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23 June 1970

Materiel Test Procedure 9-2-202
General Equipment Test Activity

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

HOISTS, CHAIN AND WIRE ROPE

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1. OBJECTIVE*

This document provides test methodology and testing techniques necessary to determine the technical performance and safety characteristics of chain and wire rope hoists and associated tools and equipment as described in Qualitative Materiel Requirements (QMR's), Small Development Requirements (SDR's), and Technical Characteristics (TC's), and to determine the item's suitability for service tests.

2. BACKGROUND

The U. S. Army in its normal shop operations requires the presence of devices which are capable of moving heavy loads through vertical displacements where either or both the load and displacement desired are beyond human effort. These devices are classed as hoisting mechanisms. The test item, in addition to the fact that it is explicit by title, is one such device. There are extensive variations in the design characteristics of the test item (hereafter to be referred to as "hoist") some examples of which are as follows:

- a. Linear element - can be chain or wire rope
- b. Operation - manual or motor driven.
- c. Suspension - hook, lug, trolley.
- d. Mounting - fixed, fixed on a movable beam, or trolley mounted on an I beam.
- e. Mechanical operation - see Appendix A for the types usually employed.

The test item is a useful device because it provides force multiplication, mechanical advantage, (see Appendix A for an explanation of how this is achieved) e.g. if a load of weight W is to be lifted and a force F is available, $F < W$, then the device in effect multiplies F, say n times so that:

$$nF = W$$

With manually operated devices, the force F is supplied by the user and Figure 1 provides a comparison of the most commonly used types. The motor driven unit, of course, supplies F through the torque characteristics of the motor used.

The purpose of testing the hoist will be to determine that it not

*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 QMR's, SDR's, TC's, and any other applicable documents.

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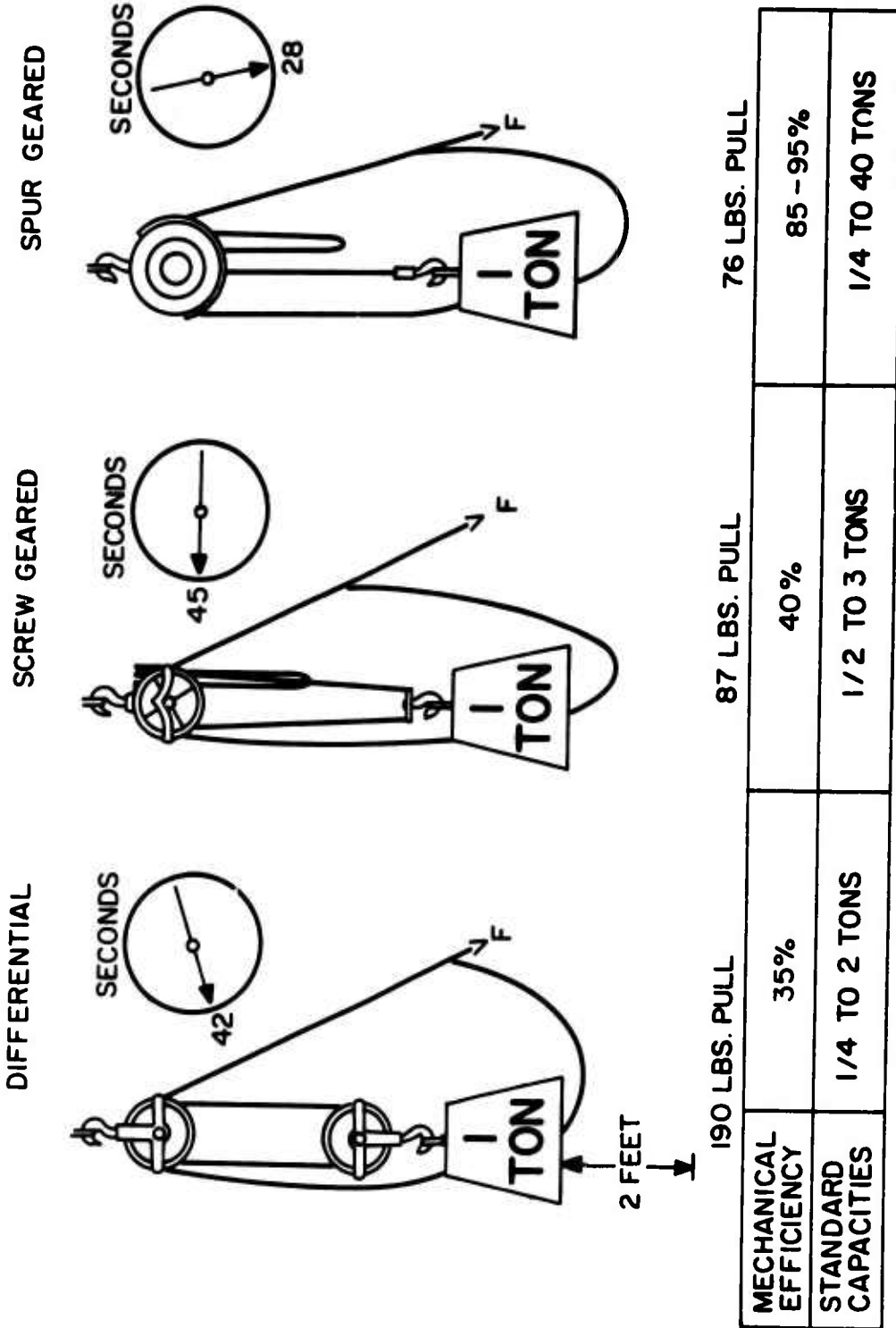


FIG. 1 COMPARISON OF HAND HOISTS.

only satisfies the general requirements of all military equipment and specific requirements of its device class but that it accomplishes its primary functional purpose through effective utilization of the physical principles discussed.

3. REQUIRED EQUIPMENT

- a. Transportability Test Facility.
- b. Electromagnetic Interference (EMI) Facility-shielded room or open area.
- c. Spring Scales.
- d. Weighing Scales.
- e. Dielectric Strength Tester, 0-3000 VRMS, 25-60 Hz.
- f. 500 vdc Megohmmeter.
- g. Wheatstone Bridge.
- h. EMI Field Intensity Equipment and Antennas per MIL-STD-461.
- i. Various Weighted Loads.
- j. Miscellaneous Hand Tools.
- k. Rulers.

4. REFERENCES

- A. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
- B. USATECOM Regulation 700-1, Value Engineering.
- C. USATECOM Regulation 70-23, Equipment Performance Report (EPRs).
- D. USAGETA (HEDGE) Human Factors Evaluation Data for General Equipment.
- E. MIL-STD-129, Marking for Shipment and Storage.
- F. MIL-STD-130, Identification Marking of U. S. Military Property.
- G. MIL-STD-461, Electromagnetic Interference Characteristics Requirements for Equipment.
- H. MIL-STD-462, Electromagnetic Interference Characteristics, Measurement of.
- I. MIL-STD-463, Definition and System of Units, Electromagnetic Interference Technology.
- J. MIL-STD-810, Environmental Test Methods.
- K. MIL-H-15424, Hand Tool, Packaging of.
- L. MIL-H-26935B, Hoist, Chain and Wire Rope, Electric Motor Driven.
- M. MIL-H-904E, Hoists, Chain and Wire Rope, (Hand Operated).
- N. MIL-H-3280, Hoists, Chain, Manually Operated, Packaging of.
- O. MIL-P-116, Preservation, Methods of.
- P. MIL-E-16298, Electric Machines Having Rotating Parts and Associated Repair Parts, Packaging of.
- Q. Federal Test Method Standard No. 101, Drop Test (Free Fall).
- R. Federal Specification RR-W-410, Wire Rope and Strand.
- S. HEL-STDS-1-63B, Maximum Noise Level for Army Materiel Command Equipment.
- T. NEMA-MG-1 National Electric Manufacturer's Association, Tests and Performance - AC and DC Fractional and Integral Horsepower Motors Part 12 - 1966.

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- U. Morrow, Maintenance Engineering Handbook McGraw-Hill Book Co. 1957.
- V. MTP 9-2-155, Motors, Electrical.
- W. MTP 9-2-503, Durability.
- X. MTP 10-2-500, Physical Characteristics.
- Y. MTP 10-2-501, Operator Training and Familiarization.
- Z. MTP 10-2-503, Transportability.
- AA. MTP 10-2-505, Human Factors Evaluation.
- AB. MTP 10-2-507, Maintenance Evaluation.
- AC. MTP 10-2-508, Safety.
- AD. MTP 10-2-511, Quality Assurance.
- AE. MTP 10-2-512, Reliability.

5. SCOPE

5.1 SUMMARY

This materiel test procedure describes the following tests to be conducted on the test item.

a. Preparation for Test - A determination of the condition of the test item upon its arrival and other preparatory procedures to be completed prior to the start of active testing. These will include the following:

- 1) Packaging and test item inspection
- 2) Inventory check
- 3) Physical characteristics
- 4) Operator training and familiarization
- 5) Pre-operational checks

b. Operational Performance - An evaluation to examine specific operational design characteristics including the test item's ability to perform its primary function and its specific technical characteristics.

c. Electromagnetic Interference - An evaluation to determine the degree to which the test item produces radiated or line conducted interference.

d. Durability - An evaluation of the test item's ability to display original physical and performance characteristics after an extended period of continuous operation.

e. Transportability - An evaluation to determine the ability of the test item and its container to withstand the forces which it will experience during normal handling and transporting.

f. Maintenance - An evaluation to determine and appraise the test item's maintenance characteristics and requirements, a verification and appraisal of its malfunctions, an evaluation of the test item's associated publications and other common and special support elements (maintenance test package), an appraisal of the test item's design for maintainability (AMCP 706-134: accessibility, ease of maintenance, standardization, and interchangeability) an evaluation of component and system durability and reliability, and the calculation of indicators which express the effects of appropriate preceding aspects.

g. Safety - An evaluation to determine the test item compliance with safety requirements and to confirm the test item's safety characteristics during conduct of all tests.

h. Human Factors - An evaluation to determine the adequacy of the design and performance characteristics of the test item and associated equipment in terms of conformance to accepted human factors engineering design criteria. The sound noise level of the test item will also be determined.

i. Value Analysis - An evaluation directed at analyzing the primary functions and features of the test item for the purpose of reducing the cost of the test item without compromising the desired performance and safety characteristics.

j. Quality Assurance - A review to determine and evaluate defects in material and workmanship.

5.2 LIMITATIONS

The tests contained in this document are applicable for the engineering evaluation of chain or wire rope hoists which are either manually powered or driven by an electrical motor and with either fixed or trolley suspension.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Initial Inspection

6.1.1.1 Shipping and Packaging Inspections

a. Examine the shipping method, preservation and packaging and determine any nonconformance with the following:

- 1) Packaging of manually operated hoists - MIL-H-3280.
- 2) Preservation, packaging and packing of electrically powered units - MIL-P-16298.
- 3) General preservation requirements - MIL-P-116.
- 4) Container markings - MIL-STD-129.
- 5) Packaging of provided hand tools - MIL-H-15424.

b. Record the following:

- 1) Evidence of damage or deterioration to packaging or shipping components and materials.
- 2) All identification markings.

c. Remove the test item from its shipping carrier, or container, and record the following:

- 1) All printed material accompanying the test item and agreement with test item markings.
- 2) Equipment, time and personnel required.

- 3) Comments regarding the method and materials used to secure the test item.

6.1.1.2 Test Item Inspection

The test item should have been marked in accordance with MIL-STD-130. Visually inspect the test item for evidence of defects and damage in its manufacturing, materials, and workmanship. In particular, the following will be considered:

- a. Metal surfaces shall be treated for rust and/or painted in accordance with the best commercial practice. Paint shall be smooth and uniform without runs and sags.

- b. Component junctions.

- 1) Rivets shall be of a size to completely fill holes and allow for a sufficient flare over.
- 2) Welding shall be free from slag, cracks, fractures and have a smooth, clean appearance.
- 3) Hardware shall be of sufficient size and strength and be tightly drawn.
- 4) Seams, joints and edges shall have a good fit and alignment and there shall be no sharp edges or burrs.

6.1.2 Inventory Check

Verify completeness of the test item and its associated maintenance test package and material with the Basic Issue Item List (BIIL) and file an Equipment Performance Report (EPR) if required.

6.1.3 Physical Characteristics

The physical characteristics of the test item shall be determined by performing the applicable sections of MTP 10-2-500, and the following:

- a. Code Markings - Note the legibility of the test item markings and record all data.

- b. Dimension and Weight Data - Record the dimensions and weights of all assembly components.

- c. Test item Characteristics - Record the following:

- 1) Hoist type - manual or driven
- 2) Chain or rope
- 3) Lifting capacity and range
- 4) Hoisting speed
- 5) Mounting type
- 6) Suspension method
- 7) Motor and controller characteristics
- 8) Gear type
- 9) Limit devices
- 10) Safety latches or locks

- 11) Range of load hook
- 12) Other nameplate data

d. Verify that the assembly components are in accordance with the following standards:

- 1) Motors - NEMA-MG-1
- 2) Controllers - NEMA IC-1
- 3) Wire rope - Federal Specification RR-W-410

6.1.4 Operator Training and Familiarization

Test personnel should undergo the applicable procedures of MTP 10-2-501 and in particular the following should be undertaken:

- a. Instruct and train the test personnel in the safety, operation, and maintenance of the test item utilizing the technical manuals.
- b. Test personnel shall be informed of the objectives and be knowledgeable in the procedures of the tests to be performed.
- c. Record all personal data required for the selected test personnel.

6.1.5 Pre-Operational Checks

Perform the following:

- a. Depreservation and assembly - remove all preservation from the test item and attach any devices, etc. which are removed from the test item for transporting convenience.
- b. Lubrication - verify complete lubrication of the test item.
- c. Manual units - operate the hand line and load line to ensure that there is no binding in the unit.
- d. Controls - operate all controls to ensure that they are functioning properly.
- e. Brakes - check all mechanical and electrical brakes for proper operation.
- f. Locking devices - where used these will be checked.
- g. Limit switches - ensure that all limit devices function to prevent overload or overtravel.

6.2 TEST CONDUCT

NOTE: Prepare an Equipment Performance Report for all equipment malfunctions.

6.2.1 Operational Performance

The following tests will be used on the test item where applicable:

6.2.1.1 Preliminary Electrical Tests

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- a. Continuity and short - using an ohmmeter, check power input leads and ensure that only the building ground lead is connected to the test item housing and that no shorts exist between the other leads.
- b. Dielectric strength - using a dielectric strength tester, (0-3000VRMS, 25-60Hz) test each electrical circuit.
- c. Insulation resistance (IR) - using a 500 vdc megohmmeter, check each electrical circuit for insulation resistance.

6.2.1.2 Rated Capacity Load

Perform the following:

- a. Have the test item installed by its normal method of suspension (trolley, hook, etc.).
- b. Place a rated capacity load on the hook.
- c. On all types of hoists check the operation of controls, mechanical and electrical brakes.
- d. On all units check the load displacement range by measuring the extremes of upward and downward load travel.
- e. Observe the load motion and note the presence of jars, jerking or vibrations or excessive noise.
- f. For motor driven units the load speed will be measured by timing (1) cycle each of lowering and lifting the load over its range.
- g. Efficiency of manual units will be determined by the following:
 - 1) Hand operated hoists - Using a spring scale in line with the load chain, raise the load through any conveniently measured distance (L). Record the number of feet of hand chain (T) passed by a reference mark in raising the load to the selected height and the tension (P) in the hand chain.
 - 2) Lever operated or hoists with hand crank- Raise the load through any conveniently measured distance with a spring balance connected not more than 2 inches from the end of the operating lever or the handle of the crank. The closed length of a telescoping type of lever shall be used for this determination. The mean force (P) required to operate the lever or handle through one operating stroke shall be determined by measuring the force, at 5 different positions in the operating stroke. Measurement shall be made with the spring balance always at a right angle to the lever or crank handle and for at least six successive operating strokes. The total distance through which the operating force acts (T) and the distance (L) through which the load is lifted, shall be recorded.

6.2.1.3 Static Overload

Perform the following:

- a. Obtain a load equal to 200% of rated and attach it to the fully

extended load line or hook.

- b. Allow the load to stand for 10 minutes.
- c. Detach the overload and inspect the test item for breakage and/or deformation.
- d. Reattach the rated load and operate the test item through several lift and lowering cycles to determine any impairment to operational characteristics.

6.2.1.4 Dynamic Overload

Perform the following:

a. Obtain a load equal to 150% rated and attach it to the load line or hook.

b. For fixed, manually, operated units the load will be raised and lowered a minimum of 6 inches for 15 cycles. Trolley mounted units will be moved back and forth over a distance of at least 8 feet at the fastest speed obtainable.

c. For electrically operated units, the overload will be raised and lowered through the full hoisting range for 5 cycles at no specified speed. Perform 2 additional cycles and during the lowering sequence apply the brakes twice, once at midpoint and once near the lower limit. The brakes should stop and hold the load when lowering at rated speed. Trolley mounted units will also be checked as in section b above.

d. At the completion of the test, examine the unit for signs of damage or deformation and evidence of overheated components.

6.2.1.5 Impact Test (Free Falling Load)

For test items rated for high impact the following will be performed:

- a. Attach a load of rated capacity to the test item.
- b. Drop the load from 1 through 4 inches in 1 inch increments in such a manner that the falling load is stopped by the hoist load hook.
- c. Trolley hoists will be secured against lateral movement.
- d. The hoist will not drop its load although deformation may occur.

Record the amount of deformation if any.

e. Examine the test item for damage and operate the load through a normal cycle to determine proper operation.

6.2.1.6 Track Clamp Test

For trolley type units equipped with a track clamp, perform the following:

- a. Attach a load of rated capacity to the hoist.
- b. Connect a line of suitable strength (wire rope) to the hoist so as to be able to exert a pulling force on the hoist parallel to the track. The line may be brought around an appropriately placed sheave and down in a vertical direction so that its end is at an accessible height.

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- c. Attach a spring scale in line with the rope.
- d. Apply a force of 1/3 the rated load of the hoist. This may also be achieved by the use of suitable weights.
- e. Note that the hoist remains stationary. Record any signs of movement.

6.2.1.7 Environmental Test

If military requirements indicate a need to operate in extreme environments, selected performance tests will be re-run of the designated environmental conditions. Reference MIL-STD-810.

6.2.2 Electromagnetic Interference

This test shall be conducted in accordance with the requirements of MIL-STD-461, 462, and 463. In particular, the subtests required of the MIL-STD-461 Class II B equipment shall consist of the following:

<u>TEST</u>	<u>DESCRIPTION</u>
CE03	150 KHz to 50 MHz, Power Leads
CE05	30 Hz to 50 MHz, Inverse Filter Method
RE01	0.03 to 30 KHz, Magnetic Field
RE02	150 KHz to 400 MHz, Electric Field
(T) RE04	0.02 to 50 KHz, Magnetic Field

Perform the following:

- a. Obtain the measuring equipment and antennas required by MIL-STD-461.
- b. Calibrate the equipment where required.
- c. Have the test item in a normal operating configuration under the test conditions specified by MIL-STD-462.
- d. Conduct the subtests listed above, recording frequencies and levels of interference.
- e. Compare the interference readings against the allowable limit graphs of MIL-STD-461 and note out-of-tolerance readings.

6.2.3 Durability

Perform the applicable sections of MTP 9-2-503 and the following:

- a. Have the assembly in the setup of section 6.2.2 with the rated load attached and a thermometer, °C., attached to the power unit housing, if applicable.
- b. The test will consist of cycling the hoist through upward and downward displacements of at least 50% of the total range. The rate of travel will be the following:
 - 1) Manual units - the approximate speed displayed in manual operation.

- 2) Powered units - the rated hoisting speed.
- c. The test will consist of 1000 complete cycles.
- d. The test setup can consist of the following:
 - 1) Manual units - Attach the pulling end of the assembly to a device which is capable of raising, lowering and reversing direction of the load automatically at a variable rate. A suggested means for accomplishing this would be a take-up reel powered by a reversible, variable speed, motor which is controlled in turn by an electrical programmable cam assembly. Set the motor speed for the selected load displacement rate and adjust the programmer to reverse the motor direction at the 2 points of maximum travel selected.
 - 2) Powered unit - These can be controlled by connecting the reversing programmer directly into the motor controller leads which determine direction.
- e. During the test, monitor and record the maximum temperature which the housing attains.
- f. When the test is complete examine the complete assembly for any damage, signs of accelerated wear, or areas of excessive temperature.
- g. For each defect revealed by section e record the nature of the defect and location.

NOTE: In the event of equipment malfunction during the durability test, the procedures of the maintenance section will be performed and the durability test re-run following repair.

6.2.4 Transportability

Perform the applicable portions of MTP 10-2-503 and the following:

- a. Upon completion of the test perform the following:
 - 1) Examine and record the extent of physical damage which the exterior of the test item container exhibits.
 - 2) Remove the test item from its container and note the following:
 - a) Broken bracing or damaged packing material
 - b) Undesirable shifting in the contents
 - c) Loose, free or broken materials or components
- b. Visually inspect the test item for any damage. Operate the test item under normal conditions and record any change in its operating efficiency.

6.2.5 Maintenance

Evaluate the maintenance - related factors of the test item as described in MTP 10-2-509 and MTP 10-2-513 with emphasis on the following:

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- a. Organizational (O), Direct Support (F), and General Support (H) maintenance requirements.
- b. Operator through General Support Maintenance Literature.
- c. Repair parts.
- d. Tools.
- e. Test and handling equipment.
- f. Calibration and maintenance facilities.
- g. Personnel skill requirements.
- h. Maintainability.
- i. Reliability.
- j. Availability.

6.2.6 Safety

This test is to evaluate the safety characteristics and features of the test item. The requirements of MTP 10-2-508 will apply.

- NOTE:
1. At the completion of the test, issue a safety statement in accordance with USATECOM Regulation 385-6.
 2. During the conduct of all tests, test personnel shall observe the proper safety precautions and, in particular, shall adhere closely to the draft manual for the handling and use of the test item.
 3. The procedures for all tests and the test item shall be examined and any condition which might constitute a safety hazard shall be recorded and also reported to the testing officer.

Perform the following:

a. Prepare a list of all safety features such as overheat, limit switches, and load lock devices used on the test item. For each device listed, a minimum of 2 cycles of operation will be caused by simulating the type failure which the device is to detect or otherwise utilizing the feature. Record the following:

- 1) The device/feature tested
- 2) Failure which the device is to detect
- 3) Proper operation of the device or failure detected

b. Examine the test item for the possible additions and/or improvements to its safety characteristics. Record any recommendations.

c. Determine that capacity and any precautionary instructions essential to operation are clearly marked on the item or on appropriate name plates.

6.2.7 Human Factors Evaluation

Throughout the test, evaluate the effectiveness and characteristics of the man-item interaction as related to human factors by performing the applicable sections of MTP 10-2-505 and the following:

a. Prepare checklists to evaluate the human factor characteristic using Human Factors Evaluation Data for General Equipment (HEDGE) for the Class IIIA (Man-Operated Materiel Handlers) and Class IIA as appropriate, including the following:

- 1) Operability
 - a) Engage load-evaluate design for bringing into contact with the load.
 - b) Lift, move load-evaluate design for performance of operation.
- 2) Maintainability
 - a) Perform preventative maintenance - evaluate lubrication procedures.
 - b) Remove and replace - evaluate the ease of sheave and other parts replacement.
- 3) Transportability
 - a) Place in transit configuration - evaluate procedures required to prepare the test item.
 - b) Packaging - evaluate the packaging procedures.
 - c) Place on carrier - evaluate ease of placing test item/package onto/in the carrier.
- 4) Erectability - evaluate the problems associated with the selection and requirements of an erection or hanging location.

b. Evaluation of the tasks of step a shall include but not be limited to the following:

- 1) Adequacy of instructions and tools to perform the task
- 2) Mental and physical effort required
- 3) Design of the test item as it affects the task
- 4) Time required for the task
- 5) Personnel required for the task

6.2.8 Value Analysis

During the conduct of all tests, personnel shall examine the materials, construction, and design of the test item from a value standpoint in an effort to affect cost reduction of the test item. USATECOM Regulation 700-1 shall serve as a basis for this evaluation. Perform the following:

a. Examine the test item in the following cost reduction areas:

- 1) Deletion of ineffective or unnecessary features or components.

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- 2) Substitution of less expensive but comparable component or material.
- 3) Changes in the design to reduce the cost of manufacturing.

b. Examine all proposals to determine that the performance and safety characteristics have not been lowered.

c. Record the following for each suggested change.

- 1) Component or feature involved
- 2) Suggested change
- 3) Reasons for the suggestion

6.2.9 Quality Assurance

Determine the quality of the test item as described in the applicable section of MTP 10-2-511.

6.3 TEST DATA

NOTE: In compiling the Test Data section, test personnel should expound upon those data procedures which are other than quantitative in nature by recording narrative descriptions and/or events occurring during the conduct of the test.

6.3.1 Preparation for Test

6.3.1.1 Initial Inspection

6.3.1.1.1 Shipping and Packaging Inspection

Record the following:

- a. Any noncompliance with the standards for shipping, marking, preservation, and packaging.
- b. Evidence of damage, identification markings, and list of printed matter enclosed.
- c. Equipment, time, and personnel required to unpack the test item and comments concerning the method and materials used in packing.

6.3.1.1.2 Test Item Inspection

Record the following:

- a. Any instances of noncompliance with the marking requirements of MIL-STD-130.
- b. Evidence of defects in the manufacturing, materials, and workmanship.

6.3.1.2 Inventory Check

List any materials missing from the Basic Issue Item List or

maintenance test package.

6.3.1.3 Physical Characteristics

Record the data required by MTP 10-2-500 and the following:

- a. Test item code markings
- b. Dimension and weight data
- c. Class characteristics
 - 1) The type of hoist.
 - 2) Chain or wire rope.
 - 3) Lifting capacity in tons and hoisting range in feet.
 - 4) Hoisting speed in ft/min.
 - 5) Mounting type.
 - 6) Suspension method.
 - 7) Motor electrical and power characteristics and type of controller.
 - 8) Gear type.
 - 9) Limit devices.
 - 10) Safety latches or locks.
 - 11) Range of load hook.

d. Any instances where components are not in accordance with listed specifications.

6.3.1.4 Operator Training and Familiarization

Record the data required by MTP 10-2-501 and the following:

- a. Methods used and completion of test personnel training and evaluation of the adequacy of the technical manuals for training purposes.
- b. Evidence that the test personnel are sufficiently knowledgeable in objectives and procedures.
- c. The personal data required for selected personnel.

6.3.1.5 Pre-operational Checks

Record the following:

- a. Depreservation procedures utilized
- b. Any assembly required
- c. Lubrication procedures
- d. Any binding or rubbing in the test item
- e. Any non-operational controls
- f. Brakes which are ineffective or inoperative
- g. Nonfunctional locking devices or limit switches
- h. Defective chain or rope

6.3.2 Test Conduct

6.3.2.1 Operational Performance

6.3.2.1.1 Preliminary Electrical Tests

Record the following:

- a. Any shorts or discontinuities. Identify the circuit.
- b. Dielectric strength failures.
- c. The insulation resistance in megohms.

6.3.2.1.2 Rated Capacity Load

Record the following:

- a. The capacity load in tons.
- b. Ineffective, inoperative or brakes which fail to hold the load.
- c. The load displacement range in feet.
- d. Any irregularities in the motion of the load or excessive noise.
- e. The lifting and lowering speeds both in feet/sec.
- f. For the efficiency determination:
 - 1) Hand operated hoists - The number of feet of hand chain passed (T) in ft., the tension (P) in lbs., and the distance of load (L).
 - 2) Lever or hand crank - The mean force (P) in lbs., the distance of the operating force (L) in ft., and the distance (L) in feet.

6.3.2.1.3 Static Overload

Record the following:

- a. The load used, in tons
- b. The length of the test, in minutes
- c. Any damage to the test item

6.3.2.1.4 Dynamic Overload

Record the following:

- a. The load used in tons.
- b. Any evidence of damage, deformation or overheating on the test item.

6.3.2.1.5 Impact Test

Record any damage to the test item, describing the type and location.

6.3.2.1.6 Track Clamp Test

Record the following:

- a. The pulling force used in the test, in tons
- b. Any motion exhibited by the test item

6.3.2.1.7 Environmental Tests

Record applicable data.

6.3.2.2 Electromagnetic Interference

- a. Prepare a diagrammatic layout of the test site showing the test item and locations at which measurements were made.
- b. Record for each test and its frequency band, the frequency and its corresponding highest in-band interference reading.

6.3.2.3 Durability (Including Temperature Rise)

Record the following data in addition to that required by MTP 9-2-503.

- a. The load in tons.
- b. Number of cycles performed, time per cycle, and total test time.
- c. Any lubrication procedures used.
- d. The maximum temperature in °C.
- e. Post test physical examination.
 - 1) Damage to any component, material or finish
 - 2) Loosening of hardware, breaks in welds
 - 3) Excessive temperatures on the enclosure
 - 4) Signs of leakage
- f. For each defect of section e, record the nature, location, and recommended remedy.

6.3.2.4 Transportability

Record the data required by MTP 10-2-503 and the following:

- a. The locations and types of damage which the test item container exhibits and any breakage, shifting, etc. of the container contents.
- b. Any damage to the test item or impairment of its operating efficiency. Include details as to location and nature of the fault.

6.3.2.5 Maintenance

Record data collected as described in the applicable sections of MTP 10-2-507, MTP 10-2-512 and the following:

- a. Maintenance literature which is not easily understood,

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incomplete or ineffective.

- b. Repair parts which are not proper type or are non-standard.
- c. Ineffective or improperly specified tools.

6.3.2.6 Safety

Record the data required by MTP 10-2-508 and the following:

- a. Comments regarding unsafe conditions found in the procedures of any test.
- b. Prepare a table to include the following:
 - 1) A list of all safety devices used on the test item.
 - 2) The type of failure each device is to detect.
 - 3) Indication that the device has successfully passed two cycles of operation.
- c. List any missing devices or unsafe conditions.
- d. List any suggested additions to the test item's safety features.
- e. Prepare a statement as to safety suitability of the item for service test.

6.3.2.7 Human Factors Evaluation

- a. Record data collected as described in the applicable sections of MTP 10-2-505.
- b. Retain completed checklists.

6.3.2.8 Value Analysis

Record the following:

- a. The component or feature involved
- b. Suggested change
- c. Reasons for the suggested change

6.3.2.9 Quality Assurance

Record data collected as described in the applicable sections of MTP 10-2-511.

6.4 DATA REDUCTION AND PRESENTATION

6.4.1 Operational Performance

6.4.1.1 Preliminary Electrical Tests

Compare the measured value of IR to the minimum allowed value and note any failures.

6.4.1.2 Rated Capacity Load

For hand-operated units calculate the efficiency by the following:

$$E = \frac{CL \times 100}{PT}$$

where:

E = mechanical efficiency in % of 100.

C = rated capacity of hoist in pounds.

L = distance lifted (feet).

P = mean operating force in lbs.

T = number of feet of hand chain to raise load or total distance through which "P" acts, for lever and hand crank operated hoists.

6.4.2 Electromagnetic Interference

Prepare a table showing the interference test conducted, out-of-limit reading, or the highest reading in the band and corresponding frequency. Consult the graphs of MIL-STD-461 for maximum allowable readings.

Tabulate and summarize the remaining data as appropriate. All data shall be compared with the technical performance characteristics specified in the QMR's, SDR's, or other specifications.

A Safety Release Recommendation shall be submitted in accordance with USATECOM Regulation 385-6 based on the data collected related to safety.

APPENDIX A

HOIST TYPES

Differential Hoists. In this type, the mechanical advantage is gained by a differential in the diameters of the two picketed grooves of the upper sheave. An endless-link chain is reeved continuously through the double upper and the single lower sheave. This is the simplest and least expensive type of chain hoist.

Screw-gear Hoists. This type, gains its mechanical advantage through the worm and gear principle, and its efficiency is approximately twice that obtained in the differential hoist. Although it is somewhat slower than the differential, it is much smoother in operation. It is recommended for applications requiring vibrationless motion where speed of lift is not important.

Spur-gear Hoists. This type is much more efficient than the preceding two, although higher in initial cost. It operates on the principle of gear reduction and reduces friction to such an extent that some type of automatic brake is required to hold the load. The spur-gear hoist is the accepted standard for industrial applications, and this basic type is available in several model variations.

Spur-gear hoists are available also in lightweight models which duplicate performance characteristics but utilize more compact design, lightweight alloys, and more antifriction bearings to achieve greater portability through a weight reduction of about 50 percent. Other standard model variations are as follows:

Twin-hook Hoists. Spur-gear hoists with twin hooks, are available for applications requiring widely separated load chains for two-point suspension of long pieces.

Extended-hand-wheel Hoists. The extended-hand-wheel variation of the spur-gear hoist is designed for applications where it is desirable for hand chain and operator to be clear of the load being lifted. Standard extensions range from 3 to 10 feet.

Low-headroom Trolley Hoists. This type is a spur-gear hoist built integrally with a trolley for installation where minimum headroom is available. In the 1-ton model about 1 foot of headroom is saved by this design. In heavier capacities the headroom saving is correspondingly greater. Geared trolleys are also available.

Pullers. A puller sometimes called a "come-along", is a simple form of chain hoist operated by a ratchet lever instead of a hand wheel and is designed for lifting, pulling, dragging, or stretching vertically, horizontally, or at any angle. Pullers are available in link and roller chain and wire rope types in capacities from 3/4 to 15 tons.

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Electric Hoists. Electric hoists are motor-driven spur-gearred hoists and have either push-button or pendant-rope controls. They are made in both link and roller chain types and usually are equipped with limit switches, as a safety precaution to control both "up" and "down" extremes of travel.

While electric hoists are available for use with all types of current, many small capacity models are equipped with single-phase 115-volt motors, which can be plugged into any lighting circuit. Some manufacturers offer three-phase dual-voltage hoists designed to operate on 60-cycle a-c 220/440-volt power.

Electric chain hoists in capacities from 1/8 to 2 tons are widely used throughout industry because of their portability, speed, safety, economy, and reduction of operator fatigue.

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