

15 April 1971

Materiel Test Procedure 2-2-537  
General Equipment Test Activity

U. S. ARMY TEST AND EVALUATION COMMAND  
COMMON ENGINEERING TEST PROCEDURE

CARGO LOADING ADAPTABILITY (CLA)



AD723410

1. OBJECTIVE\*

This document provides procedures and guidelines for examining, during the engineering tests, the aspects of cargo loading adaptability. This will be determined by the evaluation of design characteristics in relation to requirements for loading/unloading operations as dictated by the handling of various cargos at different facilities. The contents herein will aid in assuring that Army cargo carriers satisfy, and are adaptable to, loading requirements which are stated in governing documents, (Materiel Need (MN)), and/or which are considered otherwise acceptable according to existing practices and procedures. This evaluation will determine the suitability of the test item for the service test.

2. BACKGROUND

a. Cargo loading adaptability shall be defined by the following:

The inherent capability of a cargo carrier, through its design, to satisfy or be adaptable to conditions and procedures encountered during loading/unloading operations which are conducted at various types of cargo terminals and which involve the transfer of various types of cargos.

Vehicles which are properly designed from a CLA standpoint will maximize the efficiency, effectiveness, and safety of loading operations. Testing for CLA shall be those procedures which are required to determine the degree to which the test item satisfies the above definition.

b. In order to understand the need for and the aspects of a CLA evaluation, it is important to provide a foundation by examining the subject of cargo loading. A cargo loading operation can be broken down into basically four constituent subjects, these being the following:

- 1) Carrier - that item providing the means by which cargo is moved, (cargo vehicles to be tested)
- 2) Cargo - that which the carrier is to move or haul.
- 3) Type of operation - this describes basically the type of facility at which the operation takes place.

\*This MTP is intended to be used as a basic guide in preparing actual test plans for the subject equipment. Specific criteria and test procedures must be determined only after careful appraisal of pertinent MN and any other applicable documents.

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- 4) Interface - those aspects which deal with the way in which the carrier, cargo, and the facility and its characteristics, interact.

As examples of each of the above, consider the following list:

<u>Carrier</u>	<u>Cargo</u>	<u>Operation</u>	<u>Interface</u>
trucks	gases, liquids	load at air terminal	carrier accepts
aircraft	packages, boxes	load at rail terminal	various types of
ships	bulk material	load at vehicle terminal	cargo
railroad cars	vehicles	(interchange of cargo	carrier mates phys-
	pallets	between vehicles)	ically with vari-
		cargo movement at	ous terminals
		storage area	carrier accommodates
			different kinds of
			MHE.

c. Utilizing the above four factors in a typical cargo loading operation, the carrier is placed in position at the terminal and cargo is transferred from/to the carrier by a capability of the facility. These operations can be considered as providing the reasons for CLA investigation because it is during each of these operations that there is interplay between the carrier, cargo and the facility. To further elaborate on this point, consider the following questions which arise when conducting the above operations and which form part of the CLA evaluation.

- 1) How effective is the carrier in accepting or adapting to various types of military cargo?
- 2) Is the carrier compatible or can it be made compatible with various types of cargo terminals?
- 3) Can various kinds of MHE and other terminal loading devices be used with the carrier?

d. Cargo loading is a subclass of the topic of material handling. Since material handling is an art more than a science, the engineering test for CLA will be more qualitative than quantitative. After having determined that the vehicle satisfies any requirements in its design (size, shape, and position of cargo aspects) specified as criteria for CLA in governing documents, the balance of the evaluation will consist of comparison and checks of vehicle characteristics utilizing knowledge of Army transport data such as cargo and facility information, matching the vehicle characteristics for cargo loading operations at various types of military terminals and with various types of cargos. Testing may be completed by subjecting the loaded vehicle to transport operation to determine the effectiveness of the loading operations. The total evaluation will aid in ensuring the suitability of the test item for Army use.

3. REQUIRED SUPPORT

- a. Transportation test courses.
- b. Various types of measuring and weighing devices.
- c. Various types of military cargo terminals, storage areas and MHE.
- d. Samples of, and information relating to, various types of military cargo.
- e. Detailed engineering drawings and engineering specifications for the test item.

4. REFERENCES

- A. AMC Regulation 70-7, Research and Development: Test and Evaluation of Materiel.
- B. USATECOM Regulation 70-23, Research and Development: Equipment Performance Reports (EPRs).
- C. USATECOM Regulation 70-24, Research and Development: Documenting Test Plans and Reports.
- D. USATECOM Regulation 108-1, Photographic Coverage (As implemented by MTP 7-3-519).
- E. MTP 10-1-001, Testing General Supplies and Equipment.
- F. MTP 10-2-500, Physical Characteristics.
- G. MTP 10-2-501, Operator Training and Familiarization.
- H. FM 55-15, Transportation Reference Data.
- I. TM 55-310, Motor Transport Operations.
- J. TM 55-513, Military Stevedoring.
- K. TM 743-200, Storage and Materials Handling.
- L. Bolz and Hagemann, Materials Handling Handbook, Ronald Press 1958.
- M. MN, engineering and service MTPs for the test item, or other governing documents.

5. SCOPE

5.1 SUMMARY

This document contains procedures and recommendations for the proper evaluation of CLA characteristics of a materiel item in comparison with CLA criteria. These criteria shall be: those found in general Army publications dealing with the subject, those found in specifying documents of the item and, where no specific criteria is available, general criteria as determined by existing procedures and practices and by design embodying "good engineering practice". The primary purpose of the contents of this document is to specify procedures for conducting a CLA evaluation, for collecting data and methods of evaluating collected data. The following paragraphs summarize contents of the document.

5.1.1 Preparation for Test

This section provides guidance for test project planning including procedures for test personnel training.

5.1.2 Test Conduct

The individual procedures constituting the CLA evaluation are given in this section. The following will be conducted as part of the engineering test CLA evaluation:

a. Cargo Considerations - An evaluation of cargo carrying capacity of the test item and its compatibility with the various classes, types, and mixtures of military cargo which it will be required to transport. This test will be used to determine where such factors as weight, size, shape and quantity of different cargos restrict or limit the usage of the test item.

b. Terminal and Loading Aspects - An evaluation of capability of the test item to interface properly at the various types of cargo loading facilities at which it will be loaded and unloaded. Such topics as physical and dimensional compatibility with the corresponding characteristics of the terminal and compatibility or acceptance of typical cargo loading devices and materials handling equipment (MHE) typical of each type of terminal, will be examined.

c. Transporting Procedures - An evaluation of the ability of the of the test item to traverse various types of terrains, etc., while loaded, to determine the effectiveness of loading, stability of cargo, and effects on the physical and operational integrity of the test item.

5.1.3 Test Data

This section details the information which is to be collected and recorded during the conduct of test procedures.

5.1.4 Data Reduction and Presentation

This section provides guidance for evaluating test results and related data and determining the cargo loading adaptability of the test item.

5.2 LIMITATIONS

This MTP is intended to be used as a basic guide and aid to enable test planners and test personnel to better examine the subject of CLA during the engineering test of general equipment. The contents herein have been presented in a general way so as to touch on all aspects of the subject. A careful review of all germane documents such as MN, should be made so that specific requirements which are related to CLA will be thoroughly examined by the test program. Specific load capability testing of the item will be performed in the commodity engineering test.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Test Planning

Formulate the plan of test to include the following procedures:

- a. Review the requirements of USATECOM Regulation 70-24.
- b. Review the test directive to determine test objectives.
- c. Determine CLA criteria by reviewing the Materiel Need document. If specific criteria are not given, CLA considerations shall be based on generally accepted standards.
- d. Review the proposed test plan operational/usage tests to ensure that each CLA requirement is programmed for testing.
- e. Become familiar with the item technical and operational or use characteristics using draft literature. In particular, use the maintenance sections of the manual dealing with preventive maintenance to be familiar with possible sources of trouble.

6.1.2 Support

Perform the following:

- a. Review all test procedures and determine any support required in conjunction with CLA evaluations.
- b. Analyze all requirements with respect to scheduling and availability.

6.1.3 Personnel Training and Familiarization

a. Train selected personnel in the concepts and the evaluation of CLA characteristics. Utilize MTP 10-2-501. CLA examinations should be conducted by persons familiar with the Army posture and capabilities in this area, i.e., knowledge and familiar with Army facilities and cargo requirements and experienced in cargo loading operations.

b. Determine qualification in accordance with MTP 10-2-501. In particular, ensure that personnel are aware of the importance of CLA evaluations, understand concepts and techniques, and are knowledgeable in the procedures to be used.

c. Record all personal information for personnel selected for testing.

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d. Instruct personnel in the proper method and techniques to be used in the collection and recording of data.

e. The test officer will review the safety statement and assure that all test personnel are aware of the safety limitations of the test item prior to the conduct of the engineering test.

6.2 TEST CONDUCT

6.2.1 Cargo Considerations

Perform the following (where applicable):

a. Examine the cargo capacity of the test item by the following:

- 1) For completely enclosed vehicles, compute the cargo volume.
- 2) Using lists of typical military cargos, compute the maximum cargo capacity, noting quantity, weight, size and shape.
- 3) Determine cargo capacity and types for vehicles with expandable dimensions.
- 4) Determine cargo capacity and types for oversized loads where item has detachable sections.
- 5) Examine the test item and determine its capability for use in carrying materiel such as shelters, etc.

b. Examine cargo securing capabilities by determining the sufficiency of types, numbers and locations of tiedowns, straps, chains, etc.

6.2.2 Terminal and Loading Aspects

Perform loading operations including consideration of the following:

a. Load the item from each type of cargo terminal, e.g.,

- 1) Marine.
- 2) Air.
- 3) Truck.
- 4) Rail.
- 5) Storage area.

b. Use facilities indigenous to each facility.

c. Loads shall be cargo typical of Army types up to and including the maximum rated load.

d. Include different patterns and concentrations of cargo.

e. Include the following types of cargos:

- 1) Unitized and non-unitized.
- 2) Boxes, crates.
- 3) Bags.
- 4) Drums and cans.
- 5) Bulk material.
- 6) Raw stock.
- 7) Pallets.
- 8) CONEX transporters.

f. Load with each type of cargo handling feature, e.g., MHE, cranes, ships booms, slings, manually, chutes, conveyors, pipelines.

g. Load the test item in as many positions as possible with respect to the facility, e.g., packed rear, packed side, etc.

h. Load the test item in all possible loading configurations, e.g., cargo inserted from the side, rear, top, etc.

i. Utilize all internal securing devices available on the test item to stabilize the load.

j. Time and photograph all loading procedures.

k. Examine the test vehicle to determine if any damage has been caused by the loading operation, e.g., dents in the cargo ports, etc.

### 6.2.3 Transporting Procedures

Perform the following:

a. Conduct transporting operations over all types of roads and terrains on which the test item will be utilized. Include a line-haul operation and passage over various kinds of test courses.

b. Determine the stability of the load and any effects on the performance characteristics of the vehicle due to the loading operation.

c. At the conclusion of each transporting procedure, examine both the test item and cargo for damage, shifting, etc., noting the nature, location and probable causes. Photograph all evidence of damage.

## 6.3 TEST DATA

### 6.3.1 Preparation for Test

### 6.3.2 Test Conduct

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6.3.2.1 Cargo Considerations

Record the following:

- a. The cargo volume for enclosed vehicles.
- b. Lists of various types of military cargo and vehicle load limitations for each type.
- c. For vehicles with expandable dimensions, the minimum and maximum cargo volume.
- d. A list of cargo capabilities where vehicle can carry oversized loads.
- e. Any extended capability the vehicle has for carrying large unit cargos, e.g., shelters, construction equipment, etc.
- f. Comments concerning the location, strength, and number of restraining devices supplied with the vehicle.

6.3.2.2 Terminal and Loading Aspects

Record the following:

- a. A list of each type of cargo loading terminal at which tests were conducted.
- b. The methods used to load the test vehicle at each type of terminal, e.g., equipment used, orientation of vehicle, equipment limitations.
- c. A list for each cargo load tested including
  - 1) Type(s) of material.
  - 2) Weights.
  - 3) Dimensions.
  - 4) Shapes.
- d. A detailed description of the way in which each load was distributed in the test vehicle.
- e. Each different vehicle loading configuration utilized.
- f. The manner in which existing tiedown or securing devices were utilized; any problems encountered.
- g. The elapsed time for each loading operation.
- h. List all damage to either cargo, vehicle or loading equipment. Photograph the damage.



**6.3.2.3 Transporting Procedures**

Record the following:

- a. Complete details of the terrain or test course over which each transporting procedure was conducted and the time required.
- b. Any damage to cargo while in transit, shifting of cargo, adverse effects of cargo on vehicle stability or maneuverability.
- c. On the completion of each transport procedure, any damage to cargo or vehicle; photograph the damage.
- d. Any adverse effects created by loading patterns.

**6.4 DATA REDUCTION AND PRESENTATION**

Summarize all data using tabulations and/or charts as appropriate. Identify all photographic records. Analyze and compare the summarized data against specific criteria stated in governing documents. Analyze all failures and give conclusions relating to probable causes and suggested cures. List all shortcomings and deficiencies. Further analyze data and draw conclusions concerning apparent trends in performance leading to failures or below normal performance levels. Finally, provide a recommendation as to the sufficiency of CLA characteristics and the suitability of the test item for service testing.

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14. KEY WORDS	LINK A		LINK B		LINK C	
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Cargo Loading Load Compatibility						

ACCESSION FOR

CPSTI      WHITE SECTION

DDC      BUFF SECTION

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