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TECP 700-700
Materiel Test Procedure 2-2-512*
Aberdeen Proving Ground

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

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AIRBORNE VEHICLES

1. OBJECTIVE

The objective of this document is to determine the degree to which automotive equipment meets the technical requirements necessary to be transported by air or air dropped.

2. BACKGROUND

Automotive equipment which is designed to be transported by aircraft must have the capability to be loaded onboard or attached to a specific aircraft, to be transported by the aircraft and to be unloaded or air dropped from the aircraft, all without damage to the design operational functions of the vehicle. The design of the vehicle must also be such that its mobility characteristics and other major functions are not seriously compromised by the design for air transportability.

3. REQUIRED EQUIPMENT

a. Stratosphere chamber capable of containing test vehicle and of simulating elevations up to 40,000 feet.

b. Shock Test Facility (capable of applying 4.5g's in both horizontal and vertical direction).

c. Controlled Impact Facility (only for vehicles designed with an air drop capability).

d. Accelerometers and associated instrumentation

4. REFERENCES

A. AR 705-8 Department of Defense Engineering for Transportability Program, 4 December 1959
B. AR 705-35 Criteria for Air-Transportatility and Air Delivery of Material, 3 April 1963
C. AR 705-15 Operation of Materiel Under Extreme Conditions of Environment, with Change 1, 14 October 1963
D. MIL-A-8421B (USAF) General Specification for Air-Transportability Requirements, 5 May 1960
E. MIL-M-008090D (USAF) General Specification for Mobility Requirements, Ground Support Equipment, 21 February 1961
F. MIL-STD-814A Requirements for Tie-Down, Suspension and Extraction; Provisions on Military Materiel for Air Drop, 10 November 1964

*Supersedes Ordnance Proof Manual 60-125

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G. MIL-STD-669A Loading environment and Related Requirements for Platform Rigged Airdrop Materiel, 3 November 1965
H. MTP 2-2-500 Characteristics
I. MTP 2-2-502 Inspection (Automotive)
J. MTP 2-2-503 Maintenance
K. MTP 2-2-505 Preliminary Operations
L. MTP 2-2-506 Durability Testing of Wheeled Vehicles
M. MTP 2-2-503 Vehicle Fuel Consumption
N. MTP 2-2-507 Durability Testing of Tracked Vehicles
O. MTP 2-2-800 Center of Gravity
P. MTP 3-2-605 Accuracy Firing of Vehicular Mounted Weapons
Q. MTP 7-2-510 Engineering Testing of Airdrop System and Components

5. SCOPE

5.1 SUMMARY

This procedure shall provide airborne vehicle testing to accomplish the following:

a. Determination of the handling and loading characteristics of the vehicle.

b. Determination of the vehicle's ability to withstand low pressures associated with actual flight using a stratosphere chamber to simulate elevations up to 40,000 feet.

c. Determination of the vehicle's tie-down suspension provisions to withstand simulated deceleration forces and retardation equipment deployment.

d. Determination of the vehicle's ability to withstand ground impact forces generated at $28\frac{1}{2}$ feet per second (only for those vehicles designed with an air drop capability).

e. Evaluation of the overall design of the vehicle to ascertain if the design for air transportability or air drop has seriously compromised the other basic functions, e.g., mobility.

5.2 LIMITATIONS

The procedures outlined in the following paragraphs deal primarily with the airborne characteristics of vehicles; however, some evaluation of conventional land usage is required to determine the effect of flights and air drops on the vehicles. Overall land usage is evaluated in accordance with applicable provisions of MTP 2-2-506 or MTP 2-2-507, allowing for unique limitations inherent in the special purpose design. Mobility requirements for ground support equipment used for aircraft and missiles are covered in MIL-M-C0809A (USAF).

6. PROCEDURE

6.1 PREPARATION FOR TEST

Perform the following:

a. Record vehicle characteristics as determined in accordance with MTP 2-2-500, including specified tire pressure.

NOTE: Particular attention shall be given to vehicle weight. Weights shall be specified without crew or payload but with fuel tanks 75% full and "On Vehicle Equipment".

b. Determine center of gravity in accordance with MTP 2-2-800 and identify on vehicle.

c. Conduct vehicle inspection as described in MTP 2-2-502.

d. Conduct operational testing of all new vehicles as described in MTP 2-2-505.

6.2 TEST CONDUCT

6.2.1 Handling and Loading Characteristics

a. Determine that the tie-down, suspension and extraction provision characteristics are in accordance with the requirements of reference 4F.

b. Determine that the test item complies with the dimensional limitations specified in reference 4B.

c. Determine that the vehicle is loadable at ramp angles of 17 degrees (13 degrees for helicopter ramps).

d. Determine that vehicles designed for use with a platform rigged energy dissipater system are capable of being driven or towed, depending on the test item, on and off the platform.

6.2.2 Altitude Tests

Perform the following:

a. Place vehicle in a stratosphere chamber capable of simulating elevations up to 40,000 feet

b. Simulate an altitude of 5,000 feet for a minimum of $\frac{1}{2}$ hour. Record the pressure.

c. Return the chamber to ambient conditions and check for the following vehicle failures:

1) Overflow of fluids (radiator, brake fluid, etc.)
2) Tire deflation
3) Braking system malfunction
4) Inability of vehicle to start.

d. Repeat steps b and c for an altitude of 15,000 feet.

e. Repeat steps b and c for an altitude of 40,000 feet.

6.2.3 Deceleration Tests

6.2.3.1 Tie-Down System Check

a. Tie-down the test item, as it shall be done in actual flight, on the shock test facility and instrument it to record applied force.

NOTE: The shock test facility shall be isolated from test personnel and other equipment to prevent personnel injury and equipment damage in the event of tie-down failure.

b. Apply a shock of 2-5g's to the test item and examine the tie-down provisions to insure that no structural damage has occurred. Record evidence of structural failure.

6.2.3.2 Suspension System Check

a. Attach the test item, via its suspension provision to a shock test facility capable of applying 2.5g's to the suspension provisions and instrument the test item to record the applied force.

b. Apply a 2.5g shock to the test item and examine the suspension provisions to insure that no structural damage has occurred. Record evidence of structural failure.

6.2.4 Static Drop Test

NOTE: This test shall be conducted for those vehicles designed with an air drop (parachute) capability.

Perform the following procedures at a Controlled Impact Facility:

a. Rig the vehicle on an appropriate platform together with the necessary tie-down devices and kinetic energy dissipators.

NOTE: Retardation equipment (parachutes) shall not constitute part of this load.

b. Equipment shall be instrumented to collect ground impact force data.

c. Static drop shall be made from a height of 12 feet 7 inches above point of impact.

d. Record ground impact force.

e. Inspect vehicle for damage (component and structural).

6.2.5 Post Drop/Flight Operability

NOTE: At the conclusion of deceleration testing (6.2.3) and/or static drop testing (6.2.4) all functions of the vehicle, including operation and firing of the weapons system shall be tested.

6.2.5.1 Armament and Fire Control Equipment

NOTE: The fire power of a combat vehicle must be unimpaired by virtue of being air transported and must be capable of being put into immediate action. Concurrently with this testing an evaluation shall be made to determine if the design for air transportability has seriously compromised the other major functions of the vehicle e.g., mobility.

a. After a drop test check stowed ammunition. Record any evidence of disabling damage.

b. Check serviceability by firing five rounds of ammunition. Record any evidence of round malfunction.

c. When fire control equipment is complex or sensitive its accurracy shall be checked as described in MTP 3-2-605.

d. Tactical suitability shall be evaluated by the Airborne, Electronic and Special Warefare Board.

6.2.5.2 Automotive Specifications

Determine airborne vehicles ability to meet operating specifications by performing the following:

6.2.5.2.1 Durability - The vehicle shall be subject to the applicable procedures of MTP 2-2-506 or MTP 2-2-507.

6.2.5.2.2 Maintenance Requirements - The vehicle shall be subject to the procedures of MTP 2-2-508.

6.2.5.2.3 Fuel Consumption - The vehicle shall be subject to the procedures of MTP 2-2-603.

6.3 TEST DATA

6.3.1 Preparation for Test

Record the following:

a. Vehicle characteristics data as described in MTP 2-2-500.
b. Tire pressure in psi.
c. Center of gravity data as described in MTP 2-2-800.
d. Vehicle inspection data as described in MTP 2-2-502.
e. Vehicle operational data as described in MTP 2-2-505.

6.3.2 Test Conduct

6.3.2.1 Handling and Loading Characteristics

a. Record the following:

1) Adequacy of tie-down, suspension and extraction provisions.
2) Vertical and lateral clearnace of vehicle in inches.
3) Loadability of vehicle under its own power at 17 degrees (13 degrees for helicopter)
4) Ability to mount the test item on a drop platform.

6.3.2.2 Altitude Tests

Record the following for each altitude test:

a. Simulated altitude
b. Overflow of fluids (radiator, brake fluids, etc.)
c. Tire deflation, in psi
d. Braking system malfunction
e. Inability of vehicle to start
f. Chamber pressure in inches of mercury

6.3.2.3 Deceleration Tests

Record the following:

a. Type of test (tie-down check, suspension system check)
b. Deceleration applied in forces of gravity
c. Evidence of tie-down/suspension provision damage

6.3.2.4 Static Drop Tests

Record the following based on a drop of 12 feet 7 inches:

a. Ground impact force in feet per second.
b. Noticeable vehicle damage.

6.3.2.5 Post Drop/Flight Operability

6.3.2.5.1 Armament and Fire Control Equipment - Record the following:

a. Evidence of disabling damage to stowed ammunition
b. Evidence of poor serviceability
c. Record fire control accuracy data as described in MTP 3-2-605.

6.3.2.5.2 Automotive Specifications

a. Record durability data as described in MTP 2-2-506 or MTP 2-2-507.
b. Record maintenance data as described in MTP 2-2-508.
c. Record vehicle fuel consumption as described in MTP 2-2-603.

6.4 DATA REDUCTION AND PRESENTATION

The final evaluation of those vehicles specifically designed for airborne use, whether for carry or air drop, is based on a compromise between the air transportability features of the vehicle and the characteristics normally desired in military vehicles.

The test engineer shall be required to evaluate the effectiveness and serviceability of the item under test by weighing its air transportability against engineering/operational degradation as determined by durability and fuel consumption tests, maintenance evaluation, and loss of combat effectiveness due to decreased weight which can affect the vehicle's ability to withstand enemy action.

At the successful completion of air drop testing a safety of flight release shall be accomplished by the testing agency and/or activity.

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