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PHYSICAL CHARACTERISTICS

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Army Test and Evaluation Command  
Aberdeen Proving Ground, Maryland

30 August 1972

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U. S. ARMY TEST AND EVALUATION COMMAND  
COMMON SYSTEM SERVICE TEST OPERATIONS PROCEDURES

AMSTE-RP-702-100

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\*Test Operations Procedure 1-3-504

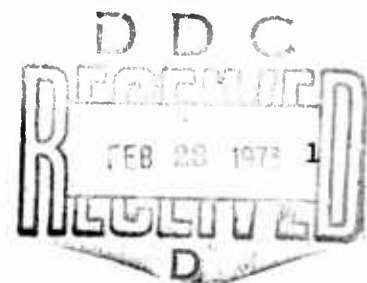
PHYSICAL CHARACTERISTICS

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\*This TOP supersedes MTP 2-3-500, dated 1 July 1969; MTP 3-3-500, dated August 1967; MTP 4-3-500, dated 24 September 1968; MTP 5-3-500, dated 5 February 1968; MTP 6-3-500, dated 24 March 1970; MTP 7-3-500, dated 16 August 1967; MTP 8-3-500, dated 12 November 1969; MTP 9-3-500, dated 6 July 1970; and MTP 10-3-500, dated 17 April 1967, including all changes.

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SECTION I  
GENERAL

1. Purpose and Scope.

a. This common test operations procedure (TOP) establishes procedures and methodologies for determining the physical characteristics of all categories of equipment and supplies undergoing expanded service test (EST); however, with modifications, the TOP may also be utilized during a developmental suitability test, check test, initial production test, and military potential test. The project officer will use this common TOP as a guide for preparing the test plan, conducting the test, and analyzing and reporting the physical characteristics test results.

b. The procedures and methodologies will generate adequate and accurate data to enable the EST agency to determine the degree to which the equipment and supplies (test item) meet the characteristics specified in the requirements document and to assist the reviewing agencies in determining the military worth of the test item.

c. The common TOP provides for objective and subjective analysis of test data to determine whether the test item meets specified physical characteristics criteria. In the event that the test item does not meet the criteria for particular measurements or configuration, the project officer will include in his report of test a subjective analysis, based on technical or military experience and judgment, of the effect this will have on the overall suitability of the test item.

d. The environmental conditions for conducting the EST using the procedures presented herein are those associated with climatic categories 1 through 8 specified in AR 70-38 (appendix A), that are appropriate to the specific test agency, and as modified by the test directive.

2. Background. The physical characteristics of each test item are determined and recorded during engineering test (ET), however, the test item received for EST may not be identical to the one used for ET. The EST must verify or determine the important aspects of physical characteristics of the test item received for EST and determine whether the test item meets the criteria specified in the requirements document. The failure of a test item to meet specified physical characteristics criteria may in itself constitute a basis for the determination of unsuitability for military use.

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3. Equipment and Facilities.

a. Equipment.

(1) Test item, its components, ancillary equipment, and the government furnished equipment required to support the test item.

(2) Maintenance test package.

(3) Safety release.

(4) Safety equipment as required by the test directive.

(5) Materials handling equipment.

(6) Measuring tapes.

(7) Scales for weighing the test item.

(8) Theodolite or survey transit.

(9) Micrometers.

(10) Calipers, including vernier.

(11) Dividers.

(12) Steel squares.

(13) Sling cables.

(14) Chemical agent detector kit.

(15) Decontamination agents and devices.

(16) Medical aid equipment and supplies.

(17) Photographic equipment, still and motion picture, and film, including color and black and white.

b. Facilities.

(1) Maintenance facilities including aircraft, through general support.

(2) Level and smooth hardstand.

c. The above is only a representative listing of equipment and facilities required in determining the physical characteristics of all categories of equipment and supplies.

## SECTION II TEST PROCEDURES

### 4. Preliminary Activities.

a. The test procedures prescribe the objective, standards, method, data required, and analytical plan. The objective, standards, and analytical plan for all categories of equipment are the same. However, the method and data required vary with each category of equipment. Accordingly, those procedures common to all categories of equipment are presented in paragraph 5. Procedures peculiar to each category of equipment are presented in subsequent paragraphs by category of equipment.

b. The project officer will conduct the preliminary activities described in the following common service TOP's prior to conducting physical characteristics tests.

<u>TITLE</u>	<u>PUBLICATION NO.</u>
(1) Personnel Training	1-3-508
(2) Safety	1-3-506
(3) Preoperational Inspection	1-3-505

### 5. All Categories of Equipment.

a. Objective. The EST will determine whether the physical characteristics of the test item meet the criteria specified in the requirements document.

b. Standards. The criteria are obtained from the requirements document.

c. Method. Test personnel will weigh, measure, and photograph the completely assembled test item and its components and ancillary items, including measurement scales in the photographs and illustrating features of interest in the test item, in both operating and traveling configurations. Test personnel will also perform these same operations with the test item disassembled to minimum reducible dimensions and weights for rail, sea, and highway shipment, air transport, airdrop,

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floating, and swimming operations as pertinent to the particular test item. Test personnel will also determine or verify centers of gravity of test items for which this characteristic is of interest (appendix B). The project officer will prepare a check list of physical characteristics of the test item to insure that no characteristic is overlooked, based on the list of physical characteristics contained in the draft technical manual provided with the test item and characteristics listed in the requirements document. Refer to following paragraphs covering specific categories of equipment for details on obtaining additional physical characteristics peculiar to these items of equipment.

d. Data Required. See the following paragraphs for data required for specific categories of equipment.

e. Analytical Plan. The project officer will present test results in narrative form, supplemented by tables, charts, graphs, and photographs, as required to present results clearly and accurately. He will analyze test results and classify them as deficiencies or shortcomings where appropriate. He will review equipment performance reports for reclassification and inclusion of data in the test report. He will compare the physical characteristics specified in the requirements document to determine criteria met and not met. He will specify criteria met or not met, and classify them as deficiencies or shortcomings where appropriate. In the case of deficiencies, he will provide a supporting rationale for classifying the failure as a deficiency. In both cases, he will include an assessment of the impact of the failure on operational capability of the test item. He will also compare the physical characteristics determined by test to those specified in the draft technical manuals to determine errors in the manual. He will also present results of analysis in narrative form, supplemented by tables, charts, and graphs where required to present analysis clearly and accurately. The project officer will terminate his analysis with a conclusion on whether the test item is suitable with respect to the objective of the physical characteristics subtest and the specific criteria under consideration.

6. Wheeled, Tracked and Special Purpose Vehicles.

a. Objective. See paragraph 5a.

b. Standards. See paragraph 5b.

c. Method. See paragraph 5c. Personnel will determine the turning radius of wheeled vehicles by executing 360° turns on dry level paved surface, with and without towed loads, in both left and right directions. They will determine the turning radius of tracked vehicles



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by locking out one track (left or right) and executing 360° drag turns in both left and right directions on dry level surfaces. They will pivot vehicles with cross-drive transmissions with the transmission in neutral steer. Record the data on the form at figure 1.

d. Data required. The project officer will obtain the following data:

(1) Vehicle: nomenclature, USA registration number, serial number, and manufacturer; the construction of the test item and its components, including kits, chassis, body, hull, packing case material, finish, any waterproofing, and apparent quality of workmanship; length, width, height in meters or centimeters, volume in cubic meters or centimeters, as appropriate, and the weight in kilograms; center of gravity location, if required, and turning radius in centimeters; and photographs of vehicle, complete and reduced, illustrating the front, side, rear, top, and three-quarter front and rear views.

(2) Vehicle reduced (external components and attachments removed): length, width, height in meters or centimeters, volume in cubic meters or centimeters, as appropriate, and the weight in kilograms; and center of gravity location, if required.

(3) Components and attachments (removed from vehicle reduced): nomenclature and serial number, if applicable: length, width, height in meters or centimeters, volume in cubic meters or centimeters, as appropriate, and the weight in kilograms; and number of personnel by MOS and manhours required to remove components and attachments, and the equipment and tools required.

e. Analytical plan. See paragraph 5e.

#### 7. Armament and Individual Weapons.

a. Objective. See paragraph 5a.

b. Standards. See paragraph 5b.

c. Method. See paragraph 5c. Record the data on form at figure 2.

d. Data required. The project officer will obtain the following data:

(1) General: nomenclature, serial number, model number, and manufacturer; the construction of the test item and its components, packing case material, finish, any waterproofing, and apparent quality of workmanship.

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NOMENCLATURE \_\_\_\_\_ U.S.A. SERIAL  
 MANUFACTURER \_\_\_\_\_ REGISTRATION NUMBER \_\_\_\_\_ NUMBER \_\_\_\_\_

ITEM	(TEST ITEM)		REDUCED DIMENSIONS		(COMPONENT)					
	R	A	R	A	R	A	R	A	R	A
<del> </del>										
WEIGHT*										
LENGTH										
HEIGHT										
WIDTH										
VOLUME										
TURNING RADIUS										
MET										
NOT MET										

R - REQUIRED; A - ACTUAL \*Test item will be empty when weighed.

CENTER OF GRAVITY: \_\_\_\_\_

DEFICIENCIES OR SHORTCOMINGS: \_\_\_\_\_

WATERPROOFING: \_\_\_\_\_

NUMBER OF PERSONNEL BY MOS REQUIRED TO REMOVE COMPONENTS: \_\_\_\_\_

NUMBER OF MANHOURS REQUIRED: \_\_\_\_\_

TOOLS AND EQUIPMENT: \_\_\_\_\_

OPERATIONAL CAPABILITY: \_\_\_\_\_

Figure 1. Vehicle Physical Characteristics.

NOMENCLATURE \_\_\_\_\_  
 MANUFACTURER \_\_\_\_\_ SERIAL NUMBER \_\_\_\_\_ MODEL NUMBER \_\_\_\_\_

ITEM	(TEST ITEM)		(COMPONENT)		(COMPONENT)		TRAVEL POSITION		FIRING POSITION	
	R	A	R	A	R	A	R	A	R	A
<del> </del>										
LENGTH										
WIDTH										
HEIGHT										
DIAMETER										
VOLUME										
WEIGHT										
MET										
NOT MET										

R - REQUIRED; A - ACTUAL

DEFICIENCIES OR SHORTCOMINGS: \_\_\_\_\_

WATERPROOFING: \_\_\_\_\_

OPERATIONAL CAPABILITY: \_\_\_\_\_

Figure 2. Armament and Individual Weapons Physical Characteristics.

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(2) Self-propelled and towed weapons: length of gun (howitzer) in travel and firing positions, with and without muzzle attachments in meters or centimeters, as appropriate; height of gun (howitzer) in travel and firing positions, with and without muzzle attachments in meters or centimeters, as appropriate; width of gun (howitzer) in travel and firing positions in meters, as appropriate; rear pintle height and minimum ground clearance in centimeters, and angles of approach and departure in degrees for towed weapons; and total weight in kilograms.

(3) Recoilless rifles: length, width, height, diameters in meters or centimeters, as appropriate, and volume in cubic meters or centimeters; and total weight in kilograms.

(4) Mortars: length of mortar in centimeters; and weight of mortar, the mount, and base plate in kilograms.

(5) Rocket launchers: length overall, length of tubes or rails in meters or centimeters, as appropriate, and number of tubes or rails; and width overall, height in travel and firing positions in meters or centimeters, as appropriate, and weight in kilograms.

(6) Small arms (handguns): length overall, and barrel length in centimeters; and weight in kilograms of pistols with and without magazine loaded and unloaded, and revolvers with and without ammunition, and number of rounds, and weapon balance.

(7) Small arms (magazine fed shoulder weapons): length with and without bayonet and stock folded or retracted, and barrel with and without muzzle brake or suppressor in centimeters; and weight in kilograms without magazine or accessories, weight of magazine empty and loaded with number of rounds, weight of bayonet, sling, bipod, cleaning kit, and weapon balance.

(8) Small arms (belt and magazine fed automatic weapons): length overall, barrel length with and without muzzle brake, suppressor, burst control devices, and compensator in centimeters; and weight in kilograms with magazine empty and loaded with number of rounds, and with and without muzzle brake, burst control devices and compensator, and weapon balance.

e. Analytical plan. See paragraph 5e.

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8. Ammunition and Explosives.

a. Objective. See paragraph 5a.

b. Standards. See paragraph 5b.

c. Method. See paragraph 5c. Test personnel will use the test item samples (10%) or those that were inspected during the preoperational inspection for the physical characteristics supporting test. They will replace eyebolt lifting plugs or closing plugs into the fuze cavities of projectiles, when appropriate, and repack all components and the test item into their original containers and reseal them. Test personnel will fire the repacked test item and components first during the EST operational supporting tests. Record the data on the form at figure 3.

d. Data required. The project officer will obtain the following data:

(1) General: nomenclature, lot number, legibility of markings, and manufacturer of the items; the construction of the test item and its components, containers, fuze threads, finish, any waterproofing, and apparent quality of workmanship.

(2) Complete round: weight in kilograms to the nearest .05 kilogram, length in centimeters, and diameter to the nearest .01 millimeter.

(3) Projectiles: weight in kilograms to the nearest .05 kilogram with and without eyebolts, lifting plug, closing plug, and fuze, if applicable; length overall in centimeters, without closing plug or fuze for fixed or semi-fixed ammunition only; diameter of bourrelet to nearest .01mm and diameter of rotating band to nearest .01mm; fuze cavity compatibility with standard and developmental fuzes and fuze cavity threads durability relative to successive fuzings; cartridge case external diameter at the top, middle, and just above the rear face to nearest .01mm; and fuze cavity depth and length of supplementary charge, if applicable, to nearest .01mm.

(4) Fuzes: length overall in centimeters, weight in kilograms to the nearest .05 kilograms, and diameter to nearest .01mm; the thread size and type, protrusion length in centimeters, and condition of seals and containers.

(5) Primers and propellants: weight in kilograms to the nearest .05 kilogram, length in centimeters, and diameter to the nearest .01mm.

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NOMENCLATURE \_\_\_\_\_ LOT NUMBER \_\_\_\_\_ MANUFACTURER \_\_\_\_\_

ITEM	WEIGHT	LENGTH	DIAMETER	DEPTH
COMPLETE ROUND				
PROJECTILE WITH FUZE				
PROJECTILE (WITHOUT EYEBOLT LIFTING PLUG OR CLOSING PLUG)				
PROPELLANT (WHEN PART OF TEST ITEM)				
PRIMER				
SUPPLEMENTARY CHARGE				
CARTRIDGE CASE:				
TOP -				
MIDDLE -				
ABOVE REAR FACE -				
BOURRELET				
ROTATING BAND				
FUZE CAVITY				
FUZE				
PROTRUSION				

FUZE THREAD SIZE AND TYPE: \_\_\_\_\_

CONDITION OF FUZE SEALS AND CONTAINERS: (include waterproofing) \_\_\_\_\_

LEGIBILITY OF MARKINGS: \_\_\_\_\_

DEFICIENCIES OR SHORTCOMINGS: \_\_\_\_\_

OPERATIONAL CAPABILITY: \_\_\_\_\_

Figure 3. Ammunition and Explosives Physical Characteristics.

e. Analytical plan. See paragraph 5e.

9. Missile and Rocket Systems.

a. Objective. See paragraph 5a.

b. Standards. See paragraph 5b.

c. Method. See paragraph 5c. Record data on form at figure 4.

d. Data required. The project officer will obtain the following data:

(1) General: nomenclature, serial number, model number and manufacturer of the test item, subsystems, and components; and the construction of the test item and its subsystems and components, packing case material, finish, any waterproofing, and apparent quality of workmanship.

(2) Weight in kilograms with and without section equipment, and with and without on equipment materiel (OEM). Include weight of transporter-loader and launcher with missile or rocket.

(3) Length in meters or centimeters, as appropriate, when in operating and traveling positions, with and without missile or rocket loaded on transporter-loader and launcher.

(4) Width in meters or centimeters, as appropriate, when in operating and traveling positions, with and without missile or rocket loaded on transporter-loader and launcher.

(5) Height in meters or centimeters, as appropriate, when in operating and traveling positions, with and without missile or rocket loaded on transporter-loader and launcher.

(6) Vehicles ground clearance in centimeters and footprint areas in traveling position.

(7) Missile or rocket mounting interface dimensions in meters or centimeters, as appropriate, with launchers and transporter-loader.

e. Analytical plan. See paragraph 5e.

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MANUFACTURER \_\_\_\_\_  
 NOMENCLATURE \_\_\_\_\_ SERIAL NUMBER \_\_\_\_\_ MODEL NUMBER \_\_\_\_\_

	(TEST ITEM)		(COMPONENT)		(COMPONENT)		TRAVELING POSITION		OPERATING POSITION	
	R	A	R	A	R	A	R	A	R	A
<del> </del>										
LENGTH										
WIDTH										
HEIGHT										
DIAMETER										
VOLUME										
MET										
NOT MET										

R = REQUIRED; A = ACTUAL      VEHICLE: GROUND CLEARANCE \_\_\_\_\_  
 FOOTPRINT AREA \_\_\_\_\_

MISSILE MOUNTING INTERFACE DIMENSIONS WITH:  
 LAUNCHERS: \_\_\_\_\_  
 TRANSPORTER-LOADERS: \_\_\_\_\_  
 WATERPROOFING: \_\_\_\_\_  
 DEFICIENCIES OR SHORTCOMINGS: \_\_\_\_\_  
 OPERATIONAL CAPABILITY: \_\_\_\_\_

Figure 4. Missile and Rockets Physical Characteristics.



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10. Electronic, Avionic and Communications Equipment.

a. Objective. See paragraph 5a.

b. Standards. See paragraph 5b.

c. Method. See paragraph 5c. Test personnel will insure that test items having fuel tanks which are subjected to airdrop or air portability tests are weighed with the fuel tanks filled to 75% of capacity. Record the data on the form at figure 5.

d. Data required. The project officer will obtain the following data:

(1) Preparation for test: nomenclature, serial number, and manufacturer of test item, components, and ancillary equipment; arrangements of the test item for transportation, installation, operation and other configurations; and identification of surface or air vehicle, electrical equipment shelter, or man-pack in or on which the test item is mounted or transported.

(2) General characteristics: description of the test item, its intended military application, and general physical characteristics. The description will include the number and type of major components and ancillary items in the packed and unpacked condition, modular construction features and the arrangement of components when installed for operation, when applicable; the geometry of the test item and its major components when packed for displacement and when installed for operations including unusual forms, protuberances (fixed or removable), and shapes designed for special applications; the construction of the test item including chassis, cabinet, packing case material, finish, any waterproofing, and apparent quality of workmanship; and the photographs and sketches to illustrate the test item in the best manner possible. Identification of each photograph and sketch.

(3) Physical dimensions: the length, width, height, depth, radius, and other applicable dimensions of the complete test item and its major components and major ancillary items such as power units, test sets and large interconnecting cables, in packed and unpacked configuration, in meters or centimeters, as appropriate, and the volumes in cubic meters or centimeters; and the length, width, height and diameter in meters or centimeters, as appropriate, and the volume in cubic meters or centimeters of minor ancillary items such as test cords, tools, and repair parts in packed configuration.

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NOMENCLATURE \_\_\_\_\_ SERIAL NUMBER \_\_\_\_\_ MANUFACTURER \_\_\_\_\_

ITEM	(TEST ITEM)		(COMPONENT)							
	R	A	R	A	R	A	R	A	R	A
LENGTH:										
PACKED -										
UNPACKED -										
WIDTH:										
PACKED -										
UNPACKED -										
DIAMETER:										
PACKED -										
UNPACKED -										
HEIGHT:										
PACKED -										
UNPACKED -										
DEPTH:										
PACKED -										
UNPACKED -										
RADIUS:										
PACKED -										
UNPACKED -										
VOLUME:										
PACKED -										
UNPACKED -										
WALL THICKNESS										
WEIGHT:										
PACKED -										
UNPACKED -										
MET										
NOT MET										

R - REQUIRED; A - ACTUAL

DEFICIENCIES OR SHORTCOMINGS: \_\_\_\_\_

WATERPROOFING: \_\_\_\_\_

CENTER OF GRAVITY LOCATION: \_\_\_\_\_

OPERATIONAL CAPABILITY: \_\_\_\_\_

Figure 5. Electronic, Avionic and Communication Equipment Physical Characteristics.

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(4) Test item permanently mounted in electrical equipment shelter, van or trailer: method or manner of mounting and securing test item components and ancillary equipment; location and size of entrances and exits (ingress, egress) in centimeters; and arrangement of components and ancillary equipment within electrical equipment shelter, van or trailer, including space occupied by components and ancillary equipment, separation distance between components, aisle dimensions and crew space in centimeters.

(5) Test item installed in aircraft or combat vehicles (no special shelter): the method or manner of mounting and securing test item components and ancillary equipment; the identical type data specified in paragraph (4) and the identity of each photograph and sketch; the center of gravity locations on the test item; and test personnel comments, and observations.

e. Analytical plan. See paragraph 5e.

11. Aviation, Air Delivery Equipment and Aircraft Weapons Subsystems.

a. Objective. See paragraph 5a.

b. Standards. See paragraph 5b. Additionally, FED-STD 751, and MIL-STD's 129, 130, and 1472A are applicable to aviation, air delivery equipment and aircraft weapons subsystems.

c. Method. See paragraph 5c. In addition, test personnel will measure the various test items as described below:

(1) Fixed-wing aircraft exterior measurements. Test personnel will determine these measurements with the test item's flight controls centered or positioned as prescribed in the equipment publications. They will alternately measure the maximum height and minimum ground clearance, maximum overall length, width and turning radius with the test item in the ferry and combat configurations, and with the applicable minimum and maximum gross takeoff weight for each configuration. They will insure that the tires are inflated to the recommended air pressure prescribed in the equipment publications, with the test item emplaced on a smooth and level surface.

(2) Rotary-wing aircraft exterior measurements. Test personnel will determine these measurements with the test item's cyclic stick, directional pedals, and other controls positioned as prescribed in the equipment publications. They will alternately measure the maximum height, minimum ground clearance and maximum overall length, width and turning radius with the test item in the ferry and combat configurations, and with the applicable minimum and gross takeoff weight for each

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configuration. They will insure that the tires, if applicable, are inflated to the recommended air pressure prescribed in the equipment publications, with the test item emplaced on a smooth and level surface.

(3) Aircraft weight and center of gravity. Test personnel will weigh and determine the test item's center of gravity in accordance with TM55-405-9 (appendix A) and MTP 7-3-518.

(4) Personnel clothing (protective, flight) and equipment. Test personnel will measure these test items as follows: clothing will be measured across the breast area, from side seam to side seam at the bottom of the armholes, along the sleeve inseam, from the base of the armhole to the bottom of the sleeve cuff - along the trouser inseam, from the center of the crotch to the bottom of the leg - and along the waist belt line; match the clothing fabric and material with a sample of the specified shade in the Requirements Document under artificial daylight having a color temperature of 7,500 degrees Kelvin; identify clothing stitches, seam types, and stitchings by classification in accordance with the Requirements Document of FED-STD 751 (appendix A) as appropriate; and helmets will be fitted on various standard size headforms ranging from the 5th through the 95th percentile that the helmet will accommodate in accordance with MIL-STD 1472A (appendix A).

(5) Ammunition. Test personnel will measure and photograph at least 10% of ammunition by lot number as described under paragraph 8c, ammunition and explosives. They will photograph the ammunition belts, links, and other accessories required for use.

d. Data required. The project officer will obtain the following data:

(1) General: nomenclature, serial number, model number, lot number, and manufacturer of test item, components, accessories, and ammunition as appropriate; and the construction of the test item and its components and accessories, packing case material, finish, any waterproofing, and apparent quality of workmanship.

(2) Fixed-wing aircraft exterior measurements: wing span, overall length, and maximum fuselage width in meters or centimeters, as appropriate; height to top of cabin (ferry and combat configurations), highest point of rudder (ferry and combat configurations), and to top propeller tip in vertical position (ferry and combat configurations), in meters or centimeters, as appropriate; propeller swept circle diameter in centimeters; ground clearances (ferry and combat configurations) including propeller, wing tip, horizontal stabilizer tip, lowest point of fuselage, antennas, probes, and other accessories in centimeters; minimum turning

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radii including wing tip horizontal stabilizer tip, propeller tip (horizontal position) and outer main landing gear in centimeters; and wheel base and tread width in centimeters.

(3) Rotary-wing aircraft exterior measurements: maximum length including static, dynamic, and flight controls in extreme positions and minimum length, rotors static, in meters or centimeters, as appropriate; width including static, dynamic, and flight controls in extreme positions in meters or centimeters, as appropriate; height (ferry and combat configurations) including maximum fuselage, entrances, and cockpit in meters or centimeters, as appropriate; ground clearances (ferry and combat configurations) including rotor blades, lowest point of fuselage, antennas, probes, and other accessories in centimeters; turning radius including main or forward rotor blade tip, tail or aft rotor blade tip, and armament subsystem weapon or launcher support stations in centimeters; swept circle diameters including main or forward rotor and tail or aft rotor in centimeters; and wheel base, tread width, or skid-type landing gear dimensions in centimeters.

(4) Interior measurements of fixed-wing and rotary-wing aircraft: compartment and access door dimensions, and cockpit and passenger cabin dimensions in centimeters; floor plan sketches indicating cargo tiedown locations and floor dimensions in centimeters, and strength of each tiedown by aircraft frame station in kilograms; and avionics, ammunition, and baggage compartments dimensions in centimeters.

(5) Aircraft weight and center of gravity (C.G.) location: empty weight in kilograms and C.G. location by specific aircraft frame station identification; basic weight (ferry and combat configurations) in kilograms and C.G. location by specific aircraft frame station identification; operating weight in kilograms and C.G. location by specific aircraft frame station identification; and gross weight (ferry and combat configurations) in kilograms and C.G. location by specific aircraft frame station identification.

(6) Aircraft subsystems and allied equipment: weight of each major component, with and without expendable items, in kilograms; and dimensions of each major component, volume and sum of volumes, if appropriate, of major components in centimeters and cubic centimeters.

(7) Avionics and other ancillary equipment: length, height, and width of each unit, with and without attachments, in centimeters; weight of each unit, excluding cables and connectors, in kilograms; and other physical characteristics specified in the requirements document.

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(8) Ground support equipment (vehicles, carts): length, width, height, and wheel base in meters or centimeters, as appropriate; dimensions of control, storage, and maintenance access door in centimeters; minimum ground clearance, length of cable, hose, tow bar, height of pintle in centimeters and type of tow bar; dimensions of storage, cargo, equipment, engine, and generator compartments in meters or centimeters, as appropriate; capacity of fuel, oil, and storage tanks in liters and volume of storage bin in cubic meters or centimeters, as appropriate; total weight (empty and fueled), and gross weight (combat or mission configuration) in kilograms; and equipment C.G. locations (empty, fueled, combat or mission configuration).

(9) Test sets: the length, width, height in meters or centimeters, as appropriate, and weight in kilograms of equipment prepared for service and configured for storage.

(10) Personnel clothing (protective, flight) and equipment: breast width, sleeve length, leg inseam length, and waist circumference in centimeters; degree of material color match and identification of seams and stitches used in clothing; helmet dimensions, chin strap length, visor dimensions, and communications cable length in centimeters; helmet electrical connector types, visor lens description and color, helmet minimum and maximum sizes obtained; and helmet weight with and without accessories in kilograms.

(11) Ammunition: lot number and composition of projectile and payload, as appropriate; and round length, maximum and minimum diameter in centimeters and weight in grams or kilograms.

e. Analytical plan. See paragraph 5e.

## 12. Chemical and Radiological Equipment.

a. Objective. See paragraph 5a.

b. Standards. See paragraph 5b.

c. Method. See paragraph 5c. Record data on form at figure 6.

d. Data required. The project officer will obtain the following data:

(1) General: nomenclature, serial number, lot number, and manufacturer of the test item and its components; and the construction of the test item and its components, packing case material, finish, any waterproofing, and apparent quality of workmanship.

MANUFACTURER _____	SERIAL _____	LOT _____
NOMENCLATURE _____	NUMBER _____	NUMBER _____

ITEM	(TEST ITEM)		(COMPONENT)							
	R	A	R	A	R	A	R	A	R	A
<del>XXXXXXXXXX</del>										
LENGTH										
WIDTH										
HEIGHT										
DIAMETER										
VOLUME										
MET										
NOT MET										

R = REQUIRED; A = ACTUAL

WATERPROOFING: \_\_\_\_\_

\_\_\_\_\_

DEFICIENCIES OR SHORTCOMINGS: \_\_\_\_\_

\_\_\_\_\_

OPERATIONAL CAPABILITY: \_\_\_\_\_

Figure 6. Chemical and Radiological Equipment Physical Characteristics

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(2) A narrative description of the test item and its major components in the operating or ready-for-use and field transport configurations supported by photographs or sketches.

(3) Length, width, height and volume, when applicable, of the test item and its components in centimeters or meters, as appropriate, and the weight of the test item and its components in kilograms.

e. Analytical plan. See paragraph 5e.

13. Construction, Support and Service Equipment.

a. Objective. See paragraph 5a.

b. Standards. See paragraph 5b.

c. Method. See paragraph 5c. The project officer will insure that test personnel prepare silhouette sketches indicating the shape or geometric appearance of the test item and its components in the crated and uncrated and assembled condition including front, side, rear, and angle views. They will identify each sketch with the proper description and include dimensions. They will take color motion pictures illustrating the physical characteristics of major items such as bridges and construction items of varying shapes. Turning radius of wheeled and tracked vehicles will be determined in accordance with the method described in paragraph 6c.

d. Data required. The project officer will obtain the following data:

(1) General: nomenclature, serial number, model number, and manufacturer; and the construction of the test item, its subsystems and components, packing case material, finish, any waterproofing, and apparent quality of workmanship.

(2) Complete test item (major components and ancillary items packed, unpacked, and minor ancillary items in packed conditions): length, width, height; depth, radius, diameter (inside - outside), wall thickness in centimeters or meters, as appropriate, and volume in cubic centimeters or meters, as appropriate; rated lifting capacity in kilograms, carrying capacity in cubic meters and kilograms; and dimensions related to functional suitability such as doors, hatch covers, wheel openings and covers in centimeters.

(3) Turning radii for left and right turns in centimeters.



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(4) Test items and components installed in shelters or trailers, or intended for installations without special shelter mounting such as in aircraft or combat vehicles: description of the manner in which the equipment is mounted and received; location and dimensions of all entrances and exits in centimeters; arrangement of equipment and dimensions in cubic meters or centimeters, as appropriate, occupied by each component, and distance between each component in centimeters; and dimension of aisles in centimeters and space available for each crew member during operations in cubic meters or centimeters.

e. Analytical plan. See paragraph 5e.

14. General Supplies and Equipment.

a. Objective. See paragraph 5a.

b. Standards. See paragraph 5b.

c. Methods. See paragraph 5c.

d. Data required. The project officer will obtain the following data:

(1) General: nomenclature, serial number, model number, and manufacturer; and the construction of the test item and its components, packing case material, finish, any waterproofing, and apparent quality of workmanship.

(2) Test item and its components: weight in kilograms, length, height, width in meters or centimeters, as appropriate, wall thickness in centimeters, and volume in cubic meters or centimeters; location and dimensions of all entrances and exits in centimeters; carrying capacity in cubic meters or centimeters, kilograms, or liters; and color.

(3) Unattached ancillary items and repair parts: weight in kilograms, height, width, height in meters or centimeters, as appropriate, and volume in cubic meters or centimeters.

e. Analytical plan. See paragraph 5e.

SECTION III  
SUPPLEMENTARY INSTRUCTIONS

15. Personnel Training. In addition to performing the actions described in TOP 1-3-508, the project officer will insure that:

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a. Test personnel (EST evaluators, support and troop unit) receive new equipment training, if required.

b. Test personnel are assigned EST duties appropriate to their military occupation specialty.

16. Safety. In addition to performing the actions described in TOP 1-3-506, the project officer will insure that:

a. Test personnel are familiarized with the safety procedures prescribed in the test item equipment publications.

b. Safety procedures prescribed for handling and operating the test item are correct.

c. All safety features or devices of the test item are required, are present, and function properly.

17. Preoperational Inspection. In addition to performing the actions described in TOP 1-3-505, the project officer will delay the start of the EST until all of the items in the maintenance test package, including equipment publications, are present or an exception has been approved by TECOM.

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, President, U. S. Army Field Artillery Board, ATTN: STEBA-MC, Fort Sill, Oklahoma 73503. 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 A  
REFERENCES

1. AR 70-38, "Research, Development, Test, and Evaluation of Materiel for Extreme Climatic Conditions."
2. AR 70-44, "Department of Defense, Engineering for Transportability Program."
3. AR 95-16, "Weight and Balance, Army Aircraft."
4. AR 310-25, "Dictionary of United States Army Terms."
5. MIL-STD 129, "Marking for Shipment and Storage."
6. MIL-STD 130, "Identification Marking of U. S. Military Property."
8. MIL-STD 1472A, "Human Engineering Design Criteria for Military Systems, Equipment and Facilities."
9. TM 3-250, "Storage, Shipment, and Handling of Chemical Agents and Hazardous Chemicals."
10. TM 9-1300-206, "Care, Handling, Preservation, and Destruction of Ammunition."
11. TM 55-405-9, "Army Aviation Maintenance Engineering Manual, Weight and Balance."
12. Requirements Document.
13. Safety Release.
14. New Equipment Training Package.

APPENDIX B  
CENTER OF GRAVITY DETERMINATION

1. Longitudinal and lateral (and vertical if required) location of center of gravity must be determined for all test items and ancillary equipment intended for air portability and airdrop tests. Some test items received may have markings showing location of center of gravity. In all cases the center of gravity location will be verified to the nearest 0.5 kilogram in weight and 25 millimeters in distance. The basic procedures for determining the center of gravity location are illustrated by Figures B-1 through B-4.

2. Figure B-1 illustrates determination of longitudinal location of center of gravity of a vehicle. Lateral location of center of gravity of the same vehicle can be determined, if required, simply by positioning the vehicle so that two side wheels are supported by the scales platform and the other two side wheels are supported by the floor. Weights and dimensions would then be used in the same equation and center of gravity location calculated. The method illustrated in Figure B-1 may be applied to any item; however, the points of support (rear and front wheels in contact with floor and scales platform in Figure B-1) must be pivotal points. Pivotal points for items without wheels can be provided through use of round metal pipes or rods as support points.

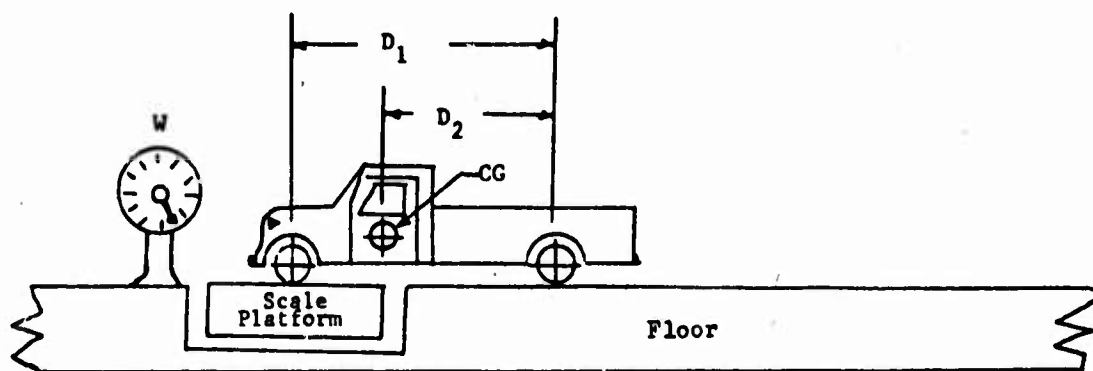


Figure B-1. Center of Gravity Horizontal Determination  
(Weighing Method).

$W_t$  = Total Item Weight in Kilograms

$W$  = Weight as indicated by scales in sketch

Then:  $D_1W = D_2W_t$

Or:  $D_2 = \frac{D_1W}{W_t}$  = Distance Forward from the Rear Axle  
where Center of Gravity is located.

3. Figure B-2 illustrates another method of determining center of gravity location. This method may be applied to any item having a flat, hard, and smooth bottom surface such as equipment or supplies rigged on a platform for airdrop. When such an item is positioned on a metal pipe or rod to obtain a balanced condition, the center of gravity lies directly above the balance point.

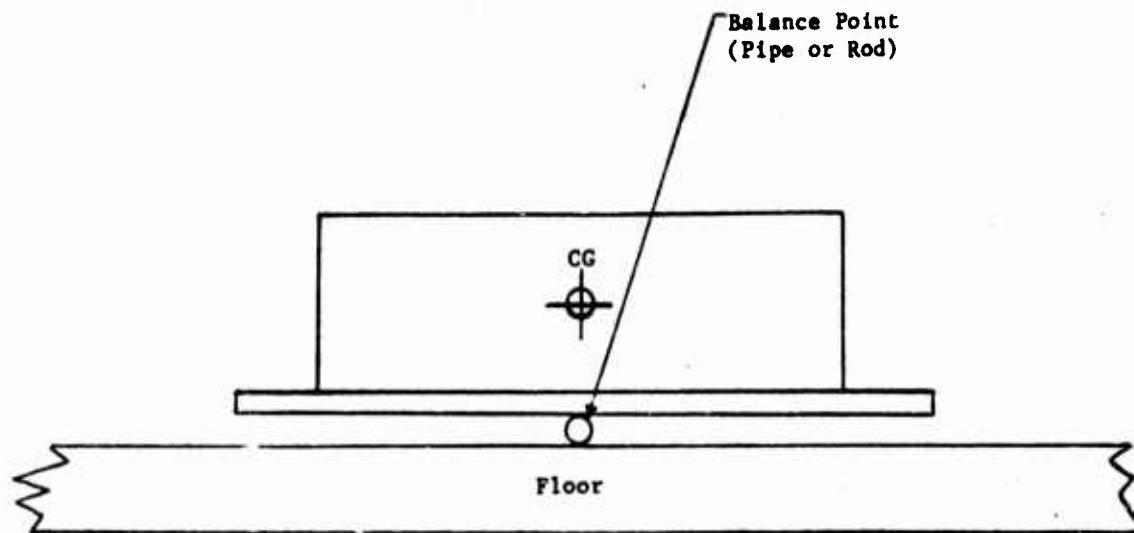


Figure B-2. Center of Gravity Horizontal Determination  
(Balancing Method)

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4. Figure B-3 illustrates the method to be used when the vertical location of the center of gravity is required. The basic procedure is to suspend the test item at an angle by use of unequal length sling cables as shown.

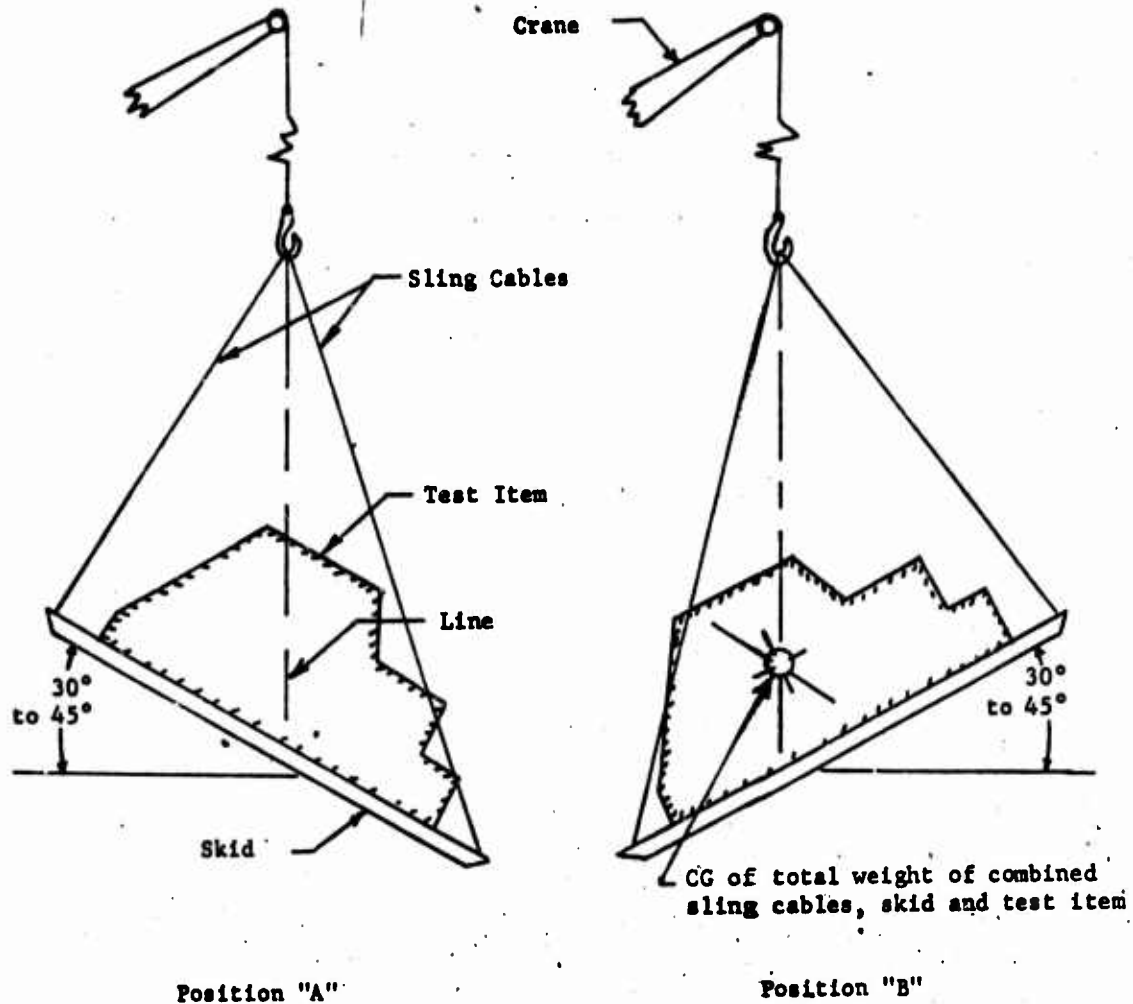


Figure B-3. Center of Gravity Horizontal and Vertical Determination (Suspension Method)

- a. With the test item suspended as in position "A" a suitable means shall be provided, such as a surveyor's transit, to project a line vertically downward from the crane suspension cable to the test item. A line approximately four millimeters wide and of suitable length should be applied to the side of the test item.
  - b. The test item is then suspended as in position "B" by reversing the sling cables so that the test item is tilted in reverse. Again a line is projected vertically downward from the crane suspension cable and applied to the test item. The exact center of gravity is at the intersection of the lines applied in position "A" and "B".
  - c. Where the test item is of such irregular nature as to make it impractical to apply the lines to the test item, a sheet of stiff cardboard or thin plywood may be secured to the side of the test item for marking purposes.
  - d. In order to maintain accuracy it is important that the sling cables be adjustable to such length as to maintain the plane of the skid tilted only in the directions shown.
  - e. The suspended load should be restrained from swinging or turning and maintained at 90° to the sighting transit.
  - f. The center of gravity thus obtained will be for the total weight of combined sling cables, skid and test item.
5. When required, the location of the center of gravity on the test item without the suspension cables and skid can be calculated as shown in Figure B-4. The instructions contained on pages B-5 through B-7 will not be followed when the conditions under a and b are applicable:
- a. A skid is not required for attachment of sling cables.
  - b. The weight of the sling cables is negligible as compared to the weight of the test item.
  - c. Establish reference planes from which to measure.

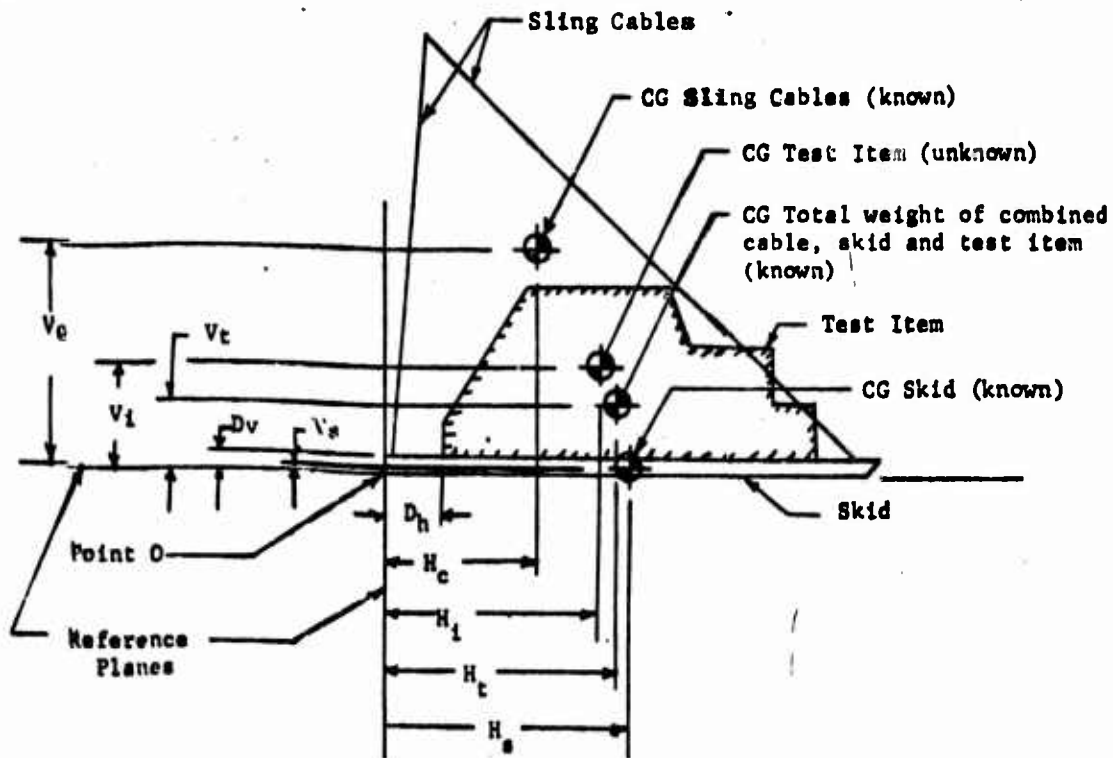


Figure B-4. Various CG Locations

## d. Explanation of dimension and weight symbols:

$D_h$  = Horizontal distance from reference plane to end of test item (known).

$H_a$  = Horizontal distance from reference plane to center of gravity of sling cable a (known).

$H_b$  = Horizontal distance from reference plane to center of gravity of sling cable b (known).

$H_i$  = Horizontal distance from reference plane to center of gravity of test item (unknown).



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$H_t$  = Horizontal distance from reference plane to center of gravity of total weight of combined cable, skid and test item (known - having been determined as shown in Figure B-3).

$H_s$  = Horizontal distance from reference plane to center of gravity of skid (known).

$V_s$  = Vertical distance from reference plane to center of gravity of skid (known).

$D_v$  = Vertical distance from reference plane to bottom of test item (known).

$V_t$  = Vertical distance from reference plane to center of gravity of total weight of combined cable, skid and test item (known - having been determined as shown in Figure B-3).

$V_i$  = Vertical distance from reference plane to center of gravity of test item (unknown).

$V_a$  = Vertical distance from reference plane to center of gravity of sling cable a (known).

$V_b$  = Vertical distance from reference plane to center of gravity of sling cable b (known).

$W_a$  = Weight of sling cable a (known).

$W_b$  = Weight of sling cable b (known).

$W_i$  = Weight of test item (known).

$W_t$  = Total combined weight of sling cable, skid and test item (known).

$W_s$  = Weight of skid (known).