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Band Tracks
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Tracks

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Describes procedures for testing tracks and their components.

US ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

DRSTE-RP-702-101
*Test Operations Procedure 2-2-705 — 19 February 1982
AD No.

TRACKS

1. SCOPE. This TOP describes procedures for testing tracks and their components including blocks or sections, connectors, wedges, guides, and bushing, as well as related parts affected by the track design. Track vulnerability to enemy fire is covered in TOP 2-2-617[1]**; soft-soil vehicle mobility is covered in TOP/MTP 2-2-619[2]; tracked vehicle suspension systems are covered in TOP 2-2-714[3]; and logistic supportability is contained in TECOM Supplement 1 to DARCOM Reg 700-15.[4]

Present military track designs are of two basic types: those that have rigid links and obtain their flexibility by means of hinges, pins, etc., and tracks that obtain their flexibility by means of pliable bands or track sections. The first type includes heavy duty tracks such as those used for combat vehicles. The most common rigid link and pin type tracks are 1) flexible pin-jointed (dry or lubricated), 2) rubber-bushed (single or double pin), and 3) irreversible types (rigid and elastic girder). Ground contact surfaces are usually of rubber

*This TOP supersedes MTP 2-2-705 dated 1 July 1970.

**Footnote numbers correspond to reference numbers in Appendix C.

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or steel. In some designs, removable rubber pads are used. Dry pin tracks made entirely of steel are used on bulldozers, crawler tractors, and some foreign vehicles.

Rubber-bushed track has an annular rubber "doughnut" surrounding each track pin (see Figure 1). The rubber-bushed pins are inserted into metal tubes of the track structure. The completed track blocks are then assembled into a series of links to form a track strand. Rubber-backed track refers to track with a rubber surface on the side away from the roadway, i.e., the surface that the road wheels contact. A conventional tracklaying vehicle puts down its own "roadway" on which it propels itself.

Flexible band tracks (see Figure 2) are generally used only on light-duty vehicles. Most band tracks are comprised of two or more rubber (or synthetic) belts with a core of steel cables and tire cord which form a loop to enclose the sprocket, idler, and road wheels. Track bars, transverse and attached to the belts, provide propelling grouser action or "bite" and a means for guiding the track through contact with the road wheels. They also transfer engine power to track and ground. Cores of other limited-use band-type tracks are of roller chain, wire loops pinned together, or other flexible track core arrangement.

2. FACILITIES AND INSTRUMENTATION.

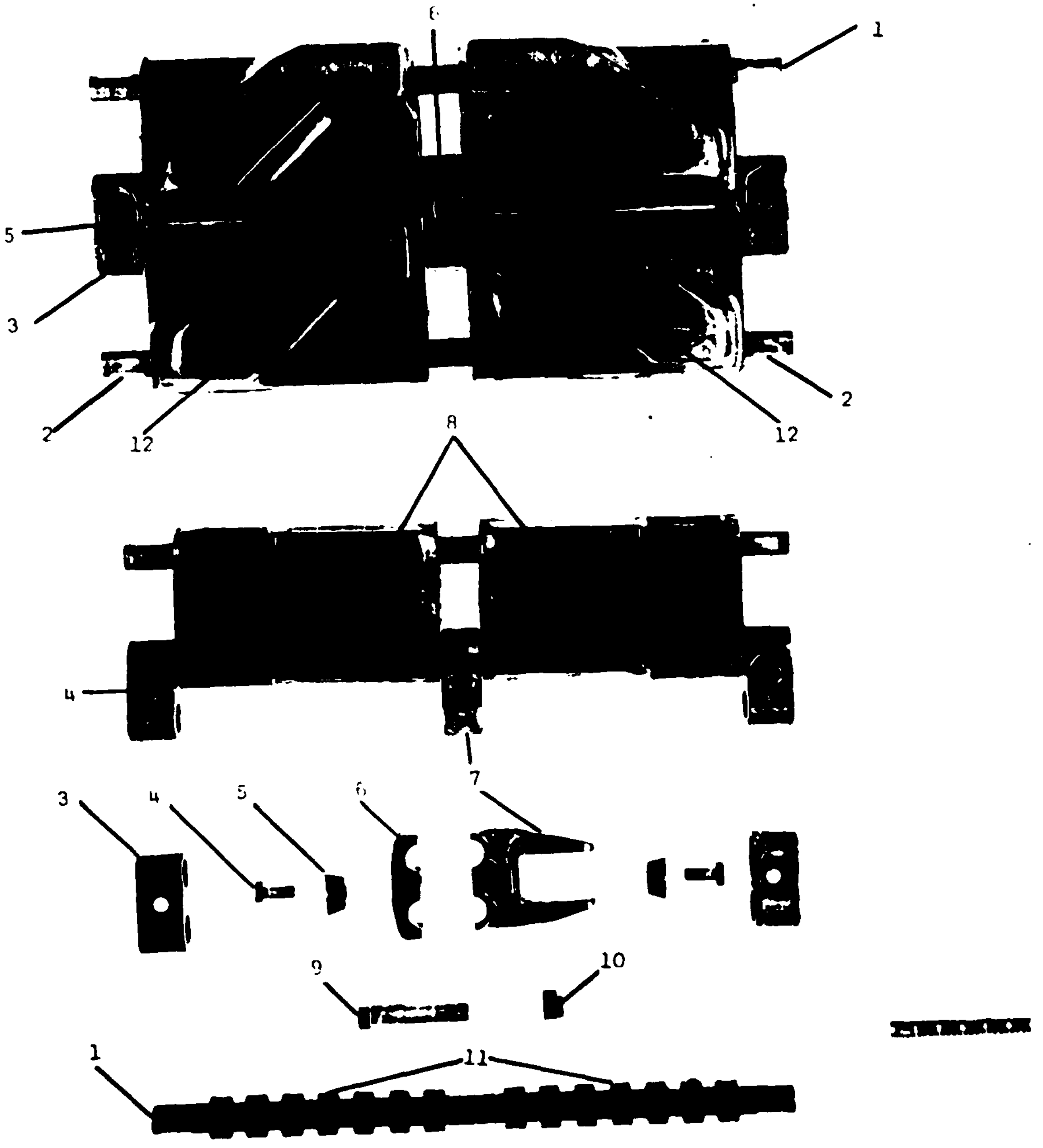
2.1 Facilities.

ITEM	REQUIREMENT
Center punch and hammer	
Tensile-testing machine	
Mobile field dynamometer	

2.2 Instrumentation.

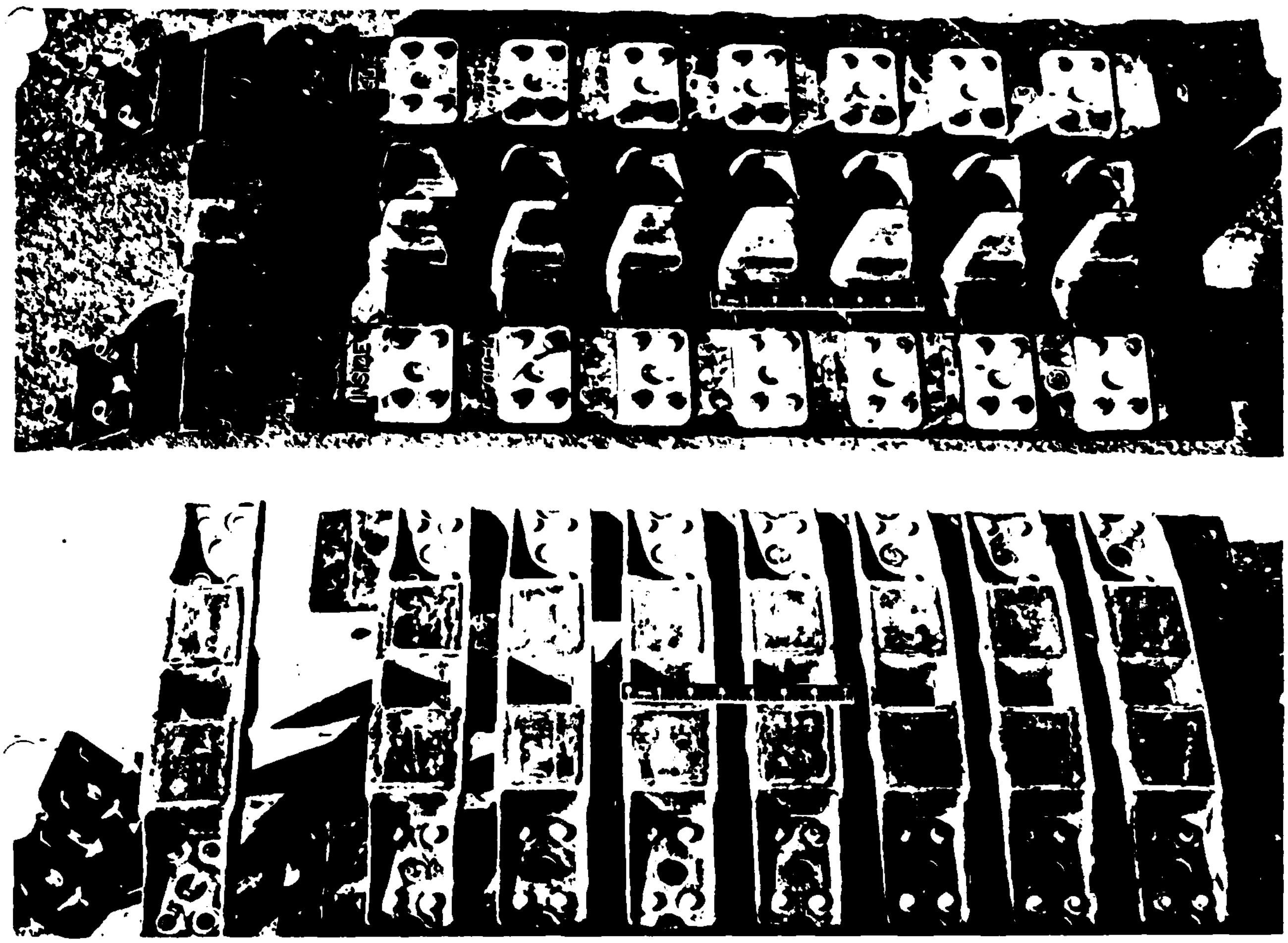
ITEM	MAXIMUM PERMISSIBLE ERROR OF MEASUREMENT*
Weight scales, various capacities	±1% of reading
Calipers, micrometers (inside and outside), and straight edges	±0.003 cm
Durometer	N/A
Brinell hardness tester	230 to 380 Bhn; ±0.05 of indentation reading
Potentiometer or pyrometer and thermocouple	±2°C
Vibration transducers and data-acquisition system	±10% of reading
Stopwatch and measuring tape	±3 mm
Strain gages and ancillary equipment	±1% of reading
X-ray apparatus	

*Values may be assumed to represent ± 2 standard deviations; thus, the stated tolerances should not be exceeded in more than 1 measurement of 20.



T97E2 TRACK

1. Pin
2. Wedge slot
3. End connector
4. Wedge bolt
5. Wedge
6. Guide cap
7. Track center guide
8. Rubber roadwheel surface of links
9. Guide cap bolt
10. Guide cap nut
11. Rubber doughnut bushings
12. Chevron



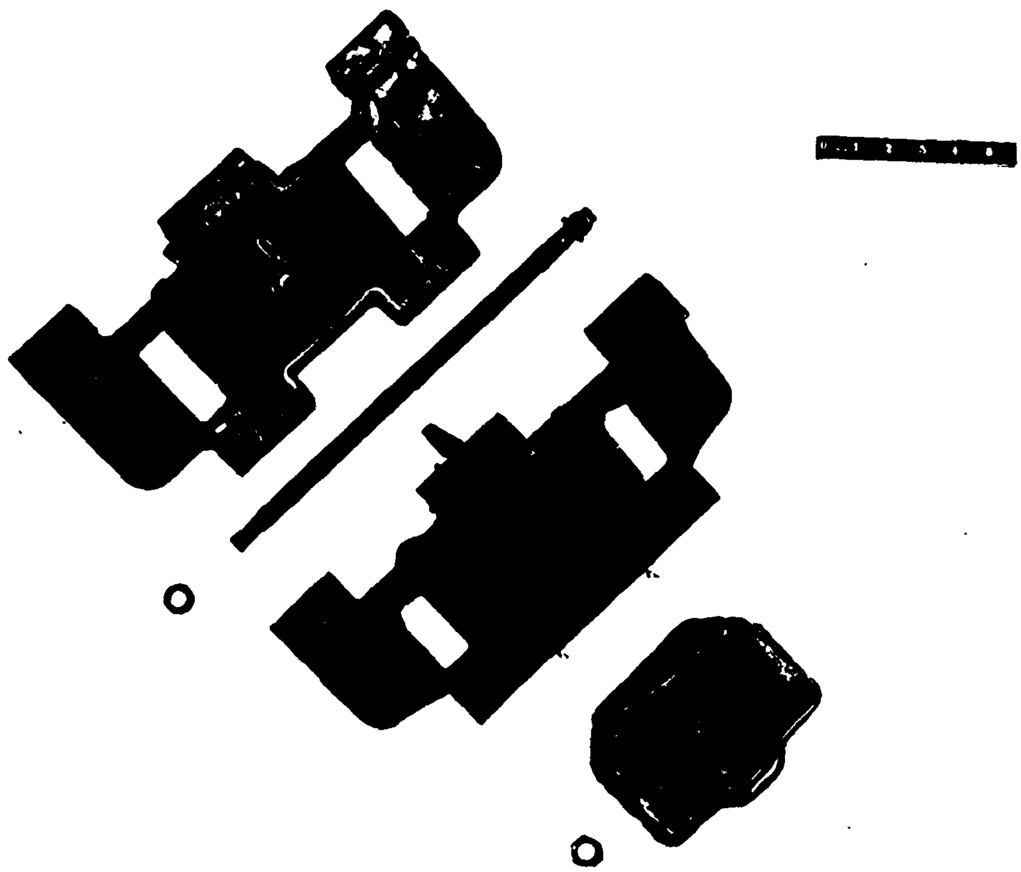
TRACK, 1/4-INCH CABLE BANDS, T135

Vehicle -------------- M114, M114A1
Tread ------- Steel with rubber pad inserts
Road wheel path ------------ Rubber
Pitch ----------------------- 4 in.
Width ------------------ 16-1/2 in.
Weight per section ---------- 88 lb
Crossbars per section ----------- 8
Grouser height ---------- 1-1/2 in.
Guide -- Double guide integral with crossbar, 3-1/2 in. height
Track contact area per crossbar -------- 13.5 sq in.

Hardness (shore durometer A)
- Pad ------------------ 60 to 75
- Bands ------------------ 60 ± 5

Hardness (metal components)
- Center guide and crossbar ----- 35 to 40 Rockwell C
- End connector plate (steel) ------ 20 to 25 Rockwell C
- Riveted plates (aluminum) -- 94 to 103 Rockwell F

Cables ---- 7 each per band, 1/4-in. diameter



TRACK, T130 FORGED (CLOSED)

Vehicle M113

Tread............Steel w/rubber pad

Roadwheel Path...............Rubber

Weight Per Block.............19 lbs
(Complete)

Weight Track Pad w/nut...2 lbs 13 oz

Weight Track Pin w/nuts....1 lb 5 oz

Width......................... 15"

Grouser Height........... 1-5/16"

Track Pad Thickness....... 1-1/2"

Bushing......Sleeve Type, Rubber

Pin ....Octagonal (Single)

Center Guide....Intergal 3½" High

Track Pitch...................6"

3. PRE-TEST REQUIREMENTS.

3.1 Characteristics Data Sheet. Prepare this sheet to use as a reference during a test. The characteristics data sheet consists of a page containing a photograph of the test item and a list of its principal dimensions and functional characteristics. After all characteristics have been confirmed (and the sheet corrected as necessary), it becomes part of the test documentation.

The photograph should be as large as possible (to preserve clarity after reduction) with unnecessary background features eliminated as much as possible.

Any design data or tentative characteristics (to be confirmed during the test) must be identified as such on the data sheet. The data should include, but not be limited to, all characteristics that are applicable to the track:

- Make, model number, and manufacturer
- Vehicles that use track
- Type tread material
- Type road wheel path surface material
- Weights:
  - Basic block
  - Assembled pitch length or section
  - Per foot of track length
  - Individual components:
    - Pad
    - Pins
    - Connectors
    - Guides
    - Attaching hardware
- Pitch length
- Width (overall)
- Pad thickness
- Grouser height
- Grouser or pad contact area
- Guide type and size
- Bushing type and material
- Pin type, material, and size
- Hardness:
  - Rubber components
  - Guiding components
  - Connectors
  - Pin

3.2 Selection of Test Components. Test with new or equivalent components. Check adjustments at the beginning of the test, and at appropriate intervals throughout the test. Depending on the purpose of the test, the vehicle is loaded with combat or rated payload. Take care to only combine test items that are compatible. NOTE: Interchanging test components can negate test results. Detailed test procedures vary with track type and the nature of the vehicle and its intended use. The test plan or specification should cover the more detailed procedures.

3.3 Initial Inspection and Preliminary Operation. Upon receipt of the test track or prior to testing, examine the track to ensure suitability of all components and proper assembly. The vehicle is also given an initial inspection in accordance with TOP 2-2-505.[5]

Unless otherwise directed, operate all tracks for 80.5 km (50 miles) over smooth gravel road (such as APG's course at the Munson test area [see TOP 1-1-011[6]]) to break in the rubber components. Operation for the first 24 km (15 miles) is at 30 percent maximum speed; for the next 24 km, 50 percent maximum speed; and for the remainder, 75 percent maximum speed. (See MIL-T-11891B and TOP 2-2-505 for examples of break-in operations.) Following this break-in operation, adjust track tension as required, and tighten all wedge center guide bolts, and other track component fasteners to the specified torque. Conduct a complete visual inspection for unusual wear, misalignment, and other defects.

3.3.1 Optimum Track Tension Adjustment. On any tracked vehicle, the optimum track tension is the adjustment that provides the lowest propulsion losses while retaining the track during operation over adverse terrain. The track cannot be adjusted tight enough on any tracked vehicle to prevent throwing during every possible operating condition; this is particularly true of a vehicle with a distorted or compressed suspension. The optimum track tension is determined for each track type or design on each vehicle model that uses that type. The track power losses over a range of track tensions indicate the desired tension range for minimum power absorption. Operation over adverse terrain indicates the tension required to readily retain the track. Three steps are necessary to determine optimum track tension:

a. Establish a ready reference for track tension (tension versus track sag).

b. Determine the resistance to motion (towing resistance) for various track tensions.

c. Determine the optimum track tension that prevents track-throwing during operation over adverse terrain.

3.3.1.1 Tension Versus Catenary Sag. A desirable reference for track tension is a curve comparing catenary sag at different track adjustments. The tensile load in the track is obtained by replacing several pitch lengths of track with one or two strain gaged links or hydraulic cylinders. These load-measuring devices are usually placed in the track catenary over top of the road wheels or support rollers opposite the point where sag measurement is to be taken. Track or catenary sag is determined by drawing a line or wire tightly across the top of the track span (the greatest unsupported span of track on a particular suspension configuration) and measuring the vertical distance from the line to the track at the center of the span. The track is physically shaken to assure equalization of forces before the tension and sag are recorded. Measurements are obtained for both right and left tracks and grapnically shown for each track (tension versus sag of drop from the straightedge reference). These curves make a suitable reference for later test phases that involve static track adjustments. When taking dynamic track tensions, one can modify this step to establish the recommended track sag, using instrumented track links.

3.3.1.2 Resistance to Motion Versus Sag (Tension). Resistance to towing and propulsion is determined for the vehicles at various track sag tension adjustments (cm of sag). At least three curves are generated, one for each selected tension, ranging from extremely loose to very tight track and including at least one tension with moderate adjustment. This test is conducted on a paved surface and with equal tension in each track (refer to 3.3.1.1 above).

3.3.1.3 Optimum Track Tension for Adverse Terrain. To attain this, test the vehicle, using sharp steering operations over several adverse soil conditions: on paved road at high speed; over loose sand; on a course with obstacles that can be struck diagonally; and on a soft soil hill crest. For the last condition, operate the vehicle parallel to the crest of a hillock with one track hooked over the top (with the vehicle straddling the hill); then make a sharp turn downhill. Perform these tests in forward and reverse. Make sure they are conducted carefully with increasing speeds to prevent damage to the track and vehicle. A track does not have to be thrown in order to realize that it is too loose to be retained. Begin the test with a tight adjustment that is gradually loosened. The static adjustment for each operation is known (3.3.1.1 above). Conduct this test with equal tension maintained in each track.

Thus, the optimum track adjustment is a reasonable compromise between the minimum tension for ready track retention, minimum resistance to propulsion (motion resistance curves), and sag/tension adjustments for each side of the vehicle. For simplification, the same track sag is recommended for both sides of the vehicle, although the tension may not be the same.

NOTE: For flexible band tracks, the method of inserting load cells into the track strand may require considerable modification. Since many band tracks are made of sections with six to ten pitch lengths, removal of an entire section may cause interference with the normal track sag. The procedure varies to suit the track design.

4. TEST PROCEDURES.

4.1 Pull and Resistance Tests.

4.1.1 Link Tracks. Perform tests to determine resistance to towing (TOP 2-2-605[7]) on each new type of track. It may be necessary to conduct a test using standard track for comparing results if directly comparable data are not available on the same vehicle. Vehicle power losses are not necessarily the same for two vehicles of the same model. This test provides basic characteristic power loss data for the track and data for determining optimum track adjustment. The track tension or sag adjustment is shown with each curve developed, along with the description and gross weight of the vehicle.

Conduct drawbar pull tests (TOP 2-2-604[8]) on various types of terrain, and compare the data with data on similar standard tracks. Drawbar pull versus slip curves are computed and plotted for both loaded and unloaded conditions. This test is conducted only when the drawbar characteristics are desired or would help to evaluate the track. A simpler test method is to determine the mean or average speed over various soil conditions as defined in terms of the cone penetrometer (CI) and moisture content. Test courses selected include soils that do and do not support the vehicle without excessive sinkage.

4.1.2 Band Tracks. Plot drawbar pull versus percent-slip curves from data obtained from field dynamometer tests (TOP 2-2-604). Drawbar tests under a variety of soil conditions and moisture contents as well as in snow are necessary for a complete evaluation (TOP/MTP 2-2-619). Compile resistance-to-towing data for use in evaluating vehicle power losses.

4.2 High Temperature Tests.

4.2.1 Link Tracks. Conduct these tests to determine heat buildup in the track. The data are needed mainly to evaluate rubber compounds, particularly during vehicle operation at sustained maximum speed. Beginning at 16 km per hour (10 miles per hour), measure stabilized temperatures of all rubber tracks for paved road operation (hard blacktop surface for highest temperature and to prevent significant penetration by tracks). If critical values for the track compound do not result, increase speed in 8-km-per-hour (5-mile-per-hour) increments until the maximum vehicle speed is reached or until critical rubber temperatures are obtained. About 2 hours' running time are required for stabilization at a given condition; however, the running time must be established by trials for each track design. Measure temperatures with a potentiometer or pyrometer and needle-shaped thermocouple. Other conditions of AR 70-38[9] must also be considered.

The heat buildup rates are obtained by taking periodic temperature measurements before stabilized temperatures are reached. The operating interval between measurements should be about 30 minutes. Temperatures are measured at critical points on the track. On heavy duty link-type track, the heat usually concentrates deep in the rubber blocks to the inside of and near the pin area. Measure two to four of these blocks on each track at each stop, using blocks selected at random. The track blocks at the front and rear of the vehicle that are off the ground after the vehicle has stopped are the most accessible. Insert the needle probe into the rubber, using lubricant (e.g., liquid soap). NOTE: Do NOT use petroleum. The same depth of penetration by the thermocouple and location on the block should be used for each measurement by drilling a pilot hole. Take the measurements as rapidly as possible after halting the vehicle, with no more than 5 minutes elapsing (after stopping) until the last reading. (Band tracks lose temperature much more rapidly, and the readings may be required in a few seconds.) The time of each measurement is recorded using either a clock or stopwatch. The last measurement taken is of the same block as the first measurement so that the cooling rate can be estimated and temperature corrections made on all readings (except the first). Rubber temperatures to 107° C (225° F) are satisfactory. Most track rubber material softens noticeably above this temperature, and the deterioration rate increases. At about 150° C (300° F), internal gas pockets form; near 204° C (400° F), revulcanization of the rubber begins. Conduct the tests on the hottest days possible during mid-day when the sun is hottest. Obtain the ambient temperature in the test vicinity, the road surface temperature, and the condition of the course for each set of recordings. (The hottest peak condition per AR 70-38 would be an air temperature of 125° F and solar radiation of 360 Btu/ft^2/second. As far as the tracks are concerned, this is assumed to be the equivalent of a 52° C (125° F) air temperature. The average air temperature recorded during the test would be considered below peak values by the amount it differs from 52° C, and data appraisals should be weighed accordingly. Also, take note of the date and general weather conditions; these data can be presented graphically.

Conduct these temperature buildup tests on all new track designs or test track within the first 805 km (500 miles) of operation. They must not be delayed until the materials are damaged or severely worn. Obtain temperatures from all rubber components: chevron, pad, bushing, and road wheel path. Take care not to exceed a sustained speed above which blowouts might occur.

4.2.2 Band Tracks. Heat buildup characteristics of these tracks depend on track design. The fabric-and-rubber-covered cable band track usually has no heat problems, but the design does not permit suitable temperature measurements. This does not, however, preclude heat buildup in other band track designs. To determine temperatures, follow procedures described in 4.2.1.

4.3 Low Temperature Tests (Link and Band Tracks). Conduct these tests by placing the vehicle in a cold room at -46° C (-50° F) for 24 hours and then immediately driving it over hard surface roads. The test should be conducted on an overcast day, with the ambient temperature as low as possible. As a minimum, testing will continue until it is judged that the temperature of tracks has substantially approached ambient. Then examine track for cracks and other damage.

4.4 Gradeability and Side Slope Tests (Link and Band Tracks). Performance on side slopes and grades is evaluated only to the extent that it is influenced by the track design being tested, especially in respect to traction. Care must therefore be taken to ensure that peculiarities of the vehicle such as transmission design are excluded from the results as much as possible.

These tests are conducted on various soils, vegetative types, moisture contents, and snow to determine the ability of the tracks to operate adequately under adverse conditions. Conduct tests in accordance with TOP 2-2-610.[10]

4.5 General Mobility (Link and Band Tracks). Conduct mobility tests over various terrain surfaces to provide data on aggressiveness of grousers, tractive characteristics, and operational performance of the track (see TOP/MTP 2-2-619). Observations can be readily made during operation over rough terrain (obstacles) and soft soil conditions. Conduct instrumented tests to obtain definitive data.

Beneficial information concerning action of the tracks can also be gained by conducting a comparison test involving several vehicles on a "follow-the-leader" basis. The tendency to "belly" in snow or soft soil is immediately apparent, as is cleaning action of the tracks, vulnerability of tracks and suspension system to rocks and logs, and general ease and speed of vehicle travel. Results are verified by alternating the leading vehicle by successive passes when conditions change. Drivers are also exchanged. A control vehicle with standard track is always included for comparison of speeds, average speed, and fuel consumption.

4.6 Endurance.

4.6.1 Link Tracks. Conduct endurance testing on a track separately or in combination by interspersing sections of various test or standard track so that direct comparisons can be made. Avoid the procedure of mounting one type track on one side of the vehicle and a comparison track on the other; a driver tends to "favor" one side of the vehicle so that both tracks are not equally exposed to the same environment. When mixing track, use the longest sections of each possible since there is cross-influencing in adjacent shoes, and the two shoes next to another section are not evaluated. That is, four shoes in each section are "lost" in the evaluation and are excluded from test results. Once the weaker points of the track are identified, tests can be planned to determine the degree of improvement after modifications are made. (Sprocket wear rate is a critical factor in determining track life. Measurements are necessary, in accordance with applicable sprocket wear standards for the test vehicle.) For subsequent tests, it is not necessary to use standard track for comparison unless small differences are to be noted, since suitable testing experience will have been obtained. Results of past tests indicate that track endurance performance is repetitive if the operating conditions are identical.

Operate heavy duty tracks in the design stage in 240-km (150-mile) cycles over paved, gravel, and cross-country courses for the life of the track. After breaking in, run the vehicle at least 161 km (100 miles) but no more than 240 km (150 miles) continuously on any one type of course. Use the maximum speed commensurate with the course, but generally limit it to 30 to 40 km per hour (20 to 25 miles per hour). The endurance mileage will depend on test objectives. If specific durability requirements and operating criteria are not established by the requirements documents for the test track, use MIL-T-11891B as a standard. Although this specification was developed for evaluations of production track, it proves suitable standards for all track evaluation (see Appendix A).

Take periodic wear measurements and photograhs before, during, and after endurance operation. Measurements of the track or its components are obtained to provide at least five points on a curve showing wear versus mileage.

If a test track includes more than one sample, mark it for identification. Each track shoe should be stamped with a code in a location that will not damage or affect the service life of the material, will not become obliterated during service, and can be readily located and read with the track mounted on the vehicle. Small punched letters and numbers in a non-wearing metal surface are most satisfactory. Standard marking locations for specific track designs are desirable so that any observer can easily find them. The following locations are recommended:

a. Double pin track - both ends of leading pin

b. Single pin track - both ends, road wheel face, outside sprocket tooth engagement hole

c. Other suitable location in keeping with above pattern

NOTE: Do not depend on previous markings unless they are suitably located and properly identify each track type with the same coding.

The coding should be a combination of letters and numbers. Track is often identified by the manufacturer; each manufacturer may provide several samples. A letter will identify the manufacturer; a number, the sample. To identify the side of the vehicle on which a track is located, use and "R" or "L". A marking of "A1R" indicates the manufacturer, sample 1, and a right side mounting. If the manufacturer is not important in the test, the letter can be dropped (e.g., 1R). If each shoe must be identified, the above coding is followed with a numbering of each shoe in sequence in the assembled track, beginning with the leading shoe (e.g., A1R-20, 1R-20, or 1-20).

4.6.2 Band Tracks. Conduct endurance tests on a variety of courses, and when a weakness is discovered, design tests to evaluate subsequent improvements. Evaluate track performance by comparing quantitative results obtained in successively testing two samples on the same vehicle or on two vehicles of the same type. If test and standard tracks are of the same dimensions, install mixed sections on both sides of the vehicle; if they are of different design, mount test and standard tracks on opposite sides of the vehicle, and change from side to side periodically during testing.

The endurance operation pattern of band-type track is similar to that for link track to permit a suitable evaluation with regard to service life and maintenance requirements. An applicable specification, however, similar to that used for link track does not exist.

Presently, band tracks are developed for vehicles having gross weights of less than 15,876 kg (35,000 lbs). The following evaluation criteria are therefore suggested:

a. Distance - 4,830 km (3,000 miles) without excessive wear or such failure that would cause the track to become unserviceable. The test mileage is divided one-third each over paved, gravel, and cross-country terrain (frozen ground is avoided because it imposes special impact loads), and a maximum safe allowable speed is maintained.

b. Wear - wear height of grouser or pad no greater than 50 percent of the original height.

4.7 Wear Measurements. The wear on all contact areas becomes important as the service life of track is extended. These areas include the sprocket contact driving areas such as end connectors, center guides, road wheel contact area, and road surface contact area. The wear rates can be obtained on the metal contact areas by making periodic profiles that can be superimposed on a sketch to show wear directly, or by using a template that permits direct measurement of material loss.

Chevron height is a measure of abrasion resistance or wear. The inside and out side chevron heights from each track are averaged and reported. Wear rate data or curves can be obtained by taking periodic measurements, such as every 800 km (500 miles). References to wear are related to chevron or pad height on rubber track components and grouser height on metal track bodies. On metal tracks with pads, the difference in height between the grouser and pad should be recorded periodically. This height difference may be no more than 1/64 or 1/32 of an inch, but it is noted.

It is not necessary to measure all test items to obtain satisfactory wear data. Measurements should be taken of random items of a given sample until the wear trend is established and an average or range of present dimensions or standard deviation is recorded.

Wear is also determined by the change in weight of the track or its components. This method is accurate, but care must be exercised, as there is loss of both metal and rubber. When the wear pattern is consistent, the component weight loss may be correlated with the weight difference.

4.8 Vibration Tests. The vibration characteristics of all new development tracks are compared with those of the tracks that are standard for the same vehicle type. Vibration pickups are located on at least two road wheel arms, one with and one without a shock absorber: at the front and rear of the hull, and at points near the center of gravity and operator's seat. Exact locations are determined by preliminary tests and equipment considerations. Velocimeters or accelerometers may be used as vibration detectors.

The fundamental frequencies of accelerations (cm per second per second) are linear functions of the periodic track impact frequency approximately three times the vehicle speed in mph (or five times in km per hour). This value is fairly accurate for track with a pitch of approximately 15 cm (6 in); the frequency will be higher for shorter pitch track and lower for longer pitch track. Track frequency is the rate at which successive blocks pass a fixed reference point on the vehicle and relates directly to track pitch length and vehicle speed. Measurements are concentrated at the fundamental frequency derived from the above guideline, although other frequencies (particularly harmonics) are present. To determine resonant frequencies, tests should be conducted at speeds from 3 km/hr (2 mph) to the maximum vehicle speed in 3-km/hr increments. Data at each speed should be recorded for approximately 30 seconds.

Further information on vibration testing is contained in TOP 1-1-050.[11] Vibration related to ride quality is addressed in TOP 2-2-808.[12]

5. DATA REQUIRED. Record the following:

a. Track characteristics
b. Failure photographs
c. Bushing and rubber load deflections
d. Durometer and Brinell hardness
e. Drawbar and towing resistance
f. Temperature data for rubber components
g. Vibration resonant frequencies
h. Wear rates
i. Slope performance
j. Mobility performance
k. Track sag versus load curves
l. Track sag versus track adjustment procedure
m. Vibration power spectral density acceleration g^2/hz versus frequency analysis
n. Mobility in adverse soils, vehicle cone penetrometer versus vehicle weight and speed
o. Slope gradient versus vehicle speeds
p. Graphs of heat buildup rates

APPENDIX A

ENDURANCE STANDARDS OF MIL-T-11891B (PRODUCTION TEST STANDARD)

The average speed and mileage objectives from MIL-T-11891B are shown in the table below. The prescribed operation is one-third of the mileage each on paved, gravel, and cross-country terrain. Testing is suspended when the ground is frozen.

Endurance Test Speed and Mileage Objectives for Production Track

Vehicle Weight (Kg)	(Lb)	Type	Average Speed (kph)	(mph)	Distance (km)	(miles)
less than 15880	35,000	Type I, Class A, Light	50	30	4830	3,000
15880 to 36290	35,000 to 80,000	Type I, Class B, Medium	40	25	4020	2,500
over 36290	80,000	Type I, Class C, Heavy	30	20	3220	2,000

NOTE: Maximum speed may not exceed the specified average by more than 33%

It is often necessary to extend the above mileage to evaluate several compounds exhibiting exceptionally good wear characteristics. After performance tests, new track designs are tested until destruction (safety standard) or until a definite comparison can be made with standard track. A complete inspection and evaluation are made when the qualification mileage is completed.

MIL-T-11891B indicates the following standard for evaluation of the rubber chevrons or pads after the prescribed service:

> "There will be no evidence of excessive wear or such failure as would cause the track shoes and pads to become unserviceable. The average height of the rubber chevrons or pads at the end of the road test shall be no less than 50 percent of their original height. No more than 30 percent of the number of shoes or pads shall lose more than 20 sq cm (3 sq in) of the rubber-bearing area, and the original total bearing area of rubber chevrons or pads shall be reduced by no more than 7 percent."

In addition, there should be no more than 1 percent loss of total number of pads from the road wheel side. In clarification of the above standard: No more than 30 percent of the shoes shall lose more than 20 sq cm of the rubber-bearing surface area (rubber chevron or pad), disregarding areas of less than 6.5 sq cm (1 sq in). The 7-percent total loss of bearing area relates to the original bearing area of new track. Since the chevrons and pads are designed with sloping sides, the projected bearing area increases with track wear. At 50 percent of chevron height, the bearing area may have increased by 25 percent. For proper evaluation, the original bearing area - not the present projected area - is

APPENDIX B

TRACK FAILURE DEFINITIONS

Link Track.

Chunking - loss of rubber from any part of the block. Such loss is reported as chunking until two-thirds of the chevron bearing areas are lost; it is then reported as loss of chevron due to excessive chunking (see Figure B-1).

Fatigue - a breakdown of rubber within the block due to continuous working of the stock. This failure is not usually discovered until a crack appears at a base of the chevron. As the failure progresses, the chevron will tear off. This is reported as loss of chevron due to fatigue (Figure B-2).

Adhesion to metal breakdown (bonding failure) - separation at rubber-to-metal surfaces and over the end plates. This breakdown is also detected by excessive movement of the rubber, resulting in cracks or tearing of rubber from the metal (Figures B-3 and B-4).

Lamination - a peeling of thin layers of rubber from the block.

Separation between "pieces of preparation" - separation at the mold parting line, usually where rubber-to-metal adhesion is poor. NOTE: A "piece of preparation" is pre-formed rubber forming a part of an assembly and resembling the final configuration.

Exposed tubes - result of rubber having been torn off or worn down to the tubes. Blocks failing from adhesion breakdown have exposed tubes, but are not reported as such until the rubber has torn off the block (adhesion to metal breakdown). The exposed tube condition generally occurs after loss of a chevron.

Separation and loss of rubber directly over end plates - this failure usually occurs at an early stage of the test. This loss of rubber does not, however, appear to shorten the life of the block if the adhesion to the tubes is good. This is a flash of rubber that results during the molding process and is not essential to satisfactory service of the track.

Blowout (see Figure B-5) - this occurs in a track block when excessive internal pressure builds up, greatly raising block temperature.

Cuts - these are not reported unless it is believed that they would lead to other failures.

Metal part failures - although these are not common if the material selection and heat treatment have been proper, they occur more often with track designed for longer service life than with other track. Most metal failures are the result of fatigue at stressed points. On a double-pin track, the tubes may break loose at the end plate brazed joints, or the pin tube may break with a characteristic spiral crack (see Figure B-6). On a single-pin track, the breaks may occur adjacent to the pin bosses, near the center guide, or at the sprocket drive hole. Periodic close examinations are made of the metal track parts to locate any metal cracks or breaks before they become serious.

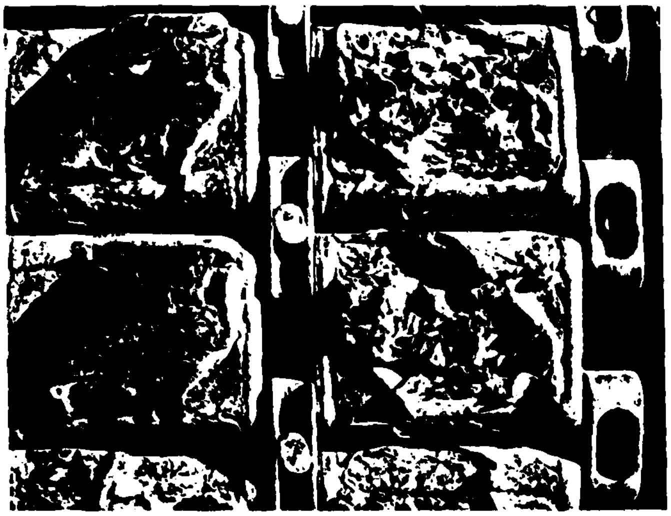


Figure B-1. Chunking.

Figure B-2. Fatigue.

Figure B-3. Adhesion to metal breakdown (bonding failure).

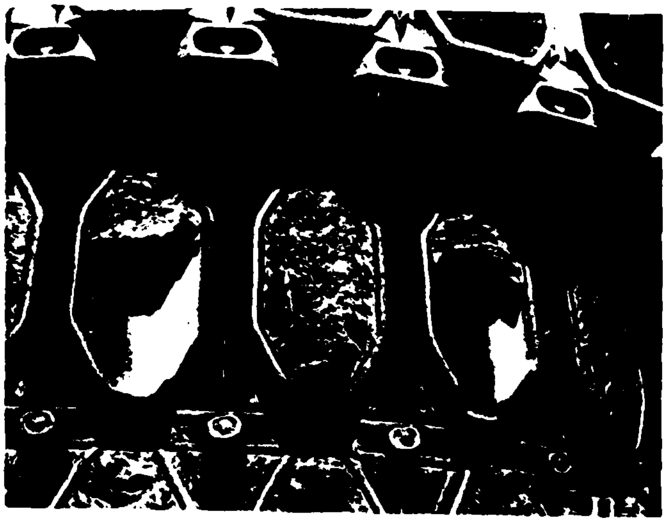


Figure B-4.

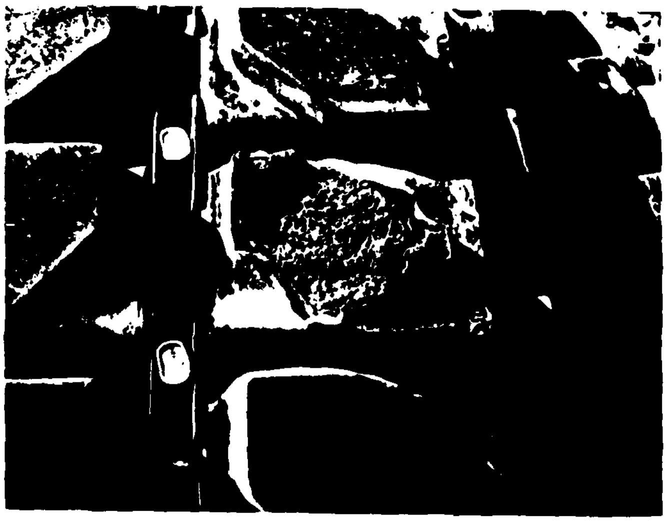


Figure B-5. Blowout.

Figure B-6. Pin failure.

Track failures that lead to complete shoe separation or track throwing are not tolerated because of the hazards to operating the vehicle. Without a track, the standard vehicle cannot be driven, steered, stopped, or controlled in any way.

Band Tracks.

Blisters - these resemble blisters on human skin and result from imperfections in manufacture. They are not normally serious enough to impede operation.

Loss of track bars - this results from rivets, that connect the track bars to the rubber belts, shearing or pulling through the belt. In most cases, complete failure of the track follows loss of track bars.

Cracking, wearing through, and breaking of track bars - this is due to faulty design. Such failures precipitate other failures that finally immobilize the vehicle.

Cable failures - usually occur next to the end connector where maximum flexure develops.

Longitudinal splits - caused by flexing and weakening of the fabric and rubber.

APPENDIX C

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