Materiel Test Procedure 9-3-170
U.S. Army Armor and Engineer Board

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

ROCK DRILLING RIG

1. OBJECTIVE

The objective of this Materiel Test Procedure (MTP) is to set forth the test methodology and testing techniques necessary to determine to what degree rock drilling rigs and their components perform their mission as described in Materiel Need (MN) or other approved criteria and to determine the suitability of the equipment with accompanying maintenance test package for U.S. Army use.

2. BACKGROUND

The U.S. Army uses crawler mounted drills to support construction operations (quarry type). The current standard crawler drill is a self-propelled unit designed primarily to drill vertical and angular-blast holes in rock. The track mounting gives the drill good on-the-job mobility as well as excellent drilling stability on difficult terrain. The crawler drill is composed of two basic assemblies - the carrier unit and the drill unit. The crawler drill can drill up to 100-foot boreholes in all kinds of rock. It can propel itself at 2-1/2 miles per hour, or pull a 600 cfm compressor at 2 miles per hour. Drill steels are available in 6-, 8-, 10-, 12- and 14- foot lengths. The bit sizes range up to 4-1/2 inches in diameter. It operates at 90 pounds per square inch (psi) rated air pressure and uses air at the rate of 600 cubic feet per minute (fcm).

In order to determine the extent to which their functional performance and military characteristics conform to the requirements of the applicable MN, or other appropriate criteria, rock drilling rigs must be tested in the field by personnel representative of those who will actually use and maintain the items under combat conditions.

3. REQUIRED EQUIPMENT

a. Gauge to measure cubic feet per minute (cfm) of air
b. Gauge to measure pounds per square inch (psi) of air
c. Cold and wet weather gear
d. Air compressor 600 cfm
e. Instrument for measuring side slope
f. Goggles
g. Photographic equipment (still and motion)
h. Platform scales
i. Support vehicles and equipment, as required
j. Various type aircraft for transportation tests, if specified
k. Ambulance with medical aid personnel and equipment
l. Meteorological equipment, as required, for determining ambient temperature, wind direction, and precipitation

m. Measuring tape
n. Warming facilities/tents
o. Infrared and image intensification devices, as required
p. Communications equipment
q. Shop facilities
r. Road and cross country courses
s. Area suitable for rock drilling operations
t. Other equipment as specified in MTP referenced in paragraph 4

4. REFERENCES

A. USATECOM REG 385-6, Verification of Safety of Materiel During Testing
B. MTP 10-3-501, Operator Training and Familiarization
C. MTP 2-3-512, Compatibility with Related Equipment
D. MTP 2-3-500, Preoperational Inspection and Physical Characteristics
E. MTP 2-3-501, Safety Hazards
F. MTP 2-3-511, Security (Susceptibility to Detection)
G. MTP 2-3-505, Road Mobility
H. MTP 2-3-504, Cross Country Mobility
I. MTP 9-3-502, Transportability
J. MTP 7-3-515, Air Portability, Internal - Suitability of Supplies and Equipment for
K. MTP 7-3-516, Air Portability, External - Suitability of Supplies and Equipment for
L. MTP 2-3-506, Simulated Tactical Operations
M. MTP 2-3-520, Logistics Over the Shore (LOTS)
N. MTP 2-3-516, Human Factors Engineering
O. MTP 2-3-502, Maintainability
P. MTP 2-3-527, Maintenenace Evaluation - Tools and Test Equipment
Q. MTP 2-3-528, Maintenance Evaluation - Technical Manuscripts and Manuals
R. MTP 9-3-503, Reliability

5. SCOPE

5.1 SUMMARY

This MTP describes procedures to be used in evaluating rock drilling rigs which are outlined as follows:

a. Preparation for Test. Arrange for required facilities and review the safety release to determine the operational limitations, if any, placed on the test item due to safety hazards.

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13. ABSTRACT

Procedures are prescribed for determining the functional suitability of rock drilling rigs.

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Drill, pneumatic						
Drill, rock						
Drill, self-propelled						
Compressor						

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b. Operator Training and Familiarization. Procedures for conducting necessary training and familiarizaing personnel with the test item and recording related data.

c. Preoperational Inspection and Physical Characteristics. Pretest inspection, service and repair of the test item as required to ensure that it is in proper condition for test operations, and to determine whether physical characteristics meet specified requirements.

d. Safety Hazards. A determination of the inherent safety hazards and a continuous evaluation of safety aspects of the test item throughout the service test to support the safety confirmation (safe for intended use) statement required in service test reports by reference 4.A.

e. Functional Suitability. A series of tests to determine whether or not the test item can adequately perform the functions for which it was designed.

f. Compatibility with Related Equipment. A series of tests to determine:

1) The compatibility of the item with recovery vehicles, transporters, and emergency starting facilities.
2) Whether the item can tow and be towed by similar weight vehicles with which it will be associated.
3) The self-recovery capability of the test item, if applicable.

g. Road Mobility. A test to determine the capability of the test item to move over primary and secondary roads alone under varying weather conditions.

h. Cross Country Mobility. A test to determine the capability of the test item to move over various types of cross country terrain alone under varying weather and soil conditions.

i. Security (Susceptibility to Detection). A test to determine the susceptibility of the test item to detection by visual, aural, infrared and image intensification techniques.

j. Transportability. A series of tests to determine whether or not the test item can withstand the shock, impact, extraneous forces, and vibration in the following modes of transportation:

1) Surface Trasnportability. A study to determine the capability of the test item to be transported by various carriers other than aircraft.
2) Air Portability. A study to determine whether the test item can be carried effectively inside and/or outside various aircraft.

k. Human Factors Engineering. An evaluation to determine the human factors engineering aspects of the test item, and its compatibility with the skills and aptitudes of personnel who will operate and service it.

l. Maintenance Evaluation

1) Maintainability. A determination of the maintenance requirements, both scheduled and unscheduled, of the test items, and the ease of performing the required maintenance.
2) Tools and Test Equipment. An evaluation to determine whether common and special tools and test equipment furnished for the test item are suitable for the intended purpose and maintenance level.
3) Technical Manuscripts and Manuals. An evaluation to determine the adequacy of technical publications provided.

m. Reliability. An evaluation of the test item reliability to include information regarding expected service life.

5.2 LIMITATIONS

This MTP is limited to the pneumatic drifter, self-propelled, crawler-mounted drill; other pneumatic drills will be covered in MTP 9-3-168.

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Personnel

Ensure that all test personnel are properly trained to operate the item being tested.

6.1.2 Safety Release

The project officer shall ensure that a safety release (ref 4.A), which includes information pertaining to operational limitations and specific hazards peculiar to the test item, has been received from HQ USATECOM, is understood, and complied with during testing.

6.1.3 Equipment and Facilities

Ensure that equipment and facilities listed in paragraph 3 and in Materiel Test Procedures referenced in paragraph 4 above are available.

6.2 TEST CONDUCT

6.2.1 Operator Training and Familiarization

Conduct tests and record data as described in MTP 10-3-501 (ref 4.B).

6.2.2 Safety Hazards

Conduct a continuing evaluation of all safety aspects of the test item as described in MTP 2-3-501 (ref 4.E).

6.2.3 Preoperational Inspection and Physical Characteristics

Perform inspections, checks, inventories, measurements, weighing, and break-in operations as described in applicable portions of MTP 2-3-500 (ref 4.D).

6.2.4 Functional Suitability

Determine the capability of the test item to perform rock drilling operations as described in the following tests:

6.2.4.1 Towing Air Compressor

With the tramming motor controls of the track drill in the fully open position, tow a 600 cfm compressor weighing not less than 8,500 pounds over a level 1 mile measured course. Then travel up a 20 percent grade for 100 yards. The minimum average speed for this measured course shall be (e.g., 1-1/2 miles per hour).

A specified percentage (e.g., 20 percent) of the towing operation is to be conducted during hours of darkness using artificial light inherent to the test item as well as other sources, if needed. All data of this operation is to be recorded and documented photographically when appropriate.

6.2.4.2 Boom and Mast Positioning

Hydraulically control the boom and mast movement by placing the mast in the vertical position. Drill vertical holes (e.g., 4-1/2 inches in diameter and 18 feet deep) on a line not less than 12 inches outside of each track without repositioning the crawler. Place the boom in the vertical position so that horizontal holes can be drilled at 2-1/2 feet and 8 feet measured from the ground surface of the track to the center of the hole. A specified percentage (e.g., 20 percent) of the boom and mast positioning operation is to be conducted during the hours of darkness using artificial light inherent to the test item as well as other sources, if needed. All data of this operation are to be recorded and documented photographically when appropriate.

6.2.4.3 Stability on Slope

a. Position the track drill on a slope (e.g., 35 percent slope).

b. With the test item positioned on a slope, drill holes (e.g., 4-1/2 inch diameter and 30 feet deep) at various angles.

c. During operations of the test item observe feed mechanism to ensure that it is functioning properly.

d. A specified percentage (e.g., 20 percent) of the operation is to be conducted during hours of darkness using artificial light inherent to the test item, or other items of construction equipment on the job site. Data on these operations are to be recorded and documented photographically, when appropriate.

6.2.4.4 Endurance Drilling

With the track drill towing the compressor and spacing the holes approximately 10 feet apart, drill 30-foot deep holes at various angles using the telescopic method of drilling by starting with 10-foot drill steels with the 4-inch bit. When hole has been drilled to a depth of 10 feet another 10-foot drill steel should be attached and a 3-inch bit should be utilized. By using this method especially where rock is full of cracks and fissures much more efficiency is gained as this normally eliminates binding of the bit and subsequent loss of the bit and drill steel. In addition, this type of operation facilitates cleaning out the rock cuttings more effectively. A specified percentage (e.g., 10 percent) of this operation is to be conducted during hours of darkness using artificial light inherent to the test item as well as other sources, if needed. All data of this operation are to be recorded and documented photographically when appropriate.

6.2.4.5 Lubricator Check

a. The test items lubricator reservoir is to be filled with rock drill oil prior to start of operations.

b. During operations, test item is to be checked to ensure it is getting proper lubrication to both the feed motor and drifter drill by passing a piece of paper in front of the exhaust port. If a thin film of oil accumulates on the paper, the tool is being properly lubricated. If drops of oil appear on the paper or if oil is foaming around the exhaust port, this indicates over lubrication. If no oil appears, check the lubricating device immediately and adjust the needle or refill oiler, as applicable.

c. Periodically during operations, the strainer in the lubricator is to be checked for cleanliness.

d. A specified percentage (e.g., 20 percent) of the lubricator test is to be conducted during the hours of darkness using artificial light

inherent to the test item or other items of construction equipment on the job site. Data on lubrication test are to be recorded and documented photographically, when appropriate.

6.2.5 Compatibility with Related Equipment

Conduct tests as described in MTP 2-3-512 (ref 4.C).

6.2.6 Road Mobility

Conduct road mobility testing as described in MTP 2-3-505 (ref 4.G).

6.2.7 Cross Country Mobility

Conduct cross country mobility testing as described in MTP 2-3-504 (ref 4.H).

6.2.8 Transportability

a. Transportability. Conduct tests as described in MTP 9-3-502 (ref 4.I).

b. Air Portability, Internal - Suitability of Supplies and Equipment for. Conduct tests as described in MTP 7-3-515 (ref 4.J), if applicable.

c. Air Portability, External - Suitability of Supplies and Equipment for. Conduct tests as described in MTP 7-3-516 (ref 4.K), if applicable.

6.2.9 Simulated Tactical Operations

Conduct simulated tactical operations as described in MTP 2-3-506 (ref 4.L).

6.2.10 Security (Susceptibility to Detection)

Conduct security tests as described in MTP 2-3-511 (ref 4.F).

6.2.11 Logistics Over the Shore (LOTS)

Conduct LOTS tests as described in MTP 2-3-520 (ref 4.M), if applicable.

6.2.12 Human Factors Engineering

Determine the effectiveness of the man-machine relationship during use of the test item as described in MTP 2-3-516 (ref 4.N).

6.2.13 Maintenance Evaluation

a. Maintainability. Conduct maintainability evaluation and make required computations for the test items as described in MTP 2-3-502 (ref 4.O) or other appropriate documents.

b. Tools and Test Equipment. Throughout the test, the special tools and test equipment supplied with the test item and tools applicable to the various levels of maintenance will be used. An evaluation of these items will be conducted as described in MTP 2-3-527 (ref 4.P).

c. Technical Manuscripts and Manuals. All equipment publications provided with the test item shall be evaluated as described in MTP 2-3-528 (ref 4.Q).

6.2.14 Reliability

Conduct reliability testing and compute the reliability of the test item in accordance with the procedures outlined in MTP 9-3-503 (ref 4.R) or other appropriate documents.

6.3 TEST DATA

6.3.1 Operator Training and Familiarization

Record data for each test participant as described in MTP 10-3-501 (ref 4.B).

6.3.2 Safety Hazards

Record data as described in MTP 2-3-501 (ref 4.E).

6.3.3 Preoperational Inspection and Physical Characteristics

Record data as described in MTP 2-3-500 (ref 4.D). When services, adjustments, and repairs are required, this data will be recorded under the Maintainability subtest of Maintenance Evaluation (para 6.3.14a).

6.3.4 Functional Suitability

Record the following for all functional suitability testing:

a. Ambient temperature.

b. Ambient light (natural and artificial).

c. Type and size crawler-mounted track drill.

d. Type of drill steel and length.

e. Sizes of various bits used.

f. Number of hours of testing during darkness.

6.3.4.1 Towing Air Compressor

Record the following:

a. Total hours testing towing air compressor.

b. Type of terrain.

c. Adequacy of track drill to tow air compressor.

d. Air pressure, psi.

e. Cubic feet of air per minute (cfm).

f. Adequacy of brakes.

g. Distance towed and average speed.

h. Make and model of air compressor towed.

6.3.4.2 Boom and Mast Positioning

Record the following:

a. Total hours tested.

b. Type of terrain.

c. Type rock (hard, medium, or soft).

d. Percent of slope of work area.

e. Ability of rock drill with boom in the horizontal position to drill vertical holes in line 12 inches outside track.

f. Number of holes drilled, diameter and depth.

g. Number of holes drilled per hour.

h. Ability of rock drilling rig with boom in the vertical position to drill horizontal holes.

i. Height of horizontal holes drilled above ground surface of track.

j. Number of horizontal holes drilled per hour, size, and depth.

k. Amount of creepage of boom, if any.

l. Whether cracks or fissures were encountered during drilling operation.

6.3.4.3 Stability on Slope

Record the following:

a. Total hours tested.

b. Type terrain.

c. Percent of slope.

d. Type slope (side or longitudinal).

e. Ground clearance in inches.

f. Ability of brakes or track locks to hold crawler drill in a fixed position on a 35 percent slope and a 50 percent slope.

g. Type of rock (hard, medium, or soft).

h. Type of holes drilled (vertical, horizontal, or other angles).

i. Number of holes drilled per hour, diameter, depth and angle.

j. Amount of creepage of boom, if any.

k. Whether cracks or fissures were encountered during drilling operation.

6.3.4.4 Endurance

Record the following:

a. Total hours tested.

b. Type terrain.

c. Type of rock (hard, medium, or soft).

d. Percent of slope.

e. Whether cracks or fissures were encountered during drilling operation.

f. Depth, diameter, and number of holes drilled at specific angles.

g. Number of holes and depth drilled per hour by specific angle.

h. Whether telescopic method of drilling was utilized.

i. Amount of creepage of boom, if any.

j. Did the drill function properly in the clockwise rotation mode?

k. Did the drill function properly in the counterclockwise rotation mode?

l. Did the air hole in drill steel plug up?

6.3.4.5 Lubrication Check

Record the following:

a. Type lubricator.

b. Capacity of lubricator.

c. Number of hours operated during darkness.

d. Amount of oil consumed.

e. Adequacy of lubricator to lubricate test item.

f. Total hours of operation.

6.3.5 Compatibility with Related Equipment

Record data as described in MTP 2-3-512 (ref 4.C).

6.3.6 Road Mobility

Record data as described in MTP 2-3-505 (ref 4.G).

6.3.7 Cross Country Mobility

Record data as described in MTP 2-3-504 (ref 4.H).

6.3.8 Transportability

a. Transportability. Record data as described in MTP 9-3-502 (ref 4.I).

b. Air Portability, Internal - Suitability of Supplies and Equipment for. Record data as described in MTP 7-3-515 (ref 4.J), if applicable.

c. Air Portability, External - Suitability of Supplies and Equipment for. Record data as described in MTP 7-3-516 (ref 4.K), if applicable.

6.3.9 Simulated Tactical Operations

Record data as described in MTP 2-3-506 (ref 4.L).

6.3.10 Security (Susceptibility to Detection)

Record data as described in MTP 2-3-511 (ref 4.F).

6.3.11 Logistics Over the Shore (LOTS)

Record data as described in MTP 2-3-520 (ref 4.M).

6.3.12 Human Factors Engineering

Record data as described in MTP 2-3-516 (ref 4.N).

6.3.13 Maintenance Evaluation

a. Maintainability. Record data and make the required computations as described in MTP 2-3-502 (ref 4.O).

b. Tools and Test Equipment. Record data as described in MTP 2-3-527 (ref 4.P).

c. Technical Manuscripts and Manuals. Record data as described in MTP 2-3-528 (ref 4.Q).

6.3.14 Reliability

Record data and make the required computations described in MTP 9-3-503 (ref 4.R).

6.4 DATA REDUCTION AND PRESENTATION

All data obtained by inspection, observation, questionnaires, and testing, including photographs, are to be analyzed and presented in a manner to indicate whether the test item meets the established criteria.

6.4.1 Safety Confirmation

A safety confirmation shall be presented in accordance with USATECOM Regulation 385-6 (ref 4.A).