1
	Equipment and Facilities	3	2
II.	TEST PROCEDURES		
	Supporting Tests	4	2
III.	SUPPLEMENTARY INSTRUCTIONS		
	Preformed Polyurethane Board	5	4
	Mechanical Flour Sifter Test	6	4
	Dough Mixing Machine	7	5
APPENDIX.	REFERENCES		6

SECTION I
GENERAL

1. Purpose and Scope. This TOP describes test procedures for evaluating the operational and performance characteristics of bakery equipment. Equipment covered includes: flour sifters, dough mixers, dough troughs, dividing machines, molding machines, mixing and make-up outfits, proofing cabinets, ovens and accessory sets. From the tests listed in Section II, the test director can select those that will satisfy the requirements for the particular test item and the particular test type (i.e., engineering test, initial production test, etc.). This document provides for simulated environmental testing but does not include service testing or environmental testing at climatic test sites.

2. Background. To produce bread and other bakery products for the field Army, the baker must not only be skilled in his trade and have good ingredients to work with, but he must also have a modern, well-designed, efficient, easy-to-operate bakery plant in which to prepare his dough and bake his bread and pastry. A field bakery may be staffed by a detachment, a section, or a platoon. It may be either a mobile bakery (trailer mounted equipment) or a portable bakery (usually limited to detachment size) used principally to increase the capability of an element of a mobile field bakery. Field bakery elements are located in functionalized companies such as Headquarters and Headquarters Company, Supply and Service Battalion, Direct Support and Field Service General

30 December 1971

Support Company, Forward. To keep pace with the highly mobile army of today, a field bakery must also have high mobility. While the major components of a bakery plant (i.e., flour sifter, dough mixing machine, dough troughs, dividers, moulders, proofing cabinets, ovens and bread racks) together with over a hundred other smaller components and accessories may be designed for efficient transport in general purpose vehicles, a much more efficient scheme is to build the mixing machine together with the divider and moulder into a trailer mounted unit and the oven into another such unit. To further increase the efficiency, reliability and ease of operation, internal combustion engine drives may be replaced with electric motors supported by a portable or trailer mounted power generator.

3. Equipment and Facilities. In addition to the equipment and facilities defined in the documents listed in Section II, a supply of ingredients for straight dough garrison sheet bread and a bakery accessory set are required to perform the procedures defined by paragraphs 6 and 7.

SECTION II TEST PROCEDURES

4. Supporting Tests. Common Engineering MIPs/TOPs, Military Standards, the tests defined in Section III, and other published documents to be considered in formulating a test plan are as follows:

<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
a. Pre-operational Inspection	10-3-500
(1) Operator Training & Familiarization	10-2-501
(2) Photographic Coverage	7-3-519
b. Physical Characteristics	10-2-500
(1) Cellular Hard Board	ASTM
(a) Water Absorption	D-1056-68
(b) Density (pounds/cu ft)	D-1565-70
(c) Compressive strength (psi)	D-1621-64
(2) Preformed Polyurethane Board Density (Refer to para 5)	
c. Safety	10-2-508
d. Performance Tests	
(1) Mechanical Flour Sifter (Refer to para 6)	
(2) Dough Mixing Machine (Refer to para 7)	
(3) Dough Troughs	

	INSTRUCTIONS/DEFINITION 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. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.	JUSTIFICATION 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. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.
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MIL-D-13053D
Para 4.5

30 December 1971

TOP 10-2-011

<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
(4) Dough Dividing Machines	MIL-D-2471D Para 4.5
(5) Dough Molding Machine	MIL-D-2477C Para 4.5
(6) Dough Mixing and Make-Up Outfit	MIL-D-43490A Para 4.4
(7) Dough Proofing Cabinet	MIL-C-40100B
(a) Insulation	Para 4.3.1.1
(b) Temperature and humidity	Para 4.4.1
(8) Bakery Oven	
(a) Trailer mounted	MIL-B-12570C Para 4.4
(b) Portable	MIL-O-43085A
Burner Unit	MIL-B-0040098D
(c) Non-Portable	MIL-O-43633 Para 4.5
(9) Bakery Accessory Set	MIL-B-43322 Para 2.1
 e. Environmental Testing	 MIL-STD-810B
(1) Temperature	Method 501
(2) Sunshine	4-2-826
(3) Rain	2-2-815
(4) Humidity	4-2-820
(5) Fungus	4-2-818
(6) Salt Fog	MIL-STD-810B Method 509
(7) Dust Test	Method 510
(8) Vibration	4-2-804
(9) Rough Handling	4-2-602
(10) Electromagnetic Interference	MIL-STD-461A
Characteristics	Notice 4 MIL-STD-462 Notice 3 Method RE05
 f. Transportability	
(1) Road, Rail, Marine	10-2-503
(2) Air	7-2-515
 g. Human Factors Evaluation	 10-2-505
Noise	HEL-STD -S-1-63B
 h. Reliability	 MIL-STD-781B Para 5

TOP 10-2-011

30 December 1971

<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
i. Durability	10-2-502
j. Maintenance Evaluation	10-2-507
k. Value Analysis	USAMC SUPPL 1 to AR 11-26

SECTION III SUPPLEMENTARY INSTRUCTIONS

5. Preformed Polyurethane Board.

a. Objective. To determine the density of preformed polyurethane board.

b. Method. Each of three random samples of any convenient size is weighed to the nearest tenth of a pound and its dimensions accurately determined.

c. Data Required.

(1) Weight of each sample.

(2) Dimensions of each sample.

d. Analytical Plan. The density in pounds per cubic foot is calculated for each sample. The results are averaged and compared to the density of the insulation required by the MN to determine conformance to specifications.

6. Mechanical Flour Sifter.

a. Objective. To determine the ability of the flour sifter to aerate the flour and remove any extraneous material that may be present.

b. Method. The sifter hopper is filled with contaminated flour and after operation, the sifted flour is examined by experienced master bakers to evaluate contamination removal and aeration provided by the sifter.

c. Data Required. Nomenclature of the test item and written evaluations prepared by each master baker.

d. Analytical Plan. Summarize and analyze the evaluations of each baker and compare with the requirements of the MN to determine conformance to specifications.

30 December 1971

TOP 10-2-011

7. Dough Mixing Machine.

a. Objective. To determine the operational and functional performance of a dough mixing machine.

b. Method. The test item is operated, without load, for a period of one hour. During this time the agitator is activated and deactivated, the bowl tilted and returned to the upright position and operation of all controls checked. Ingredients, prepared in accordance with TM 10-410 (appendix), are then loaded into the mixer in the prescribed order. The mixer is operated to mix and develop the dough. An experienced master baker determines when the dough is ready for proofing.

c. Data Required.

- (1) Nomenclature of the test item.
- (2) Time to mix and develop the dough.
- (3) Written comments of the master baker in regard to gluten development, elasticity and smoothness of mix.

d. Analytical Plan. Summarize and analyze the written comments of the master baker in regard to gluten development, elasticity and smoothness of the mixed dough and compare with the requirements of the MN to determine conformance to specifications.

Recommended changes to this publication should be forwarded to Commanding General, U.S. Army Test and Evaluation Command, ATTN: AMSTE- ME Aberdeen Proving Ground, Maryland 21005. Technical information related to this publication may be obtained from the preparing activity, Commanding Officer, Aberdeen Proving Ground, ATTN: STEAP-MT-DM, Aberdeen Proving Ground, Maryland 21005. Additional copies of this document are available from the Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314. This document is identified by the accession number (AD No.) printed on the first page.

APPENDIX
REFERENCES

1. AR 70-38, "Research, Development, Test, and Evaluation of Materiel for Extreme Climatic Conditions."
2. USAMC Supplement 1 to AR 11-26, "Value Engineering."
3. HEL-STD S-1-63B, "Maximum Noise Level for Army Materiel Command Equipment."
4. MIL-STD-461A, "Electromagnetic Interference Characteristics, Requirements for Equipment", including notices 1 thru 4.
5. MIL-STD-462, "Electromagnetic Interference Characteristics, Measurement of", including notices 1 thru 3.
6. MIL-STD-781B, "Reliability Tests: Exponential Distribution", including change 1.
7. MIL-STD-810B, "Environmental Test Methods", including notices 1 thru 4.
8. MIL-D-2471D, "Dough Dividing Machines, Automatic, Pocket."
9. MIL-D-2477C, "Dough Molding Machines, Loaf."
10. MIL-B-12570C, "Bakery Oven, Trailer Mounted, M-533."
11. MIL-D-13053D, "Dough Troughs."
12. MIL-B-0040093D, "Burner Unit, Gasoline, Field Range Outfit, M2."
13. MIL-C-40100B, "Cabinet, Dough Proofing, Portable, Insulated, 12-pan Capacity."
14. MIL-O-43085A, "Oven, Baking and Roasting, Deck, Gasoline, 3-Compartment."
15. MIL-B-43322, "Bakery Plant, Field, Portable, consisting of 170 Components."
16. MIL-D-43490A, "Dough Mixing and Make-Up Outfit, Trailer Mounted, M-534."
17. MIL-B-43633, "Oven, Baking and Roasting, Deck, Convection, Electric."

30 December 1971

TOP 10-2-011

18. TM 10-410, "Bread Baking."
19. American Society for Testing and Materials (ASTM).
D-1056-68 "Sponge and Expanded Cellular Rubber Products,
Spec. for", D-1565-70 "Flexible Foams made from Polymers or Co-
polymers of Vinal Chloride, Specs and Tests for", D-1621-64
"Compressive Strength of Rigid Cellular Plastics, Tests for."